May 16, 1967 R. O. TODRANK 3,320,442

CIRCUITRY FOR AUTOMATIC APPLIANCES

Filed Jan. 2, 1964

4 Sheets-Sheet 1

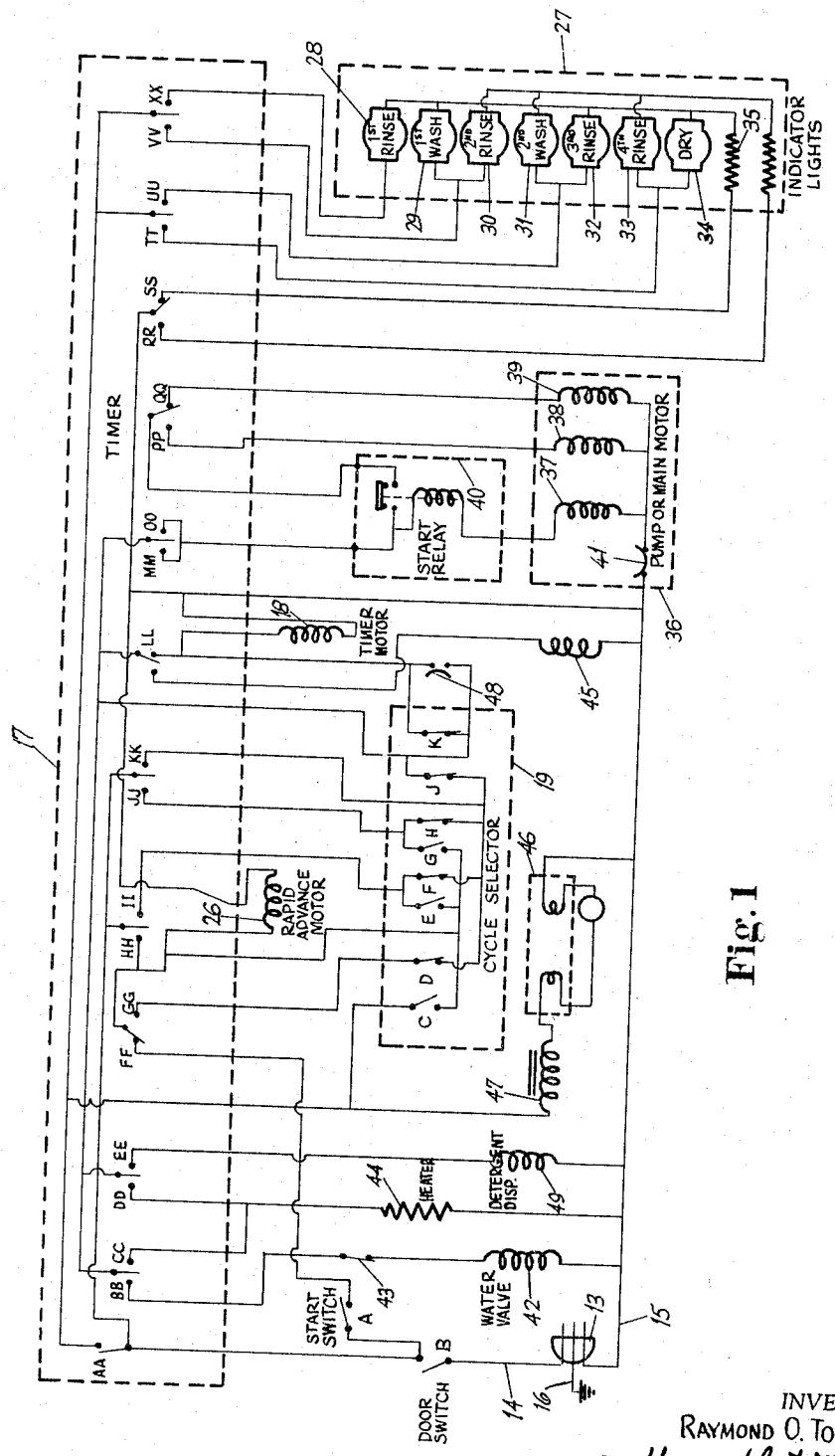


Fig. 1

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CYCLE	SWITCH POSITIONS								
	A	C	D	E	F	G	H	J	K
START	C*	E	E	E	E	E	E	E	E
CYCLE CHANGER	O	C*	C	O	C	O	C	O*	C
PRE-WASH	O	O	C	C	O	C	O	C	C
SHORT WASH	O	O	O	C	O	O	C	C	C
NORMAL WASH	O	O	C	O	C	O	C	C	C
145° WASH	O	O	O	O	C	O	C	C	O

