This invention relates in general to laundry appliances and, more particularly, to coin operated automatic washing machines with a new and improved timer control therein.

It is well known in coin operated automatic washing machines to utilize a timer for controlling the amount of hot water to be introduced into the machine, the agitation cycle, the spin cycle, the rinse cycle, etc. through an entire washing operation. However, if the power being supplied to the machine is temporarily interrupted, the washing machine will stop and its timer control may not cause the automatic continuance of the washing machine on its cycle at the point where the washing machine stopped.

One factor in the inability of a washing machine to continue its cycle after power interruption is due to the fact that the loss of power causes deenergization of a holding relay which will not thereafter become energized when power is restored. This means, of course, that with the deenergization of the holding relay and its inability to become energized, the coin, previously dropped by the operator to energize the holding relay and start the washing cycle, is lost so far as the operator is concerned and requires the insertion of another coin into the washing machine timer control mechanism to start the operating cycle again. This is not only annoying but unfair to the operator.

Attempts have been made to correct this deficiency in prior art washing machines by the utilization of relays and condensers forming part of the circuitry in the washing machine, but these have been unsatisfactory because the action of these devices was not always dependable.

Accordingly, it is a general object of this invention to provide a new and improved automatic washing machine and timer control therein which constitute an improvement over prior art washing machines to overcome the defects therein.

It is a particular object of this invention to provide a coin operated automatic washing machine with a new and improved timer control for controlling the washing machine through a series of operations and which control is provided with a means for continuing in its cycle of operations after an interruption in the power being supplied to the washing machine causes a momentary stoppage thereof.

Still another specific object of this invention is to provide a washing machine and a timer control which are positive and foolproof in operation so that if there is a stoppage of the washing machine by an interruption in the power being supplied thereto, the washing machine will continue in the cycle of operation from the point in its cycle where it has stopped.

Briefly, this invention comprises an automatic washing machine having a timer control including a plurality of electric motor driven cams for operating switching solenoids and relays which control the cycle of operation of the washing machine. The timer control is provided with a holding relay initially energized by the coin, and a stop-start cam which begins the series of operations forming the washing cycle and which stops the washing machine after completing the washing cycle. In the embodiment illustrated, the stop-start cam is constructed and arranged so that if the power being supplied to the washing machine is interrupted, and the washing machine and timer control are stopped, the stop-start cam holds the timer control in such a manner that, upon power being resumed, the holding relay may be reenergized and the remainder of the washing cycle may be completed without the loss of the coin to the operator. By utilizing a cam such as the stop-start cam in the timer control to provide for continuation of the washing cycle after electric power interruption, a positive mechanical means is provided which can be relied upon to perform under all conditions of operation.

The timer control forming part of the present invention is also provided with means for varying the time intervals or increments of the cycle of operations forming the washing cycle and this is accomplished, in the embodiment disclosed, by providing one or more of the cams with a movable plate which lengthens or shortens the cam surface of the respective cam. In addition, the timer control is also provided with means in the form of diodes and condensers arranged in the circuit of the timer control to reduce arcing between the contacts of the relays and switches during opening and closing thereof and which permit the use of smaller relays as will be understood from the explanation of the invention hereinafter. It will be noted, too, that all of the foregoing parts of the timer control are arranged in a compact, relatively small unit.

Accordingly, a further object of this invention is the provision of a coin operated washing machine and timer control therein having a cam which provides a positive means for permitting the washing machine to continue in its washing cycle after an interruption of the power supply.

Still another object of this invention is the provision of a coin operated washing machine and timer control combination which has means for preventing arcing between the contacts of relays and switches in the circuit of the timer control as the timer control operates the washing machine and which permits the use of smaller relays in the circuit.

Still another object of this invention is the provision of a coin operated washing machine and a timer control therein which is provided with means for varying the length of the time intervals or increments of the washing cycle.

Still another object of this invention is the provision of a coin operated washing machine and a compact, relatively small timer control therein.

