

July 24, 1951

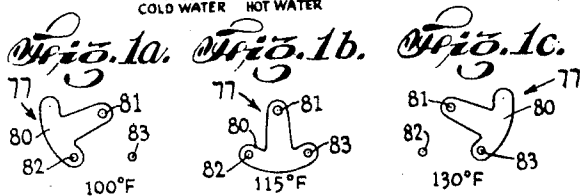
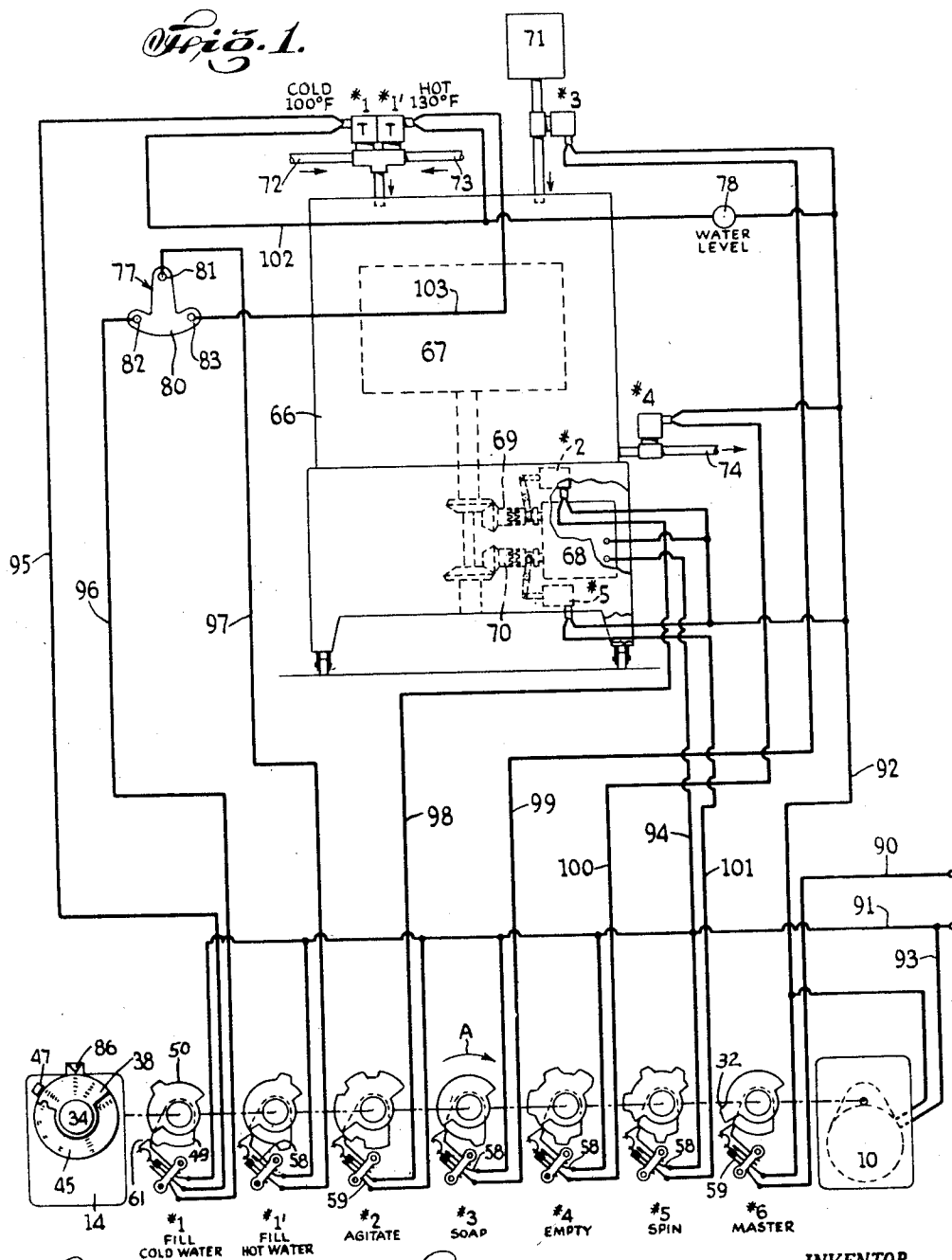
G. W. DUNHAM