LEGEND: E – EITHER
O – OPEN
C – CLOSED
* – DURING HOLD-DOWN TIME

Fig. 2

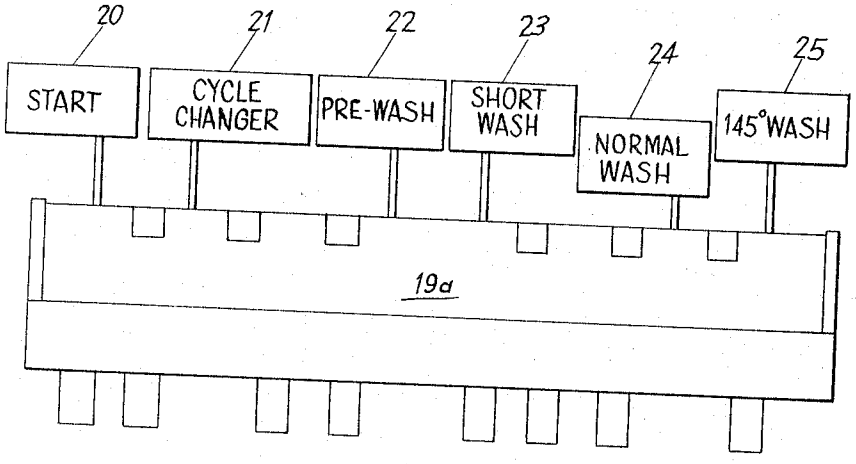


Fig. 5

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CIRCUITRY FOR AUTOMATIC APPLIANCES