A better understanding of the invention may be had from the following detailed description when taken in conjunction with the accompanying drawings and wherein:

FIG. 1 is a diagrammatic illustration of a coin operated washing machine having incorporated therein a timer control constructed in accordance with the invention;

FIG. 2 is a plan view of a timer control utilized in the washing machine of FIG. 1;

FIG. 3 is a side view of the timer control of FIG. 2;

FIG. 4 is an end view of the timer control of FIG. 2;

FIG. 5 is a perspective exploded view of the various cams utilized in the timer control shown in FIGS. 2, 3 and 4 and also showing the means for adjusting the camming surface of the cams;

FIG. 6 is a diagram illustrating a timing sequence of the cams shown in FIGS. 2-5; and

FIG. 7 is a circuit diagram of a portion of a timing control in accordance with the invention for operation of a washing machine.

Referring now to FIG. 1, there is diagrammatically illustrated a coin operated washing machine, indicated in its entirety as 10, and comprising a body 11 in which is mounted a drum 12 and an agitator 13. The drum 12 and agitator 13 are suitably mounted for independent movement on a vertical shaft 14. The shaft 14 is pro-
vided near its lower end with a pulley 15 which is connected to a pulley 16 by a drive belt 17. The pulley 16 is mounted on a shaft 18 of a drive motor 20 of any conventional type. The drive motor drives the agitator 13 to agitate the contents of the drum during the agitating cycle in a conventional manner and to spin the drum 12 and agitator 13 in a conventional manner during the spin and rinsing cycles. Suitable clutching and engaging devices, indicated in their entirety as 21 and 22, are utilized to motivate the agitator and to spin the drum. These clutching devices and engaging devices are conventional and they need not be described in detail herein. In the washing machine, there are provided suitable solenoid operated valves, indicated schematically at 23, connected to the water lines which are connected to a timing control 24 to be operated thereby. The timing control is also connected electrically to a coin box 25.

When the articles to be washed are placed in the drum and when a coin is inserted in the box 25, the contents of the drum will be washed by a series of agitation and rinsing cycles controlled by the timing control 24.

Turning now to FIGS. 2–4, it can be seen that the timing control 24 comprises a frame 26 on which is mounted an electric timer motor 27 for driving a shaft 28 through a gear reduction means 29 so that, in the embodiment illustrated, one rotation of the shaft 28 is accomplished for each washing cycle of the washing machine 10.

Mounted on the shaft 28 for rotation thereon are a plurality of cams 31, 32, 33, 34 and 35 each of which is provided with an associated cam follower roller 31a, 32a, 33a, 34a and 35a, respectively. These cam followers ride over the periphery of the cams as the latter rotate to open and close a plurality of cam switches 31b, 32b, 33b, 34b and 35b to which the cam follower rollers are connected. By engaging various cam surfaces on the cam, the switches function to energize various solenoids, later to be described, in the washing machine so as to control, for example, the time and amount of hot water and cold water flowing into the drum and for causing the agitator to operate or for causing the drum to spin at a particular time. For convenience, each of the cam switches is mounted in a bank 36 and connected to a row of terminals 37 (to be described hereinafter) for conveniently connecting the various solenoids to the switches to control the operation of the machine through the washing cycle as shown in the diagram of the timing sequence in FIG. 6.

As previously mentioned, it is often desirable that the time duration of a particular operation be changed or that its beginning time be changed and this is accomplished as illustrated in FIG. 5 by a movable plate 40 which is attached to a cam such as 34 and is coextensive with its outer periphery so that the camming surface of the cam may be lengthened or shortened by changing the position of the movable plate 40 with respect to the cam. In the embodiment illustrated, the positioning of the plate is accomplished by providing afastening means 41 operable in an elongated slot 42 formed in the plate. As can be understood, when the desired position of the plate 40 is found, the fastening means 41 is tightened against the plate to affix the position of the plate on the cam.