2,561,348

AUTOMATIC TIMER FOR WASHING MACHINES AND THE LIKE

Filed Feb. 20, 1947

3 Sheets-Sheet 1



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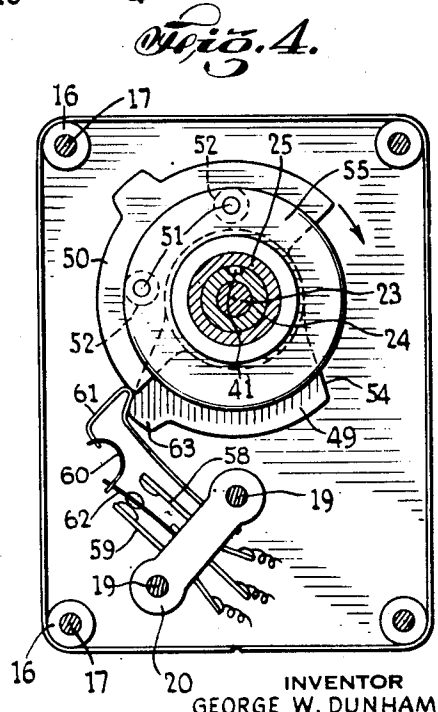
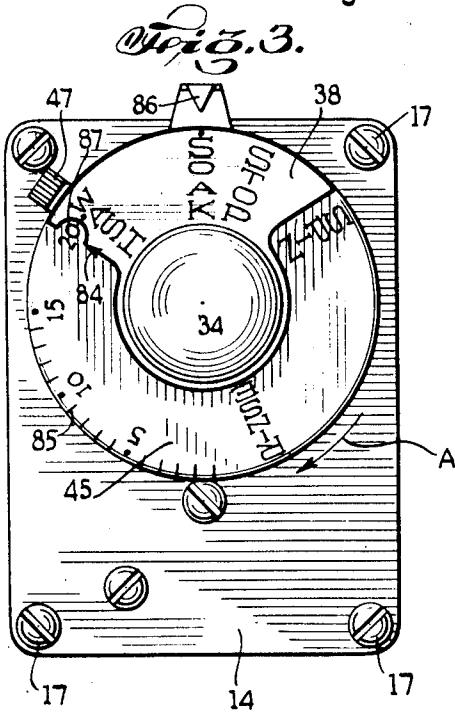
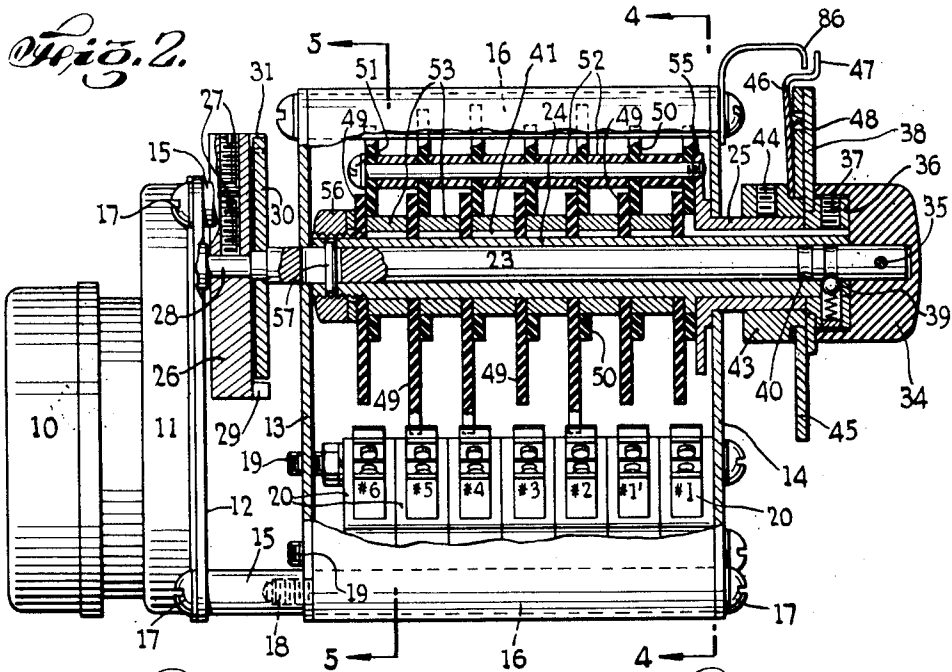
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AUTOMATIC TIMER FOR WASHING MACHINES AND THE LIKE