Filed Jan. 2, 1964 4 Sheets-Sheet 3

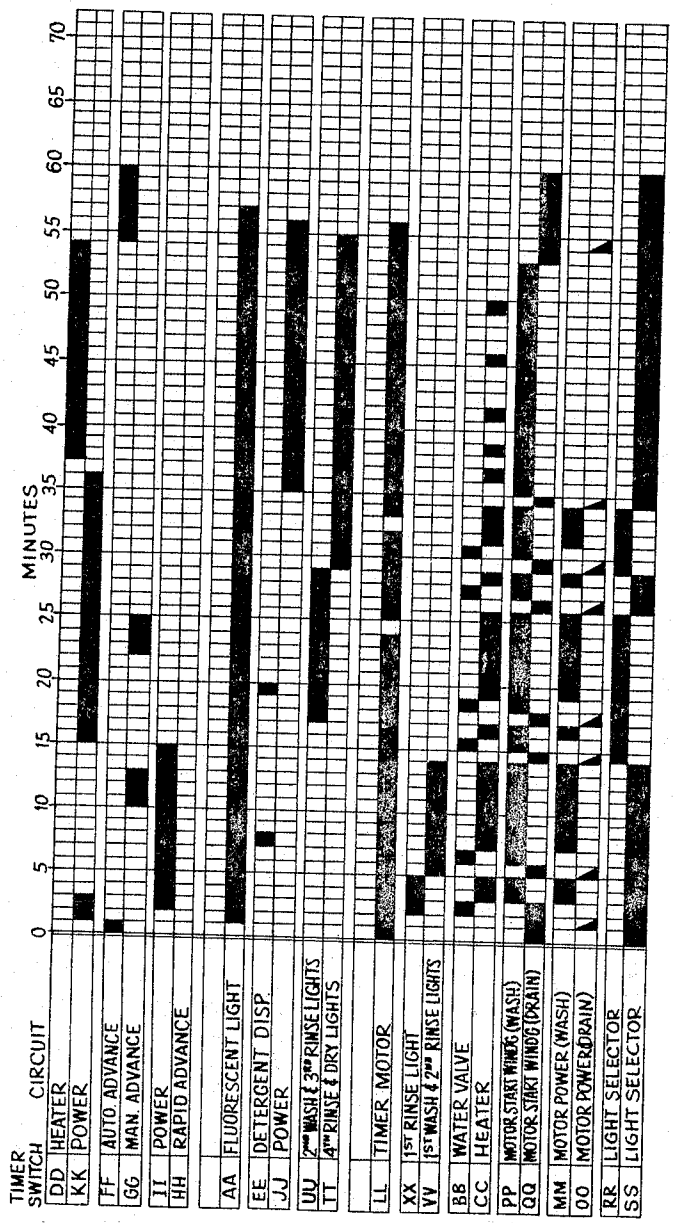


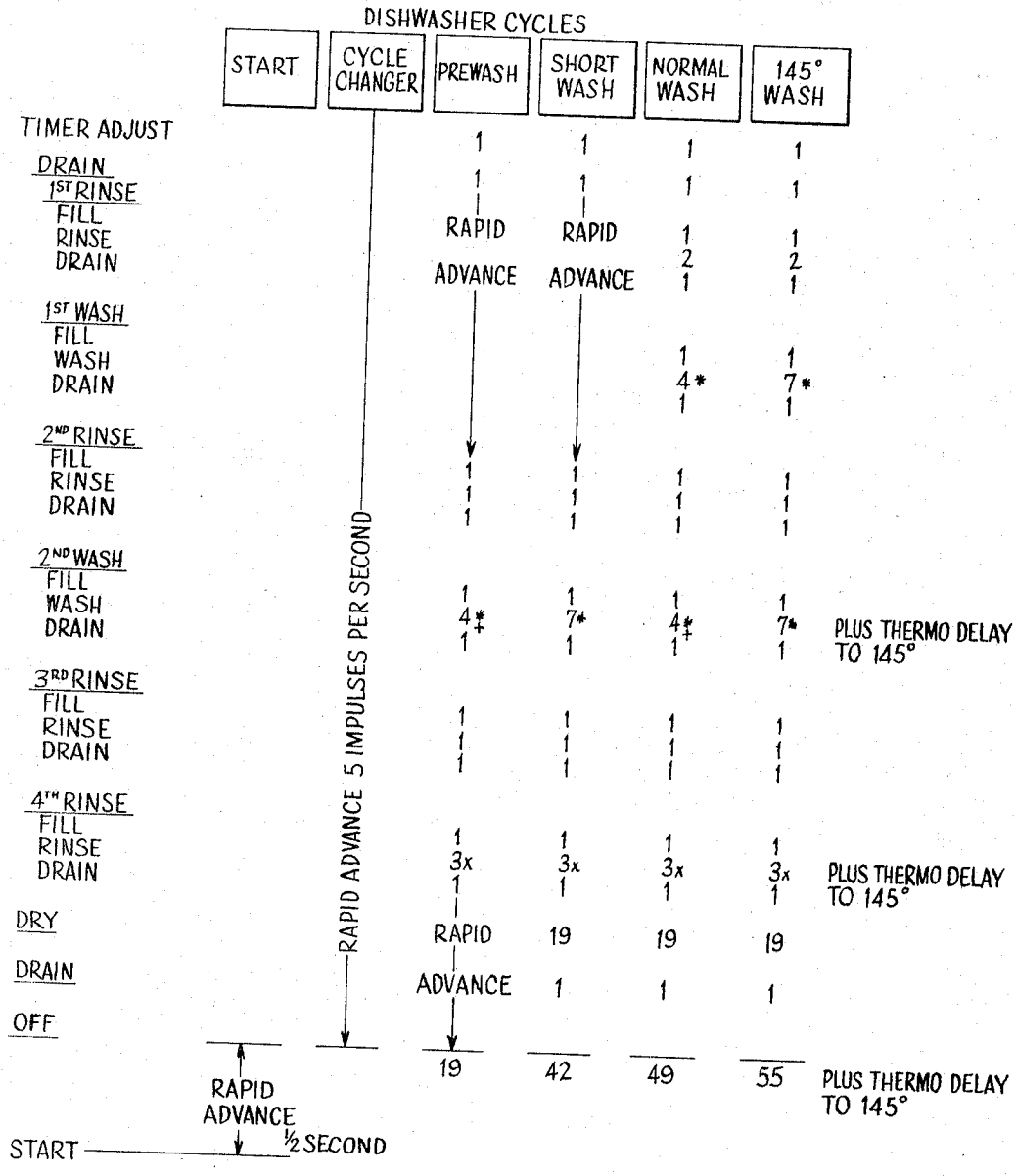
Fig. 3

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May 16, 1967 R. O. TODRANK 3,320,442

CIRCUITRY FOR AUTOMATIC APPLIANCES

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* DISPENSE DETERGENT

x DISPENSE WETTING AGENT

\+ RAPID ADVANCE THROUGH THREE TIMER IMPULSES

Fig.4

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CIRCUITRY FOR AUTOMATIC APPLIANCES

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Filed Jan. 2, 1964, Ser. No. 335,318
7 Claims. (Cl. 307—141)

ABSTRACT OF THE DISCLOSURE

An automatic timer-controlled appliance of the type having operating means for carrying on a series of functions and a motor driven timing device with a plurality of sequential positions and capable of actuating a first series of switches connected to the operating means and arranged to energize the operating means in a given sequence forming a timer cycle, including a rapid advance motor for driving the timing device at greater than normal speed through its sequential positions and a plurality of manually actuable means for selecting a plurality of operating cycles differing from each other with respect to the sequential actuation of the operating means. The manually actuable means operate a second series of switches, some at least of which are connected to energize the rapid advance motor through switches operated by the timing device, whereby the rapid advance motor may be energized selectively at at least one point in the timer cycle to advance the timer rapidly through certain of its sequential positions to cause that portion of the timer cycle to be omitted, the timing device thereafter automatically resuming its normal speed for the performance of the next operation in the operating cycle.

The invention relates to automatic appliances adapted to carry on in sequence a plurality of operations. Typical of such appliances are automatic dishwashers and automatic clothes washing machines. This invention will be described in an exemplary embodiment having to do with automatic dishwashing machines, it being understood that the principles of the invention are applicable to other appliances presenting similar problems.

The various operations are controlled or initiated by electrical means. Thus, in a dishwasher there is ordinarily an electric motor which drives one or more pumps, and in many instances an impeller for showering the tableware with water contained in the vat of the machine. In many such machines a pump is employed of such character as to result in circulating the water when the motor is driven in one direction, but to exhaust the water or drain the vat when the motor is driven in the opposite direction. Such machines contain one or more solenoid operated valves; they are generally provided with a door operated switch which will permit operations only when the door is closed; they frequently contain a switch-operated electric heater, and sometimes electrically operated devices for delivering to the vat measured increments of detergent substances and the like.

Automatic dishwashers are arranged to carry on a plurality of operations in sequence. The series of operations will be referred to herein as a "cycle." For example, a typical automatic dishwasher is arranged to carry on in sequence a series of operations which may be designated as first rinse, drain, first wash, drain, second rinse, drain, second wash, drain, third rinse, drain, fourth rinse, drain, dry and drain.