Turning now to FIG. 7, there is illustrated a schematic diagram of the timer control 24 and a part of the washing machine. It will be noted that the timer control is schematically shown as 24 and includes the previously mentioned switches 36 and terminals 37, respectively. Alternating current for the operation of the washing machine and timer control may be applied to terminals 43 and 44. The terminal 43 is connected to one side of solenoid 45 of the spin clutch 21, one side of the drive motor 20, one side of a diode 46, one side of the timer motor 27, one side of the solenoid 47 of the agitate clutch 22, and one side of a pilot light 48. One terminal 49 of the bank of terminals 37 may be employed as a tie point to make these connections. The other power supply terminal 44 is connected to a conventional fuse or circuit breaker 50 which in turn is connected via a terminal 51 of the bank of terminals 37 to each of the cam operated switches 36 and the relays as shown.

In the embodiment illustrated, when a coin is dropped in the coin box 25, a circuit is completed between the terminals 54 and 55 of the bank 37 via the upper contacts 56 of the double-pole switch 31b to energize the relay coil 53 to close the contacts 52 and 57 thereof.

It is to be noted that when the relay coils 53 or 61 are energized, a d-c current passes through the diode 46. A pair of capacitors 58 and 59 function to filter the pulsating current so that a substantially uniform direct current is applied to the relay coils 53 and 61.

It should be noted that with the use of a diode 46 and the capacitors 58 and 59 conventional d-c relays may be employed without the appearance of arcing between the contacts of the relays which might otherwise occur.

The energizing of the relay coil 53 completes a circuit via the contacts 52 to the timer motor 27 which starts turning the five cams 31–35 mounted on the common shaft 28 (see FIGS. 2 and 4). The closing of the contacts 52 and 53 energizes the relay coil 61 which causes the relay 61 to close both sets of its contacts 62 and 63. With the contacts 62 and 63 closed, a circuit is completed via terminal 64 to light the pilot light 48 and to complete the circuit to the drive motor 20 of the washing machine. The contacts 62 and 63 associated with the relay coil 61, being in parallel, assure adequate capacity for a heavy surge of current to start and run the drive motor 20.

It is to be noted, too, that with the closing of the contacts 52 and 57, the circuit completed by the dropping of the coin in the coin box 25 is no longer necessary inasmuch as the lower contacts 57 are connected to the upper contacts 56 of the switch 31b so as to complete the circuit to maintain the relay coil 53 energized. Thus the contacts 52 and 57 are held in closed position.

After the start of the timer motor 27, cam surface 65 on the stop-start cam 31 is rotated so that it no longer engages the cam follower roller 31a and the switch 31b remains open and the lower contacts 66 of the switch 31b close, deenergizing the solenoid of the relay 53 so that its contacts 52 and 57 will then open. The lower contacts 66 of the switch 31b, being closed, will remain closed for the entire washing cycle as is evident from a study of FIGS. 5 and 6 inasmuch as there is only one cam lobe 65 to operate the switch 31b.

Within a short time after the start of the washing cycle (40 seconds in the embodiment illustrated) a first or large cam lobe 67 on the cam 35 (the lower linear schematic as illustrated in FIG. 6) engages the roller 35a of the switch 35b which closes the contacts 66 thereof, completing the circuit through terminal 69 to energize the solenoid 71 of the hot water side of the hot and cold water valve 23, previously identified. As connected in FIG. 1, hot water will run into tub 12 for the length of time that the cam lobe 67 contacts the cam follower roller 35a which, in the embodiment illustrated, is approximately three minutes after which time the switch will open by disengagement of the cam lobe 67 with the cam follower roller 35a and shut off the hot water.

Within a short time thereafter (25 seconds in the embodiment illustrated) a lobe 70 on the cam 34 (see FIGS. 5 and 6) engages the cam follower roller 34a with the contacts 72, closing the circuit to the terminal 74 which energizes the solenoid 47 of the agitate clutch 22. The cam lobe 70 engages the cam follower roller 34a for a period long enough to agitate the contents of the drum 12 as desired, which in the embodiment illustrated is approximately 10 minutes.

In the embodiment illustrated, 12 minutes after the
start of the wash cycle and while the agitation cycle is still taking place, a cam lobe 76 of the cam 22, which in turn closes the circuit through the terminal 75 to energize the coil 74, disconnects the respective cam follower rollers so that the solenoids of the agitator clutch and the cold water valve are deenergized, stopping the agitation of the contents of the drum and shutting off the cold water.