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3 Sheets-Sheet 2



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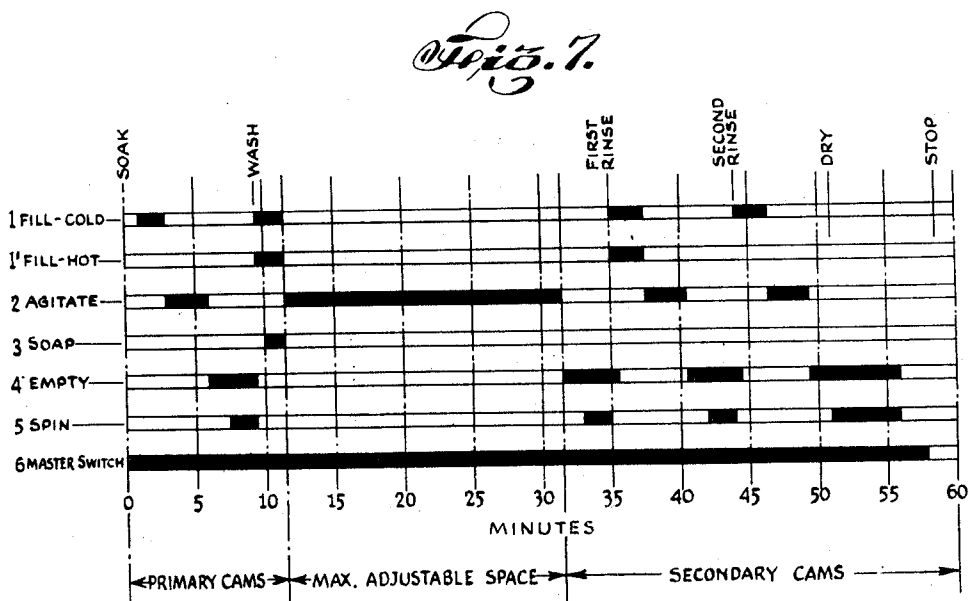
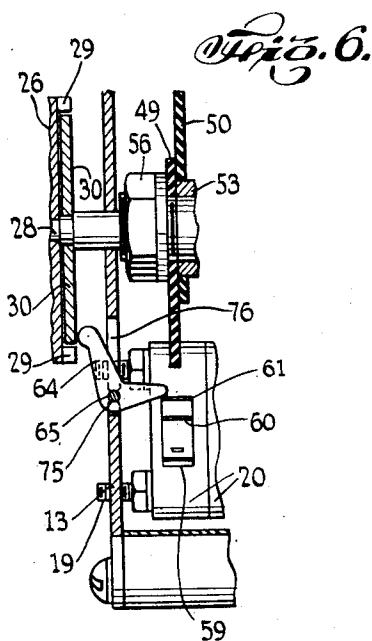
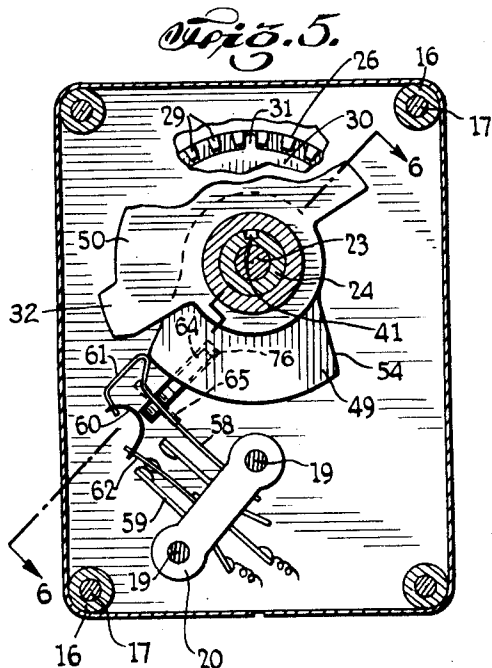
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AUTOMATIC TIMER FOR WASHING MACHINES AND THE LIKE

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,561,348

AUTOMATIC TIMER FOR WASHING
MACHINES AND THE LIKE

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Application February 20, 1947, Serial No. 729,816

4 Claims. (Cl. 68-12)

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The invention relates to timers for controlling initiation, duration and termination of one or more simultaneous actions of a cycle and, more particularly, to a timer for controlling so-called automatic household washing machines.

There are a number of different styles of automatic washing machines on the market, characterized by using a single compartment in which the clothes are placed for the several operations of soaking, washing, rinsing and partially drying. In some of these machines the clothes baskets operate on horizontal axes, in others they operate on vertical axes, and in others they operate on oblique axes. Most washers dry by centrifugal force but a limited number squeeze the water out of the clothes by means of an inflated bag usually using water pressure.

Such prior art automatic machines go through a more or less established cycle which includes a soaking period during which the clothes may or may not be agitated; then a washing period during which the clothes are agitated; then one or more rinsing periods. At the beginning of each period, proper temperature water is supplied and at the end of each period the basket is spun and water is drained from the machine.

It is convenient to classify the parts of a cycle into stations or operations and events or actions. A station or operation comprises one or more events or actions. A typical cycle may be tabulated as follows:

Operation or Station	Action or Event
Soak	Start. Fill. Agitate. Empty. Spin. Stop.
Wash	Fill. Soap. Agitate. Empty. Spin.
Rinse	Fill. Agitate. Empty.
Dry	Spin.
Stop	Stop.

The several actions are generally of fixed duration with the exception of the wash-agitate action, which is adjustable, although similar actions in the different stations may be of different lengths. For example, the agitate for soak may be less than the agitate for wash and the spin

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for soak and wash may be less than the final spin which may be sufficiently long to deliver the clothes damp dry ready for ironing.

The wash-agitate action is the exception because different kinds of material must be treated differently, according to physical condition or strength. Silks, rayon, woolens and finer cottons and linens will not stand the vigorous treatment which may be given to heavier linens and cottons. Very dirty clothes should be washed longer than those slightly soiled. It is usual to provide adjustment for anywhere from zero to fifteen or zero to twenty minutes for the wash-agitate action.