The carrying on of this or some other sequences of operations is controlled by a timer, of which various varieties are known. A timer will comprise a motor. In some instances the motor drives a device like a commutator which results in the sequential and in some instances

simultaneous opening and closing of electric switches. In other instances the timer motor drives a rotating element which is provided with camming surfaces operating electric switches. The switch operating devices of some timers are arranged to be driven at a constant speed during the operation of the automatic appliance. In other instances the switch operating mechanism is arranged to be advanced or rotated step-wise through the action of the motor. All of these variants of timers are old and well known.

At times, the operator may desire to have the appliance carry through less than the full gamut of operations making up the most complex cycle of which the machine is capable. For example, it may be desired to place breakfast dishes in the dishwasher and give them a preliminary wash or rinse or both, reserving the full cycle of operations for a time when luncheon and perhaps dinner dishes may also be placed in the tableware racks of the device. It has thus been the practice to place a knob and dial on the shaft of the timer whereby the user can omit certain initial operations of the cycle; and the operating knobs of some automatic appliances have been so arranged that the operator can select a particular operation and then stop the mechanism at the conclusion thereof.

The provision of a knob and dial in connection with the shaft of the timer, means however not only that the knob and dial must be located in a position of convenient access to the operator, but also that the timer must be located adjacent the knob and dial. This is frequently a matter of inconvenience and expense both in construction and in wiring.

One of the objects of this invention is to provide a structure which will be flexible in operation, but which does not require a dial or the manipulation of a dial, and which allows the timer to be located at any favorable position within the apparatus.

The provisions hithereto made for flexibility of operation have not generally been satisfactory per se. While it may in instances be desired to omit an early part of the cycle, there are other instances in which a later part or parts of the cycle are likewise desired to be omitted. The advantage of automatic appliances of the types referred to is best realized when a cycle or abbreviated cycle will be carried through by the apparatus when once started by the operator, and without requiring the attention of the operator to stop the apparatus after the completion of certain selected operations.

Considering a cycle to be made up of a series of operations or steps, it is not generally desirable to provide an actuating means (i.e. push button or the like) for each individual operation. It is an object of the invention to provide a simple system in which one of a plurality of preset cycles can be selected by the operator simply by actuating a plunger, button or like device.

It is an object of the invention to provide a system of the kind just outlined in which an indication of the place in a selected cycle at which the machine is presently operating will be given by the illumination of one of a plurality of signal lights.

Thus it is an object of the invention to provide an automatic appliance in which the only elements to be actuated by the operator to select a cycle is one of a series of push buttons or plungers which may be appropriately marked and in which there is further need at the outside of the machine only for a starting button and a series of signal lights. In this way automatic appliances may be manufactured having much more pleasing external appearances.

In view of the fact that an operator desiring to use the machine may find that it is set for an undesired cycle, it is one of the objects of the invention to provide circuitry facilitating the setting of the machine for a different se-

lected cycle. Further in view of the fact that a portion of one selected cycle may be started after which the operator decides upon a change of cycle, it is an object of the invention to provide circuitry which will facilitate a change from one cycle to another while the machine is operating, or which will facilitate a return of the timing mechanism to cycle-starting position before the conclusion of a cycle.

These and other objects of the invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, are accomplished by that certain structure and arrangement of parts of which an exemplary embodiment will now be described. Reference is made to the accompanying drawings wherein:

FIG. 1 is a schematic circuit diagram for an exemplary dishwashing machine.

FIG. 2 is a chart showing the positions of certain switches when actuated by means of a circuit selector device hereinafter described.

FIG. 3 is a chart showing the positions of switches and/or contact mechanisms associated with the timer for the various intervals of timer operation.

FIG. 4 is a chart showing an exemplary arrangement of operations for several cycles which may be selected by push buttons or plungers in accordance with the present invention.

FIG. 5 is a semi-diagrammatic plan view of cycle selector means showing push buttons or plungers.

The basic elements of this invention comprise (a) a series of switches and a simultaneous and sequential switch operating mechanism adapted to be operated by a timer motor, (b) a timer motor for operating the same, (c) an additional series of switches having connection with the switches in the timing device, (d) a cycle selector device adapted to actuate selected ones of the last mentioned series of switches upon the depression of plungers or push buttons, (e) an indicator assembly comprising a series of signal lights having connection with the switches of the timing mechanism, (f) a rapid advance motor having connection with the timing mechanism, (g) a main motor for operating the appliance as such and having connection with the timing mechanism, (g) a main motor for operating the appliance as such and having connection with switches of the timing mechanism, and (h) various electrically operated devices, which may be varied as to number and kind but which may include (without limitation) such elements as a safety door switch, a heater, solenoid operated valves, solenoid operated means for injecting surface-active or other substances into the vat of the appliance at desired times, a general illuminant, and the like.

Reference is now made to FIG. 1 wherein **13** is a diagrammatic representation of a plug or source of electric power having power leads **14** and **15** and a ground lead **16**. The timing mechanism, of which various kinds are known as above set forth, is indicated diagrammatically in FIG. 1 by the box **17** shown in dashed lines. The switches which are to be operated in sequence or simultaneously by the timing means are shown within the box and marked AA to VV and XX inclusive. These switches are for the most part but not entirely single pole double throw switches. Whether they are open or closed will depend upon the position of the timing device itself as later explained.

