

Feb. 19, 1957

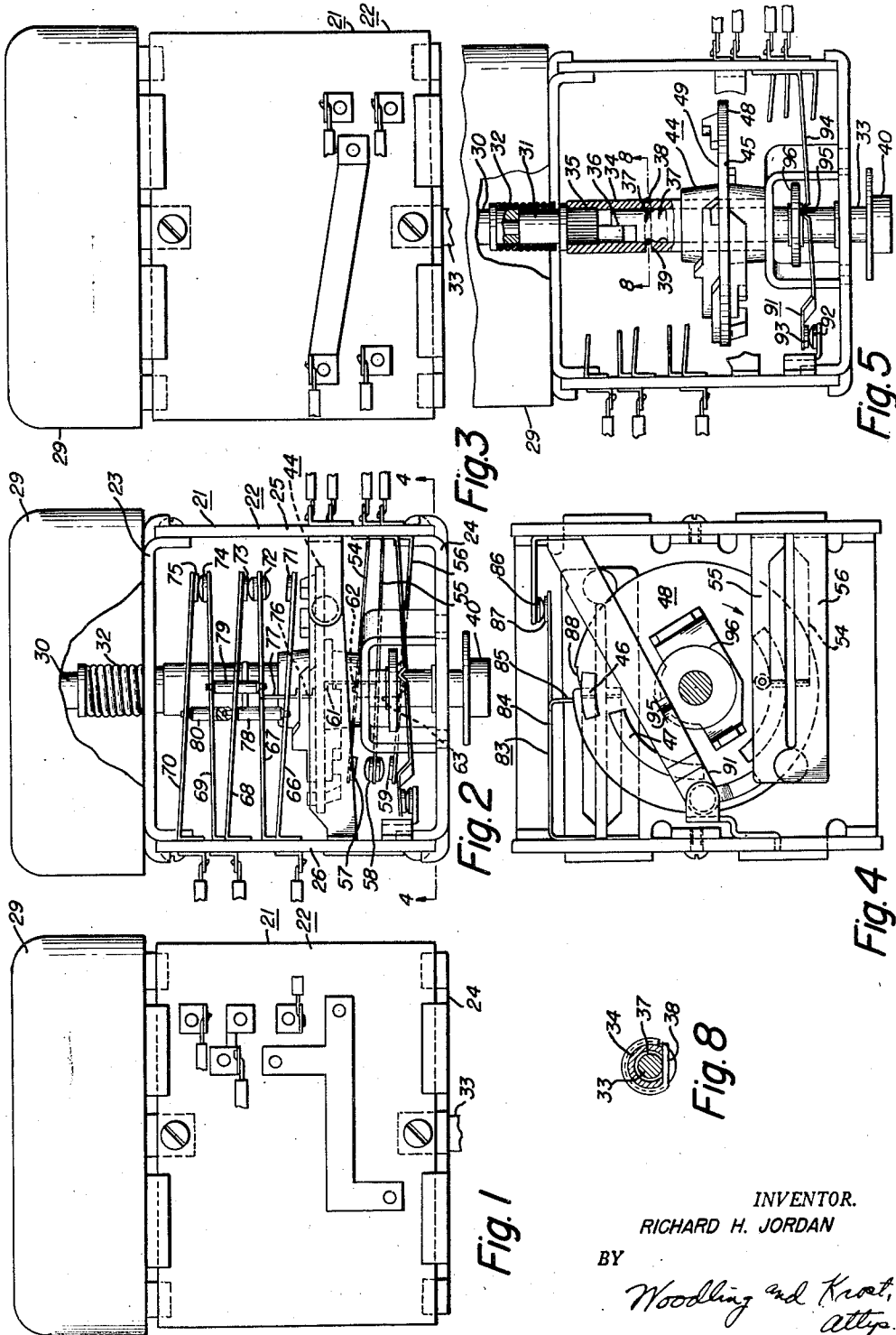
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2,782,271