Heretofore, the timers usually have been arranged to stop the machine and wait after the soap-stop action; this requires the operator to return to the machine, put in the soap, adjust the water temperature and turn the timer to the desired wash-agitate time, after which the machine will finish the job by itself.

According to the present invention, the soap is placed in an automatic dispenser and wash water temperature and time of wash-agitate may be pre-set before starting the timer or, if the operator should forget, these quantities may be set at any time during the soak period or up to the first part of the washing period, and the machine will then automatically do the entire job, automatically shutting itself off at the end of a complete cycle.

According to a preferred embodiment of the present invention, the timer may comprise a series of cams rotatable about a common axis, each cam having a primary segment and a relatively movable secondary segment, with concentric shaft arrangements for adjusting these segments with respect to each other, in unison. In this way the cams have correct shape to control the several actions of the several stations, and all of the actions of the several stations are fixedly controlled by the predetermined cam shapes, with the exception of the wash-agitate action. This action may be variably controlled by adjusting the cam segments with respect to each other, the adjustment also controlling the delay of the other actions in the succeeding stations to correspond to the selected length of wash-agitate action. The several cams may operate corresponding electric switches, or other control devices, each of which controls its particular action. It is preferable that all of the control devices be in their innermost position during the wash-agitate action.

If desired, according to the invention, a special

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hot water conservation switch may be provided. By such a switch cold water may be mixed with hot water to obtain intermediate temperature for certain actions not requiring full temperature hot water.

The invention also consists in certain new and original features and combinations hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part hereof, in which:

Fig. 1 illustrates diagrammatically one form of timer according to the invention, with circuit for controlling a cycle of operation of a hypothetical washing machine;

Figs. 1a, 1b and 1c illustrate three positions of the special hot water conservation switch, according to the invention, which may be used with the new timer;

Fig. 2 is a side elevation, parts broken away, of the timer structure;

Fig. 3 is an end elevation illustrating the dial construction;

Figs. 4 and 5 are transverse sections taken on the lines 4—4 and 5—5 respectively of Fig. 2;

Fig. 6 is a section on the line 6—6 of Fig. 5 illustrating a detail of special means for manual operation of the master switch; and

Fig. 7 is a time chart illustrating one complete cycle of operations controlled by the above timer, and illustrating the initiation, duration and termination of the several actions or events which go to make up the several operations or stations.

In the following description and in the claims, various details will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit.

Like reference characters denote like parts in the several figures of the drawings.

In the drawings accompanying and forming part of this specification, certain specific disclosure of the invention is made for purposes of explanation, but it will be understood that the details may be modified in various respects without departure from the broad aspect of the invention.

Referring now to the drawing and more particularly to Figs. 2 to 6, the timer per se will first be described. The timer consists of a main framework comprising a motor plate 12, a back plate 13 and front plate 14 secured together by a series of spacer posts 15 and 16 to which the plates are connected by a series of screws indicated in general by 17. A self-starting synchronous clock motor 10 with standard reduction gear 11 is secured to plate 12 by certain of screws 17.

As shown in Figs. 3 and 4, the posts 16 are positioned at the four corners of the generally rectangular plates 13 and 14. The posts 15 are located at the four corners of the substantially rectangular gear plate 12. The two lower posts 15 and 16 are in line and are connected together by threaded studs 18 passing through the back plate 13.

A concentric shaft assembly supports the main control cams, made up of segments 49, 50, which individually operate the several switches. Each switch has a base 20 (Figs. 4 and 5) through

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which supporting rods 19 pass, these rods being secured within frame plates 13 and 14.

The concentric shaft assembly comprises an inner slide rod 23 having both axial and rotary movement, surrounded by a tube shaft 24 which in turn is surrounded by a sleeve shaft 25 (Fig. 4). This assembly is journaled in frame plates 13 and 14, the slide rod 23 being bearinged directly in plate 13 and the sleeve 25 being bearinged directly in plate 14.

This concentric shaft assembly, together with the cams mounted thereon, is driven by the clock motor 10 through reduction gearing 11, the latter having a driven shaft 28 on which is mounted driving clutch plate 26 to which it is secured by set screws 27. Driven clutch plate 30 is fixedly secured to slide rod 23 and has a single finger 31 adapted to engage between peripheral teeth 29 on drive plate 26 (Fig. 5).

The drive clutch plate 26 is adapted to make one revolution an hour and there are sixty teeth 29 so that by moving slide rod 23 axially and circumferentially (as described below), the single finger 31 may be selectively positioned between the several teeth 29 at intervals of one minute of time.

The concentric shaft assembly is also adjustable by a dial and knob arrangement comprising knob 34 pinned at 35 to slide rod 23. Collar 36 is secured to tube 24 by set screw 37 and has fixed thereto the main dial plate 38. Tube 24 and collar 36 have a radial opening to carry a spring pressed ball detent 39 selectively engageable in spaced grooves 40 in slide rod 23 so that knob 34 and slide rod 23 may be axially pulled from the position shown in Fig. 2 to an outer position where the ball detent 39 engages in the other groove 40 in which position the finger 31 disengages clutch teeth 29.