At numeral **18** there is diagrammatically indicated a timer motor of conventional character arranged to drive the timing device in a conventional manner. It will be noted that the timer motor is connected to one of the switches LL of the timing device. Timer motors and timing devices per se are conventional in the art, and do not require specific description.

Below the timing device there is shown a cycle selector mechanism indicated by the box **19** shown in dashed lines. This mechanism includes a plurality of switches marked respectively C to K inclusive. It will be noted that these switches are in series with certain of the switches of the timing device.

Appliances of the general type described as exemplary herein will usually be provided wtih a door and a switch operated by or in connection with the door in such a fashion that the mechanism of the appliance cannot be started until the door is closed. Such a switch is shown in FIG. 1 at B. Also a starting switch is desired; and such a switch is indicated at A. The specific location of the switches A and B on the casing of the appliance does not constitute a limitation on the invention. For example, there is described and claimed in an application of William H. Yake entitled, Latch Mechanism Including Switch, Serial No. 289,906, belonging to the same assignee, a latch structure which incorporates a switch mechanism capable of serving the function of switch B and a plunger or other manually operable switch means for starting the apparatus. It is also possible to incorporate a starting switch in the assembly **19**, as later described in connection with FIG. 5.

The function of the cycle selector device **19** is to actuate selected ones of the switches C to K inclusive when any one of the buttons or plungers are depressed by the operator. In FIG. 5 the cycle selector is shown as comprising a body **19***a* and a series of push buttons or plungers **20** to **25** mechanically connected therewith. Upon the depression of a plunger, such as **25**, internal mechanism in the cycle selector will act to close selected ones of the switches C to K inclusive and to open others in the series or to open or close one or more of the switches momentarily. The device can be set up so that a given plunger will actuate one or any desired combination of the switches C to K inclusive. The device itself is known in the art. Entirely satisfactory devices, for example, are sold by General Electric Co. under the designation "Series 138B." In the exemplary embodiment of this invention illustrated in FIG. 1, the switch combinations and the direction in which they are actuated are illustrated in the chart which constitutes FIG. 2 hereof. Plunger **20** may be considered as a "start" plunger actuating switch A; and it will be noted from the chart that depressing it will momentarily close switch A while leaving switches C to K inclusive unaffected as to position. Plunger **20** is a spring pressed plunger which will return to undepressed position when released by the operator. The other plungers **21** to **25** inclusive may be considered as comprising a "cycle changer" plunger **21**, and other plungers which for purposes of this disclosure may be designated as "PRE-WASH," "SHORT WASH," "NORMAL WASH" and "145° WASH," or by other appropriate or informative designation which will enable the operator to select the desired cycle.

The "cycle changer" plunger **21** is a spring pressed plunger which will return to undepressed position when released by the operator. There is a mechanical interconnection of known type between plungers **21**, **22**, **23**, **24** and **25** such that if the appliance happens to be set at the moment for an undesired cycle, depression of the "cycle changer" plunger **21** will release the depressed plunger, insure that the timer is in starting position, and permit the depression of such other plunger of the group **22** to **25** as is related to the desired cycle. On the other hand, if the machine is running, a plunger for a cycle other than the one desired having been inadvertently depressed, one can either start over again (i.e. with the timer back to starting position) by depressing the "cycle changer" plunger **21** and then the desired plunger, or simply press the plunger of the desired cycle, which will take over from whatever position the timer happens to be in at that time.

As will be seen from FIG. 2 depression of the "PRE-WASH" plunger will result in an open condition of switches A, C, F and H and a closed position of switches D, E, G, J and K. The chart gives the switch combinations for the other plungers as will be evident. It may

be noted that FIG. 1 shows the switches C to K inclusive in the positions they will occupy for the "NORMAL WASH" cycle, i.e. upon depression of plungers 24, and that it shows switches A and B in the open position. Thus the appliance, as illustrated in FIG. 1, is set up to operate in accordance with the "NORMAL WASH" cycle. To start such operation, the operator need only close the appliance door, thus closing switch B, and momentarily depress start plunger 20. It will be noted in FIG. 2 that depression of start plunger 20 will not disturb the switch positions set up by the depression of normal wash plunger 24.

Before describing the operation of the invention, certain additional apparatus features should be described. Diagrammatically indicated at 26 is a rapid advance motor which is coupled to the shaft of the timing mechanism through an over-running clutch (not shown). The effect of the rapid advance motor when energized will be to turn the shaft of the timing device relatively rapidly through successive stages or positions representative of certain operations, the rate of movement of the timing device being so rapid that the said operations will not be performed. De-energization of the rapid advance motor will bring the timing device again under the influence of the normal timer motor 18 so that later operations will be performed as determined by the timing device.