Within a short time after the agitation ceases (20 seconds in the embodiment illustrated) to permit the contents of the drum to settle, a cam lobe 81 on the cam 33, as shown in FIGS. 5 and 6, engages the cam follower roller 33a to close the contacts 82 which completes the circuit through the terminal 83 to energize the solenoid of the spin clutch 21. In the embodiment illustrated, the spin clutch will be operative for 2 minutes. Shortly thereafter, or 5 seconds in the embodiment illustrated, after the stop of the spin cycle by the disengagement of the contacts 82 to deenergize the spin clutch, a second lobe 84 on the cam 32 will engage the cam follower roller 33a to close the contacts 76 to energize the solenoid 80 of the hot-cold water valve 23 as aforesaid. This allows the cold water to run into the drum 12 for 5 minutes, after which time the cam lobe 84 disengages the cam follower roller 33a to open up the contacts 76, shutting off the cold water.

In the meantime, and in the embodiment illustrated, two minutes before the end of the five minute period of cold water, a second lobe 85 on the cam 34 engages the cam follower roller 34a to again close the contacts 72 to energize the solenoid 47 of the agitator clutch 22 for a period of two minutes, after which the cam lobe 85 disengages the cam follower roller 34a to open the contacts 72 and cause the agitation to cease.

Shortly thereafter, that is, for a period sufficient to allow the contents of the drum to settle after agitation which in the embodiment illustrated is a period of 20 seconds, a second or large lobe 86 on the cam 33 engages the cam follower roller 33a of the switch 33b again closing its contacts 82 to energize the solenoid 45 of the spin clutch 21 as aforesaid. The cam lobe 86, being large, will hold the contacts engaged for 8 minutes in the embodiment illustrated, after which time the cam follower roller 33a is disengaged opening the contacts 82 to deenergize the solenoid 45 to disengage the spin clutch.

Shortly after the start of the spin cycle (40 seconds in the embodiment illustrated) a second cam lobe 87 on the cam 35 engages the cam follower roller 35a of the switch 35b closing the contacts 68 to energize the solenoid 71 of the hot water side of the hot-cold valve 23, as aforesaid, causing hot water to run into the drum 12 for one minute during this part of the spin cycle. This, of course, gives a hot rinse to the contents of the drum during the spin cycle for this one minute period after which the cam lobe 87 allows the contacts 68 to open and shut off the hot water.

Shortly after the previously mentioned 8 minute spin cycle (20 seconds in the embodiment illustrated), the previously mentioned small cam lobe 65 on the stop-start cam 31 again engages the roller 31a of the switch 31b to open the contacts 66 and close the contacts 56 which stopping the timer motor and deenergizing the solenoid 61. Inasmuch as the timer motor stops the turning of the cams, the cam lobe 65 will remain in engaged position with the contacts 56 closed as they were at the beginning of the washing cycle and in this position the washing machine is shut off and the automatic wash cycle is complete. The contacts 56 remain closed so that the washing machine is again in a condition to start the next wash cycle when a coin is dropped in the coin box 25.

While specific times have been recited above concerning one washing cycle of the washing machine, the time between the intervals can be varied by a change of position of the respective cams to the shaft and the beginning or end of a particular cycle can be varied by the positioning of the plate with respect to its associated cam.

From the foregoing it is to be noted that in accordance with the invention the stop-start cam 31 operates the switch 31b having contacts 56 and 66 to complete a circuit for the timer motor 27 and the remaining of the electrical components of the washing machine which is maintained despite any possible interruption of current from the power supply. Such an interruption of power will stop the timer motor 27 but will not affect the position of the contacts 56 or 66 so that after the interruption of the power the washing cycle may continue on from the point it was at when interrupted. At the same time, the stop-start cam 31 permits the operating cycle to be initiated by a coin placed in the coin drop 25 and serves to stop the machine operation in the event of any interference with the contacts 56.