TIME SWITCH

Filed Dec. 9, 1952

3 Sheets-Sheet 1



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2,782,271

3 Sheets-Sheet 2

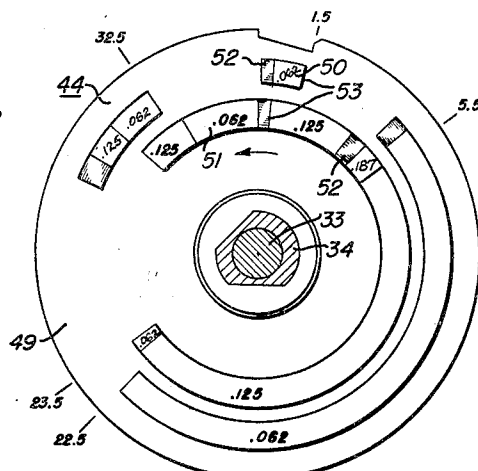


Fig. 7

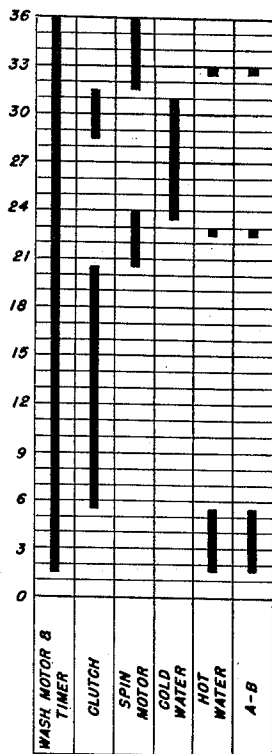


Fig. 19

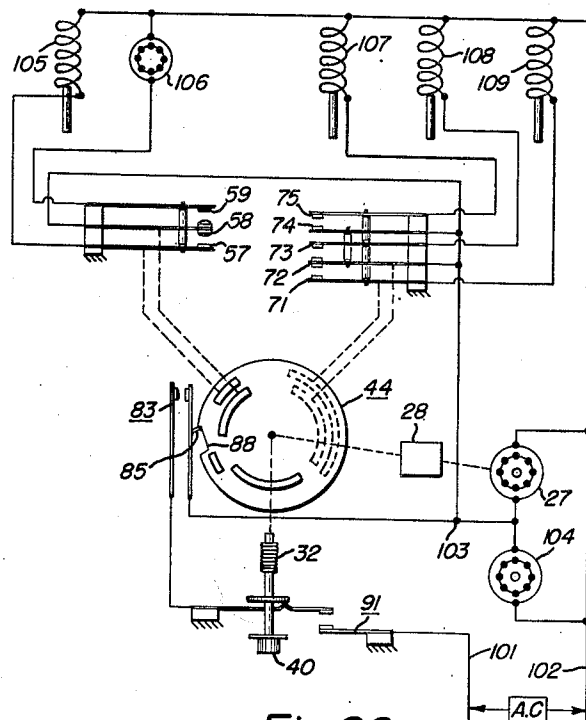


Fig. 20

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3 Sheets-Sheet 3

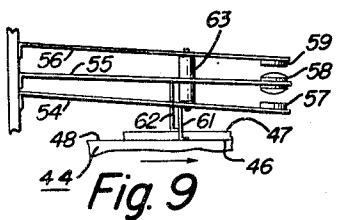


Fig. 9

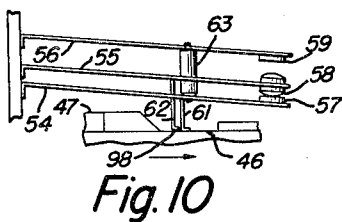


Fig. 10

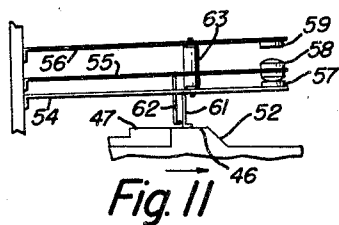


Fig. 11

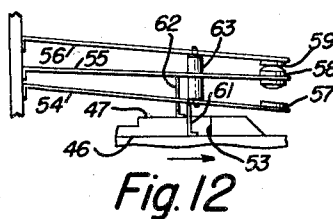


Fig. 12

Fig. 13

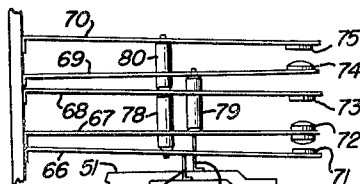


Fig. 14

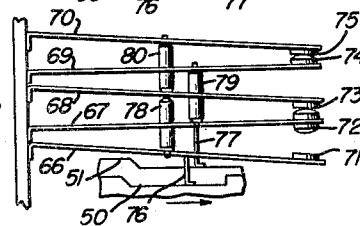


Fig. 15

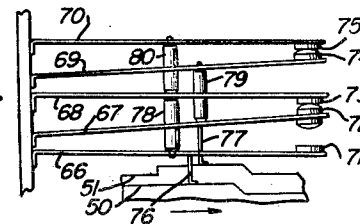


Fig. 16

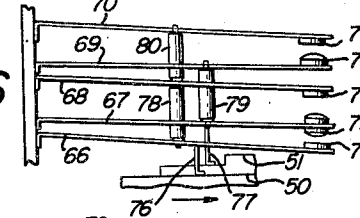


Fig. 17

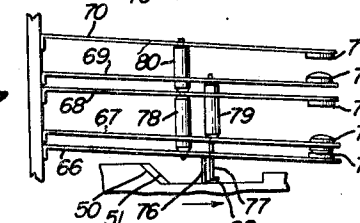
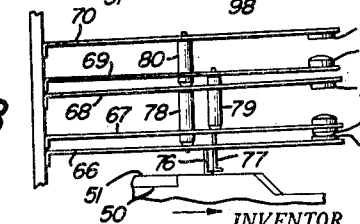


Fig. 18



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2,782,271

TIME SWITCH

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Application December 9, 1952, Serial No. 324,887

8 Claims. (Cl. 200—27)

The invention relates generally to time controlled switches and more particularly to switches having a slow movement, yet providing a snap action make and break of switch contacts.

The prior art timers or time controlled switches generally employ an electric motor and speed reducing drive and have been limited to controlling switch contacts which may open and close at a minimum interval of one-half minute. Accordingly an object of the invention is to provide a time controlled switch in which any time interval between switch opening and closing is possible, even a very short time interval.