FIG. 1 also shows an indicator light assembly diagrammatically indicated in dashed lines as a box 27. This box will contain a plurality of indicator lights, e.g. neon tubes provided with appropriate jewels or windows and marked 28 to 34 inclusive. It will be understood that the indicator light assembly will form a part of a panel located on the casing of the appliance in a position of visibility to the operator; and appropriate markings, such as "FIRST RINSE," "FIRST WASH" and the like will be employed with the indicator lights. The lights are shown as connected to certain switches in the timing device. When any particular operation is being carried on in a cycle its light will be energized, thus showing to the operator the part of the cycle which is in progress. A ballast resistor for the neon tubes is shown at 35.

A conventional reversible main motor for the dishwashing machine is indicated diagrammatically at 36 as having a main winding 37 and separate phase windings 38 and 39 for reversal. The motor has a starting relay 40 and an overload switch or circuit breaker 41. It will be noted that the main motor is connected to certain switches of the timing device.

The assembly may contain a number of other instrumentalities such as a solenoid water valve 42 with an overflow switch 43 which, as known in the art, will prevent operation of the solenoid valve if the pressure falls below a preset value. A heater 44 will ordinarily be used; and the exemplary dishwasher may be provided with a solenoid operated device 45 for injecting a surface-active materail during one of the rinses, or with other means 49 for injecting measured quantities of detergent during one or more of the washing operations, or with a fluorescent lamp 46 and its ballast 47 for general illuminating purposes.

Other than as herein described, the specific construction of the dishwasher used as an exemplary embodiment for purposes of this invention does not require description; and it will be obvious from the teachings hereinafter made that the principles of the invention may be incorporated in appliances other than dishwashers. It will be understood that in the exemplary embodiment the reversible motor 36 may be caused to drive pump means for circulating liquid in the vat of the dishwashing machine as well as pump means for draining the vat. In some operations a higher temperature is desired. This can be obtained from the heater 44 through the use of thermostatic delay or regulating means 48.

Reference is now made to FIG. 4 which is a chart of operations capable of being carried on in cycles. The

operations themselves are listed in the left hand verticle column. The first column to the right shows that when the "START" plunger is depressed, the timer will be advanced from the off position to the starting position by the rapid advance motor unless the timer is at a position other than "OFF." The next column toward the right is diagrammatically indicative of what happens when the cycle changer plunger is depressed. Unless the timing device is already in the off position, it will be brought rapidly to the off position by the rapid advance motor.

The other four columns toward the right respectively indicate pre-arranged cycles which may be set up for the appliance to follow through by the depression of any one of the plungers 22 to 25 inclusive. These columns also contain numbers indicative of the length of time in minutes required for the several operations, with totals at the bottoms of the columns. It may be noted that both the "PRE-WASH" and the "SHORT WASH" cycles omit the first rinse and first wash operations, the "PRE-WASH" cycle omitting also the final drying and draining operations. The "NORMAL WASH" and "145° WASH" cycles differ from each other in that the latter includes operation of the thermo-delay device 48 whereby a higher temperature is attained during the second wash and fourth rinse operations.

The chart, FIG. 4, is exemplary only since it would be possible to set up other cycles for special purposes. At the same time, the four cycles indicated in the figure give a wide flexibility of operation suitable for normal household work.

Reference is also made to FIG. 3 which is a diagrammatic representation of the timing means which has been referred to above as rotatable by the normal timer motor 18 and by the rapid advance motor 26. Regarding the timing means as a cylinder, FIG. 3 can be through of as the surface of that cylinder unrolled into a single plane. The axis of the cylinder would lie in the vertical direction in FIG. 3. Under the influence of the normal timer motor 18 the cylinder would rotate 6° each sixty second interval. The intervals are marked on the chart. The dark bars on the chart are indicative of switch operation, whether the timing cylinder be constructed as a commutator or whether it be constructed with commutator elements to operate separate switches. It will be understood that in the exemplary machine if the timing device were simply rotated by the normal timer motor 18 the result would be the following through of all of the operations indicated in the left hand column of FIG. 4 in the sequence indicated.

The operation of the circuitry of this invention can now be considered. Assuming that the operator of the appliance has placed her tableware in the baskets of the exemplary dishwasher, the closing of the door thereof will close switch B which is in the main power lead 14. The selection of a cycle can occur either before or after the closing of the door by the depression of any one of plungers 22 to 25 inclusive. It will be understood from what has been said above that the depression of any one of these plungers will result in the release of any other plunger of the group which has previously been depressed, so that the selection of a cycle prior to any operation of the machine is merely a matter of the depression of a selected plunger. It has been indicated above that the switches C to K inclusive are shown in FIG. 1 in the positions they will occupy upon depression of the "NORMAL WASH" cycle button 24.

Now, if the operator momentarily closes switch A (as by depressing "START" plunger 20 in FIG. 5), this will cause the rapid advance motor 26 to be energized through switch FF if the timer is not in position for the commencement of the selected cycle. However, if the timer is already in such position, or when it is brought to such position by the action of the rapid advance motor, this motor will be de-energized because the timer will have opened the switch FF. At the start of the timer into

a new cycle, timer switch AA is closed, thus energizing the fluorescent light 46; and it will be noted from FIG. 3 that this light will remain on throughout the cycle. Also, timer switches KK and LL will have been turned on by the timer mechanism, and since switch J of the cycle selector mechanism 19 is also in closed position, the timer motor 18 will be started. It will be noted from FIG. 2 that switch J will remain closed so long as any of the cycle selector plungers 22 and 25 is depressed.