While the foregoing illustration and description of the invention have been in connection with an agitation type washing machine, the invention comprehends within its scope, the horizontal type washing machine wherein the cam operates suitable mechanisms to vary the speed of the rotor drum to clear the spin dry the contents of the drum instead of having an agitation cycle as in the embodiment illustrated. It is completely adaptable to other types of washing machines which are employed for coin-initiated operation. The scope of the invention is not intended to be limited to the specific arrangement thereof described and shown and which has been illustrated by way of example only. Accordingly, any and all modifications, variations or equivalent arrangements falling within the scope of the annexed claims should be considered to be a part of the invention.

What is claimed is:

1. A timer control arrangement for a coin operated automatic washing machine comprising in combination a plurality of cam operated switches, a plurality of rotatable cams individually associated with said switches, said cams being mounted on a central shaft and arranged to operate the associated switches in a predetermined sequence, a drive motor for operating the washing machine, a timer motor coupled to the central shaft for driving the cams at a predetermined rate, electrical circuit means individually coupled to corresponding switches for controlling the washing machine through the wash, rinse and drying portions of an operating cycle, a drive motor relay having contacts connected to energize the drive motor, a coin drop switch, and a holding relay coupled to be energized by the coin drop switch, the holding relay having a first pair of contacts coupled to energize the timer motor and the drive motor relay circuit and a second pair of contacts coupled to complete a circuit path from a first cam operated switch to the holding relay actuating coil, said first switch being arranged when actuated by its associated cam to complete a circuit path directly to said timer motor and said drive motor relay and to open the circuit to the holding relay so that the timer motor circuit is maintained irrespective of power interruption until the first switch is returned to an initial position by its associated cam.

2. A timer control arrangement for a coin operated automatic washing machine comprising in combination a plurality of cam operated switches, a plurality of rotatable cams individually associated with said switches, said cams being mounted on a central shaft and arranged to operate the associated switches in a predetermined sequence, a drive motor for operating the washing machine, a timer motor coupled to the central shaft for driving the cams
at a predetermined rate, electrical circuit means individually coupled to corresponding switches for controlling the washing machine through the wash, rinse and drying portions of an operating cycle, a drive motor relay having dual sets of contacts, both of said sets being connected in parallel to energize the drive motor, a coin drop switch, and a holding relay coupled to be energized by the coin drop switch, the holding relay having a first pair of contacts coupled to energize the timer motor and the drive motor relay together and a second pair of contacts coupled to complete a circuit path from a first cam operated switch to the holding relay actuating coil, said first switch being arranged when actuated by its associated cam to complete a circuit path directly to said timer motor and said drive motor relay and to open the circuit to the holding relay so that the timer motor circuit is maintained irrespective of power interruption until the first switch is restored to an initial position by its associated cam.

3. A timer control arrangement for a coin operated automatic washing machine comprising in combination a plurality of cam operated switches, a plurality of rotatable cams individually associated with said switches, said cams being mounted on a central shaft and arranged to operate the associated switches in a predetermined sequence, a drive motor for operating the washing machine, a timer motor coupled to the central shaft for driving the cams at a predetermined rate, electrical circuit means individually coupled to corresponding switches for controlling the washing machine through the wash, rinse and drying portions of an operating cycle, a drive motor relay having contacts connected to energize the drive motor, a coin drop switch, a holding relay coupled to be energized by the coin drop switch, the holding relay having a first pair of contacts coupled to energize the timer motor and the drive motor relay together and a second pair of contacts coupled to complete a circuit path from a first cam operated switch to the holding relay actuating coil, said first switch being arranged when actuated by its associated cam to complete a circuit path directly to said timer motor and said drive motor relay and to open the circuit to the holding relay so that the timer motor circuit is maintained irrespective of power interruption until the first switch is restored to an initial position by its associated cam.

References Cited in the file of this patent

UNITED STATES PATENTS

2,100,284 Kriechbaum -------------- Nov. 23, 1937
2,139,523 Smith ------------------ Dec. 6, 1938
2,810,798 Taylor ------------------ Oct. 22, 1957
2,980,825 Frachon ------------------ Apr. 18, 1961

FOREIGN PATENTS

494,166 Great Britain ------------- Oct. 20, 1938

OTHER REFERENCES