Sleeve 25 has collar 43 fixedly secured thereto, as by set screw 44, and carries auxiliary dial plate 45. The latter carries a leaf spring 46 carrying finger piece 47 and sharp point 48 engageable, through a hole in auxiliary plate 45, with the main dial plate 38. The leaf spring assembly forms a finger clutch by which, when finger piece 47 (Fig. 3) is depressed, the dial plates 38, 45 may be moved relatively to each other for purposes discussed hereinafter.

The dial plates are marked with suitable indicia to aid the operator to adjust them. As shown in Fig. 3, main plate 38 has the legends Wash, Soak, Stop marked thereon; it also has arrow 84 and notch 87 at one edge cooperating with scale 85 on auxiliary dial plate 45. Scale 85 reads in minutes. Auxiliary dial plate 45 also has legends Spin and Rinse. The several legends cooperate with main arrow 86 affixed to the frame plate 14.

There are seven cam assemblies shown in the form illustrated, these being labeled #1 to #6 and #1'. Cam #1 controls filling with cold water; cam #1' controls filling with hot water; cam #2 controls agitation; cam #3 controls soap supply; cam #4 controls emptying the washing machine; cam #5 controls spinning the basket; and cam #6 is a master cam controlling the whole machine. The uses of these cams will be apparent as the description proceeds.

Each complete cam comprises a primary cam or segment 49 made of plate insulating material and having an integral key fitting in keyway 41 of shaft tube 24. These primary cams 49 are of similar construction except for the outer periphery which is shaped to properly time a particu-

lar action, as will be explained hereinafter. Each secondary cam or segment 50 is of plate insulating material and has a pair of openings, the openings in the several segments being aligned to pass a pair of rods 51. The rods also pass through spacers 52 and the rods are secured to a flange 55 on control sleeve 25. The secondary cams 50 ride on collars 53 which act as spacers for the primary cams 49.

Nut 56 threaded on tube 24 holds the several cam parts in assembled relation. It surrounds a pin 57 fixedly secured to tube 24 and workable in a slot in slide rod 23. Thus knob 34 on slide rod 23, because of the pin and slot connection 57, is able to rotate tube 24 and is also capable of moving axially with respect thereto to engage and disengage clutch parts 29, 31.

The cam plates 49 and 50 have the shapes illustrated in Figure 1 which shapes correspond to the chart shown in Figure 7. Each primary cam 49 has side faces 54 (Fig. 4) by which the extent of relative rotation between the cam segments is controlled, these surfaces 54 abutting the spacers 52. It will be understood that, when clutch finger 47 is depressed, auxiliary dial plate 45 may be moved with respect to main dial plate 38, which in turn relatively moves the primary and secondary cam plates 49, 50. The cam assemblies, as a unit, may be manually rotated by pulling out knob 34 to disengage clutch 29, 31 and rotating by hand. The entire timer, when in the position shown in Fig. 2, is driven by clockwork 10, 11 at the rate of one revolution an hour for the dial and cam assembly.

The several complete cams separately control individual switches of a switch bank. Each switch of this bank comprises an insulation base 20 (Figs. 4 and 5) having molded therein a forward contact 58, a back contact 59 and a movable contact 62 selectively engageable with either forward or back contact. An operating bar 61 is also molded in base 20, the operating bar being adapted to be engaged by the periphery of the cam segments 49, 50. A toggle spring 60 connects operating bar 61 and movable contact 62 to obtain snap action. When the cam bar 61 rides up on a projection, as 63 in Fig. 4, the movable contact 62 snaps from back contact 59 to front contact 58.

These switches are standard devices purchasable on the market and may have single contacts instead of double contacts if desired. That is to say, either the front contact or the back contact may be omitted depending upon the particular set-up in which the timer is to be used. The wiring diagram of Figure 1 illustrates how back contacts may be used in some switches, front contacts in others, and both front and back contacts in others.

The master switch #6, in addition to its operation by its cam, is also operated by pulling out knob 34 to disengage drive clutch 29, 31. For this purpose a bell crank 64 (Figs. 5 and 6) is pivoted within a slot in back frame plate 13. One arm of bell crank 64 is engaged by clutch element 30, the other arm engaging operating bar 61 of the master switch #6 to throw the switch in the same direction as the switch is thrown by engagement with the finger 32 on master cam #6.

The bell crank 64 is conveniently mounted in a slot 76 in frame plate 13, on a pivot pin 65 of substantially the same thickness as frame plate 13. Pin 65 is also mounted within a slot, the edges of the metal being peened over around pin

65, as indicated at 75, to hold the pin firmly in position on the plate slot.

Circuit diagram

The above described timer, in the form illustrated, or in modified form, is capable of a great variety of uses. One of the main uses, and the purpose for which the particular form was laid out, is to operate a household washing machine of the so-called automatic type in which all of the various operations, such as soaking, washing, rinsing and drying are controlled entirely automatically without any attention on the part of the operator after the initial placing of the machine in operation.