The main winding 37 of the pump motor 36 is connected to power lead 15 and in series with the coil of the starting relay 40, which senses the amount of current in the circut. Since the current drawn is high when the motor is operating below normal speed, the relay 40 will be actuated so as to connect power to one or the other of motor windings 38 and 39 depending upon the closure of either of switches PP or QQ. The resultant energization of winding 38 or 39 (which may be regarded as starting windings for the motor 36) determines the direction of rotation of the motor and also serves to bring the motor to normal speed. At normal speed the current in the main motor winding 37 drops to a fixed lower level, which allows the relay 40 to disconnect power to the previously energized starting winding.

The motor 36 may, inter alia, drive a reversible pump of known character and so arranged that rotation in one direction will produce agitation in a washing or rinsing liquid contained in the vat of the dishwasher, while rotation in the opposite direction will drain the liquid from the vat. Since, therefore, it is necessary to reverse the main motor 36 between washing and draining operations, the starting relay 40 will be seen to be connected to the power lead 14 through two timer switches MM and OO in parallel. The switch MM will be used for operation of the motor in the washing direction, but the timing device is so arranged that when the motor is reversed for draining, the power connection is made through switch OO. This last mentioned switch is so related to the timing mechanism as to be closed six seconds after the start of a timing interval and opened six seconds before the close of a timing interval. This allows the motor 36 to come to a stop before reversing; and in the exemplary mechanism it limits the drain time to 48 seconds.

It will also be noted that the connection of the starting relay for the motor to the power lead 14 is through selector switch J and timer switch KK. If either of these switches is open, the motor 36 cannot be operated. The indicator lights 28 to 34 are connected between the power leads 14 and 1 through switches RR, SS, TT, UU, VV and XX. It will readily be understood that these switches are so controlled or operated by the timing device 17 that a selected light will be energized only during the time occupied by a single one of the operations listed in the left-hand column of FIG. 4. Switch AA is in series between the indicator lights and power lead 14, as will be evident from the drawing, so that the appropriate one of the indicator lights can be energized only during such time as switch AA is maintained in closed position by the timing mechanism. So long as a cycle is in progress, however, the appropriate one of the indicator lights will give notice to the user of the appliance of the particular operation embraced in the selected cycle which is then going on.

At appropriate times during the selected cycle, filling operations occur through the actuation of the solenoid water valve 42. The overflow protector 43 is in series with the solenoid valve to prevent flooding. The actuation of the valve occurs through the closure of switches BB and KK of the timing device and switch J of the cycle selector assembly.

The heater 44 is connected at one end to the power lead 15 and at the other end through timer switches CC and DD in parallel, cycle selector switch J, and timer switch KK to power lead 14. The use of two switches CC and DD in parallel in the timer for energizing the heater is not of significance excepting that in the particular exemplary embodiment it enables a standard timer to be used on two different models of dishwasher. It may be noted that timer switch EE (which can be closed when DD is open) actuates a detergent dispenser 49 which may be employed to discharge a measured quantity of detergent substance into the liquid in the vat of the dishwasher during one or more washing cycles. It will be seen also that the rinse injector 45, designed to discharge a metered quantity of surface-active substance into the rinse liquid is controlled by timer switch NN.

The "145° WASH" is effected by turning on the heater 44 and effecting a timed delay in the operation of the dishwasher until such time as the temperature becomes hot enough in the vat to satisfy a thermostatic switch 48. It will be seen that the thermostatic switch is shunted by a switch K in the cycle selector switch assembly. The timer switch LL is arranged to be opened by the timer when higher temperature conditions are desired, which is usually during the second wash and the fourth rinse operations. As will be seen from the chart, FIG. 2, when plunger 25 has been depressed, switches C, D, E, G and K are in the open position, switches F, H and J are closed. Since cycle selector switch K and timer switch LL are both open, the timer motor stops permitting the heater to raise the temperature of the liquid in the vat. When the temperature has risen high enough for the thermostat switch 48 to close, the timer motor is restarted so as to continue with the cycle.

It has hitherto been made apparent that in the so-called "PRE-WASH" and "SHORT WASH" cycles the first rinse and first wash operations are omitted. This is accomplished by energizing the rapid advance motor so as to move the timing device ahead at a more rapid rate. If plunger 22 is depressed, the chart, FIG. 2 indicates that switches C, F and H are in the open condition while switches D, E, G, J and K are in the closed condition. Energization of the rapid advance motor under these circumstances occurs through cycle selector switch E and timer switch II; and the rapid advance motor will continue in operation until timer switch II opens at the start of the fill for the second rinse period. The consequent advancement of the timing mechanism occurs in the exemplary embodiment in about 2½ seconds as against the approximate 12 minutes, which would be occupied by the first rinse and first wash operations if the timer were driven by the normal timer motor 18.

The "PRE-WASH" and "NORMAL WASH" cycles include abbreviated wash periods. As indicated in the FIG. 2 chart, selector switches C, D, F and G will be open for the "PRE-WASH" cycle while switches E, H, J and K will be closed. For the "NORMAL WASH" cycle switches C, E and G will be open, while switches D, F, H, J and K will be closed. In either of these cycles it will be seen that cycle selector switch D will be closed; and the rapid advance motor 26 can be energized through switches GG and KK. When so energized it will advance the timing device through three positions in about ½ second as compared with the three minutes normally required.

It sometimes occurs that the operator of the exemplary appliance will have started it in operation on a cycle, and before the cycle is completed will have decided that some other cycle should have been selected. For example, having placed tableware in the dishwasher and having started it in operation on the "PRE-WASH" cycle, the housewife may decide that the she should have chosen a cycle which would result in subjecting the tableware to a more thorough cleansing. She can, under these circumstances, press any one of plungers 23, 24 and 25, and the appliance will thereafter follow the last suggested cycle, but only from the operation currently going forward. This may not be enough for the operator's purpose, whereas it would take a considerable time and be wasteful of detergent to allow the first cycle to proceed

to completion and then subject the tableware to an additional cycle of operations. For this reason a cycle changer plunger is provided in accordance with this invention. When the cycle changer plunger is depressed, the rapid advance motor is immediately energized, the cycle presently in progress is interrupted, and the timing device is driven at a rapid rate back to the starting position. If the cycle changer plunger is depressed immediately after the start of a cycle, it will take only about ten seconds for the timing device to advance through all of its stages and return to off position. A reference to FIG. 2 will indicate that depression of the cycle changer plunger will result in closure of cycle selector switches C, D, F, H and K, if these were previously open, and an opening of switches E and G if these were previously closed. Also, depression of the cycle changer plunger will result in an opening of switch J. The rapid advance motor **26** is powered through cycle selector switch C so long as the plunger **21** is held depressed. Also, the switch J is held open during this advance time to prevent connecting power to the motor or the water valve while the timing device is returning to starting position. Thus the operation is quiet, and is carried on without danger to the operating instrumentalities of the appliance. The switch J thus acts as a cut-off during cycle changing operations. When the cycle changer plunger **24** is released, switch C will return to the open position and switch J will return to the closed position, and the appliance will be set for the following of the "NORMAL WASH" cycle.

Modifications may be made in the invention without departing from the spirit of it. The invention having been described in certain exemplary embodiments, what is claimed as new and desired to be secured by Letters Patent is:

1. In an automatic timer-controlled appliance, containing operating means for carrying on a series of functions, the combination of a timing device having a plurality of sequential positions, said timing device having a first series of switches in connection with said operating means and arranged to energize said operating means in a given sequence forming a timer cycle as said timing device is driven through said sequential positions, a timer motor for driving said timing device at normal speed through said sequential positions, a rapid advance motor for driving said timing device at greater than normal speed through said sequential positions, and a plurality of manually actuable means for selecting a plurality of operating cycles differing as to the operation of said operating means, said manually actuable means serving to operate a second series of switches, certain at least of said second series of switches being connected to energize said rapid advance motor through switches operated by said timing device, whereby said rapid advance motor may be selectively energized at at least one point in said timer cycle to advance said timing device rapidly through certain of said sequential positions for certain operations so as to omit them in said operating cycle, said timing device automatically resuming said normal speed for the performance of the next operation within said operating cycle.

2. The structure claimed in claim **1** including an additional manually actuable means for interrupting a cycle and advancing said timing device to starting position, said additional manually actuable means being arranged to operate a switch for energizing said rapid advance motor irrespective of the position of the said timing device, and further arranged to operate a second switch for deenergizing some at least of said operating means while said additional manually actuable means remains in the actuated position.

3. The structure claimed in claim **1**, including a series of electrically operated signalling means, there being switching means on said timing device for selectively energizing said signalling means in accordance with operations being carried on by said operating means.

4. The structure claimed in claim **1** including means whereby any one of said manually actuable means may be actuated while said timing means is being driven whereby the cycle selected by said last mentioned manually actuable means will be performed by said appliance from that sequential position occupied by said timing device at the time said last mentioned manually actuable means was actuated.

5. In an automatic timer-controlled appliance for carrying on a series of operations and containing electrically controlled operating means for that purpose, the combination of a timing device arranged to operate a first series of switches to cause operations to be carried on by said operating means in a predetermined cycle, a timer motor for driving said timer device, a rapid advance motor for driving said timing device at a greater rate of speed, and cycle selector means comprising a plurality of manually actuable elements and a second series of switches arranged to be differentially actuated by said manually actuable elements, there being in said second series of switches a switch actuated by one of said manually actuable elements to energize said rapid advance motor for only so long as said element is actuated, and a second switch operated by the same manually actuable element for cutting off power from certain at least of said operating means for so long as said manually actuable element is actuated.

6. The structure claimed in claim **5** wherein said cycle selector means includes additional switches some at least of which are connected into the circuit of said rapid advance motor but in cascade with at least one of said first series of switches whereby the operation of said timing device will energize and de-energize said rapid advance motor.

7. The structure claimed in claim **5** including electrically operated signalling means, said first series of switches including switches for energizing said signalling means in accordance with operations being carried on by said operating means.

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