Figure 1 shows diagrammatically a hypothetical machine which is operated by this timer. This machine comprises a tank 66 having a vertical basket 67 driven by an electric motor through suitable gearing, both of which are indicated diagrammatically by 68. A clutch 69 controls the agitation of the clothes. That is to say, when clutch 69 is engaged, the basket 67 may be oscillated circumferentially to agitate the clothes therein. When clutch 70 is engaged, the basket 67 is rotated about a vertical axis at high speed to discharge water from the clothes.

Soap chamber 71 feeds the clothes basket 67 with soap. Cold water is supplied through pipe 72. Hot water is supplied through pipe 73. Tank 66 is drained by pipe 74.

The "agitate" clutch 69, the "spin" clutch 70 are operated by solenoids. Cold water pipe 72, hot water pipe 73, soap dispenser 71 and drain pipe 74 are controlled by solenoid-operated valves. The several solenoid operated parts are given numbers #1, #1', #2, #3, #4 and #5 corresponding to the switches and cams which actuate them.

The solenoid-operated water supply valves #1 and #1' may be thermostatically controlled so that the cold water is always at 100° F. and the hot water at 130° F. Such thermostatically-controlled, solenoid-operated valves are available on the market.

To conserve hot water, a hot water conservation switch 77 may be provided. This switch is a three-way switch having the three positions indicated in Figs. 1a, 1b and 1c. The switch comprises a blade 80 pivotally mounted on terminal 81 and engageable with fixed terminals 82 and 83.

This temperature switch provides a convenient means of conserving hot water so that for certain operations less hot water may be used. Many laundry experts feel that silks, rayons and woollens should be washed at a comparatively low temperature such as 100° F., while colored cottons and linens should be washed at a somewhat higher temperature, such as 115° F., and white cottons and linens at a somewhat higher temperature, such as 130° F.

In order to economize on hot water, it is obvious that if 100° water is desired, it is only necessary to actuate solenoid #1, whereas, if 130° water is desired, solenoid #1' alone should be actuated, while if 115° water is desired, both solenoid operated valves should be opened.

To insure addition of the proper amount of water in each case, the solenoid-operated valves may have constant flow devices associated therewith so that the set amount of water is added, according to the time allowed by the control cam, regardless of whether solenoid #1 is turned on alone, solenoid #1' alone, or both together. A

water level switch 78 may be provided, in any case, to turn off the water when it obtains a proper level in the machine.

Thus, if 100° water is desired for the washing operation, the hot water conservation switch 77 is operated to the position shown in Fig. 1a. If 115° wash water is desired, switch 77 takes position shown in Figure 1b. If 130° water is desired, the switch 77 takes position shown in Figure 1c.

It will be understood that, in a set-up such as shown in Figure 7, the washing machine is filled four times with water for a complete cycle. The first fill is for pre-soak and that is usually 100° water, regardless of the material. The second fill is for washing which will take the particular temperature water as explained above. The third fill is for the first rinse that will also take the particular temperature of water desired. The fourth fill is for the second rinse which is usually a cold rinse.

Referring to Fig. 1, the electric supply line mains are indicated by 90, 91. These mains supply current to timer motor 10, washing machine motor 88 and all solenoids, through the contacts of master switch #6. It will be understood that the entire periphery of master cam #6 is low except for the relatively short projection 32 which raises the switch operating bar to open back contact 58 when the total cycle is completed.

Main 91 connects with timer motor 10 by lead 93 and with main drive motor 68 by lead 94. Main 91 also connects with the contacts of the several switches #1, #1', #2, #3, #4 and #5 as shown. Main 90 connects, through the contacts of master switch #6 with distributing main 92.

It will be noted from Fig. 1 that only the back contacts 59 in switches #2 and #6 are connected in circuit, and only the forward contacts 58 in switches #1', #3, #4 and #5 are connected in circuit. Both contacts of switch #1 are in circuit.

Cold water solenoid #1 has a lead wire 102 connected to distributing wire 92 through water level switch 78, and a lead wire 95 connected to the movable contact of switch #1.

Hot water solenoid #1' has a lead wire connected to lead wire 102, and a lead wire 103 connected to contact 83 of hot water conservation switch 77, whose other stationary contact is connected to the forward contact of switch #1 by lead 96, and whose pivot contact 81 is connected to switch #1' by lead 87.

Agitate solenoid #2 is connected to switch #2 by lead 98.

Soap solenoid #3 is connected to switch #3 by lead 99.

Drain solenoid #4 is connected to switch #4 by lead 100.

Spin solenoid #5 is connected to switch #5 by lead 101.

Operation

A typical operation will now be given to assist in understanding the invention. The dial will first be adjusted to pre-set the desired washing period and to start the machine. Assuming the timer has come to rest with the point 32 on the master cam operating the master switch #6, current is disconnected from the entire machine and the timer has come to rest with the word Stop under the arrow 86 in Fig. 3.

To pre-set the washing period, say to ten minutes, the knob 34 is first pulled out to insure holding master switch #6 in inoperative position. The thumb piece 47 is then pressed and auxiliary

dial plate 45 is moved with respect to main dial plate 38 to place the arrow 84 opposite the ten minute mark on the scale 85. The entire dial is then rotated to bring the notation "Soak" under the main arrow 86. The knob 34 is then pressed inwardly, which releases master switch #6 which starts the machine in operation, and which engages timer motor clutch finger 31 between teeth 29.

10 The hot water conservation switch is set, for example, to the position shown in Fig. 1, i. e. for 115° F. hot water.

Referring also to the chart in Fig. 7, the shaded areas indicate working periods of the several events. The legends to the left indicate the several events or actions while the legends at the top indicate the several stations or operations. The chart is laid out for a full sixty minutes of operation, or one complete revolution of the timer. The primary cams or segments handle the events or actions occurring before the wash-agitate period. The secondary cams or segments handle the events or actions occurring after the wash-agitate period. The adjustable space between the cams handle the wash-agitate period.

The high points on the cams, except for cams #2 and #6, initiate and terminate the several working periods. The low points on cams #2 and #6 initiate and terminate the working periods.

30 The cams in Fig. 1 are in position for beginning of Soak. The manual turning of the entire dial to Soak causes the bar of master switch #6 to drop to the position shown in Fig. 1 and circuit to be completed through timer motor 10 and main
35 motor 88. Circuit is completed through timer motor 10 from main 91, through lead 93, motor 10, switch #6 back to main 90. Circuit is completed through the main motor from main 91, through lead 94, motor 88, main 92, switch #6,
40 back to main 90.

The timer moves, under impulsion of the timer motor in the direction of arrow A in Fig. 1. After a brief interval, the operating bar of switch #1 will be raised to admit cold water. Circuit is completed from main 91 through forward contacts of switch #1, lead 95, solenoid #1, lead 102, water level switch 78, distributing main 92, master switch #6, back to main 90. Thus water will be admitted for a certain length of time after which it is automatically turned off by opening of water level switch 78.

Agitate switch #2 next comes into operation by its switch bar dropping into a low point of agitate cam #2. This operates agitate solenoid #2 by completing circuit from main #1, switch #2, lead #8, solenoid #2 back to distributing main #2 and thence back to main #0, as before. This agitates the laundry in the basket which continues until the bar of switch #2 rides up on high point of cam #2.

At this time the bar of empty switch #4 rises, which opens the drain valve, and, after a short time, bar of spin switch #5 rises to start the basket spinning to expel soak water from the clothes.

The closing of empty switch #4 operates solenoid #4 by completing circuit from main 91, switch #4, lead 100, solenoid #4, back to distributing main 92.

70 The closing of spin switch #5 operates solenoid #5 by completing circuit from main 91, switch #5, lead 101, solenoid #5, back to distributing main 92.

At the end of the soaking period, the washing
76 period begins by rising of bar of hot water switch

#1', admitting both cold and hot water into the machine. At the same time bar of soap switch #3 rises to admit soap.

Circuit is completed through solenoids #1 and #1' as follows: from main 91, switch #1' (switch #1 not operated), lead 97, switch 77, lead 103, solenoid #1', water level switch 78, back to main 92; also from switch 77, lead 96, back contacts of switch #1, lead 95, solenoid #1, lead 102, water level switch 78, back to main 92.

Circuit is completed through soap solenoid #3 from main 91, switch #3, lead 99, solenoid #3, back to main 92.

The bar of agitator switch #2 drops and the laundry is agitated with soap and water solution for the pre-set length of time. At the end of the washing period, bar of agitator switch #2 rises to stop agitation, and bar of drain switch #4 rises to drain the machine, and bar of spin switch #5 rises to spin the clothes as before.

The next period is the first rinsing period at which bar of switch #1' rises to admit hot and cold water, after which bar of switch #2 drops to agitate the clothes, after which bar switch #4 rises to empty the water, and bar of switch #5 rises to spin the clothes dry.

The next period is the second rinse at which time bar of switch #1 rises to admit cold water and bar of switch #2 drops to agitate the laundry, at the end of which bar of switch #4 rises to drain the machine and bar of switch #5 rises to spin the basket.

The last spinning period may be longer than the others to dry the clothes as thoroughly as desired. At the end of the last drying period, all mechanism of the machine stops except the main motor 68 and timer motor 10 which run until the dial reaches the stop position (Fig. 3) at which time bar of master switch #6 rises and everything is turned off, including the timer motor and main motor.

Thus, the timer of the invention provides a convenient means of varying the time period of one of several consecutive washing machine actions and pre-setting such variation. Thus a maximum of twenty minutes may be set for washing dirty clothes while a lesser time, say ten minutes, can be allowed for washing less dirty clothes and the entire machine set in advance so that the complete cycle can be carried through without any further attention on the part of the operator.

It will be noted that the cam high points and low points are so arranged that all of the switch operating bars 61 have their innermost position during the variable wash-agitate period. It is also possible to vary this period by utilizing the high points of the cams but such use would be disadvantageous as it would utilize too much of a complete revolution of the cam. Although the only action that is working during the main part of the washing period is the agitating action, the cams for controlling the other actions must also be adjustable since the actions controlled by them are automatically extended by extending the wash-agitating period. However, such other actions may be controlled by the high points of the cams as is the case with all of the cams except agitate cam #2 and master cam #6.

It will be noted that the cold water cam #1 controls cold water for only the Soak and Second rinse periods. For the Wash and First rinse periods, the hot water cam #1' controls cold water solenoid #1 alone, if hot water conservation switch is in the 100° F. position; hot water sole-

noid #2 alone, if hot water conservation switch is in the 130° F. position; and both solenoids if the hot water conservation switch is in the 115° F. position.

It is obvious that both the timer and the hot water conservation switch may be used with different types of machines, including those now on the market operating as described above.

It will be noted that all of these machines have the same general series of events, that is, fill, agitate, spin and empty. Obviously, some of the stations or operations may be omitted in different machines or some of the actions combined. For example, the same switch may control both the spin and drain actions. A single switch may control both the agitating and spinning actions, the switch being in one position for agitation and in another position for spinning. Also, except for the variable washing period, where it is desired that the switch be actuated by low points on the cams, the other actions may be effected by either high points or low points. Also the complete cycle may be shortened by providing for only one rinse or by omitting the soaking station, or by omitting any of the other stations considered undesirable or unnecessary.

While certain novel features of the invention have been disclosed herein, and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. A timer for washing machines and the like comprising a framework, a concentric shaft arrangement comprising a slide rod, a tubular shaft surrounding said slide rod, a sleeve shaft surrounding said tubular shaft, a knob affixed to said slide rod, said slide rod and tubular shaft having pin and slot arrangement whereby said knob may be pulled outwardly to slide said rod and said knob may be rotated to rotate said rod and tubular shaft together, a main dial plate affixed to rotate with said tubular shaft, an auxiliary dial plate affixed to rotate with said sleeve shaft, clutch means operating between said dial plates to permit relative rotation therebetween or rotation together, a plurality of cams, each comprising a primary and a secondary segment, said primary segment being keyed to said tubular shaft to rotate therewith, spacer collars between said primary segments, said secondary segments being mounted on said collars, spaced nipples between said secondary segments; assembly rods passing through said secondary segments, said nipples and a flange on said sleeve shaft; a plurality of electric switches for said cams, assembly rods passing through the bases of said switches, said switches having operating bars adapted to be engaged by the peripheries of said cams; a timer motor and reduction gearing secured to said framework, a drive clutch plate driven by said reduction gearing, a driven clutch plate secured to said slide rod, one of said clutch plates having peripheral teeth and the other clutch plate having a finger adapted to selectively engage between said teeth.

2. In an automatic household washing machine performing a plurality of operations, including a soaking operation, a washing operation, a first rinsing operation, a second rinsing operation, said soaking operation requiring relatively cold water, said washing and first rinsing operations requiring water of different temperatures depend-

ing upon the goods being washed, said second rinsing operation requiring cold water, a solenoid for cold water, a solenoid for hot water, a temperature switch for determining the temperature of the water supplied during the washing and first rinsing operations, a timing device for timing the events necessary to perform the several operations, said timing device including a first cam for controlling the admission of cold water alone, a second cam for controlling the admission of hot water alone, cold water alone, or both together according to the position of said switch, cam switches operated by said cams, and circuit means for said cam switches, temperature switch and solenoids.

3. In a hot water conservation system for household washing machines and the like, a washing machine having sources of hot and cold water, a thermostatically controlled cold water valve for the cold water, a thermostatically controlled hot water valve for the hot water, a hot water conservation switch having three positions, one of which supplies cold water, another of which supplies hot water, and another of which supplies mixed hot and cold water, timing mechanism for controlling the events of said machine, said timing mechanism including a cold water cam and a hot water cam, switches operated by said cams, said cold water switch having forward and back contacts, said hot water switch having forward contacts, circuit means whereby said cold water valve is under control of both forward and back contacts of said cold water switch, both said cold water and hot water valves are under control of said hot water switch and under control of said hot water conservation switch.

4. In an automatic household washing machine performing a plurality of operations, including a soaking operation, a washing operation, a rinsing operation, said soaking operation requiring relatively cold water, said washing operation requiring water of different temperatures depending upon the goods being washed, said rinsing operation requiring cold water; a solenoid for cold water, a solenoid for hot water, a settable temperature switch for determining the temperature of the water supplied during the washing operation, a timing device for timing the events necessary to perform the several operations, said timing device including a first cam for controlling the admission of cold water alone, a second cam for controlling the admission of hot water alone, cold water alone, or both together according to the position of said settable switch, cam switches operated by said cams, and circuit means for said cam switches, temperature switch and solenoids.

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