Another object of the invention is to provide a snap acting device with a cam operation from only one side of the device.

Another object of the invention is to provide a snap acting switch wherein a cam operates on only one side of the switch blades for both on and off conditions.

Another object of the invention is to provide a device having two movable members mutually cooperating and operated by a cam so that each has a snap action.

Still another object of the invention is to provide a device with two cams and two cam followers, which cam followers may be moved at any time interval therebetween.

Still another object of the invention is to provide a switch with two movable resilient switch blades each controlled by a cam from only one side for a snap action make and break of the switch contacts on the blades.

Another object of the invention is to provide a time control switch with a plurality of switch blades and contacts operable from a single rotary cam.

Other objects and a fuller understanding of my invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a left side view of the timer;

Figure 2 is a front view of the timer;

Figure 3 is a right side view of the timer;

Figure 4 is an end view of the timer of Figure 2 with the end cover removed;

Figure 5 is a front view of the timer similar to Figure 2 with the switch blades broken away to better show the rotary cam;

Figure 6 is a plan view of the lower face of the rotary cam;

Figure 7 is a plan view of the upper face of the rotary cam;

Figure 8 is a sectional view on line 8—8 of Figure 5;

Figures 9 to 12, inclusive, show diagrammatically the various positions which the switch blades operating from the lower face of the cam may assume;

Figures 13 to 18, inclusive, show six different positions which the switch blades operating from the upper face of the rotary cam may assume;

Figure 19 is a program chart showing the on and off periods of various switches for one cycle of operation of the timer;

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Figure 20 is a schematic wiring diagram of the complete electrical circuit.

The invention has been shown as being applied to a time control switch or timer because in such construction, a switch is manually movable at a slow speed and alternately is operable at a slow speed in the same direction by a motor through a speed reducing drive. The timer is indicated generally by the reference character 21 and includes a base 22 which is a metal open-sided box having a top wall 23, a bottom wall 24, a right side wall 25 and a left side wall 26. The timer is adapted to be operated from alternating current and a timer motor 27 and a speed reducing drive 28, shown in Figure 20, are provided within a housing 29 fastened to the top wall 23. The speed reducing drive 28 has an output shaft 30 co-axial with a stub shaft 31 journaled in the top wall 23. A one way clutch 32 shown as a coil spring surrounds the adjoining ends of these two shafts 30 and 31 so that the speed reducing drive may supply torque to the stub shaft 31 only in a single direction. A second shaft 33 is journaled in the bottom wall 24 and a sleeve shaft 34 surrounds this shaft 33. The sleeve shaft 34 is fastened to the stub shaft 31 by splines 35. The shaft 33 is coaxial with the stub shaft 31 and the adjoining ends of these shafts have semi-cylindrical portions 36 interengaging to permit an axial sliding movement of the shaft 33, yet relatively locking the shafts 31 and 33 together. The shaft 33 has two grooves 37, and the sleeve shaft 34 has a snap ring 38 in a slot 39. The slot 39 permits a portion of the snap ring 38 to engage one of the grooves 37. The shaft 33 may thus be axially moved by a handle 40 and will snap between two alternate positions as determined by the snap ring 38 engaging the two grooves 37.

A rotary cam disk 44 is fastened to the sleeve shaft 34 for rotation therewith. This cam disk has a plurality of separate cams integral therewith including a peripheral cam 45 and cams on the lower face 48 and upper face 49. The rotary cam disk 44 is better seen in Figures 6 and 7 with Figure 6 showing the lower face 48 and Figure 7 showing the upper face 49. On the lower face 48 is a first cam 46 and a second cam 47. On the upper face 49 is a third cam 50 and a fourth cam 51. Each of these four cams is circular and includes as a portion thereof the cam disk 44 itself, as well as one or more steps of various axial elevations. The steps have been marked in Figures 6 and 7 with the step elevations in thousandths of an inch in order to facilitate understanding the construction of the cam disk 44. Three step elevations have been shown; namely, .062, .125, and .187 inch. The cam disk 44 is only unidirectionally rotatable and rotates clockwise as seen in Figure 6 and counter-clockwise as seen in Figure 7. On the forward side of movement of the three cams 46, 50 and 51, there are sloping or inclined planes 52. On the rearward side of movement of all four cams 46, 47, 50 and 51 are sharp shoulders such as is indicated at 53, to a step of lesser elevation. These sharp shoulders are so that cam followers will drop with a snap action as will become more apparent later with reference to the Figures 9 to 18 inclusive.

The cams 46 and 47 on the lower face 48 operate first, second and third switch blades 54, 55 and 56, better seen in Figures 2 and 4. Each of these switch blades has an end which is mounted to and insulated from the right side wall 25 and the other end thereof carries a contact. The three switch blades have first, second and third contacts 57, 58 and 59, respectively. The contact 58 is a double sided contact for cooperation with either the contact 57 or the contact 59. The first switch blade 54 has a first cam follower 61 and a second switch blade 55 has a second cam follower 62. An insulator pin 63 inter-

connects the first and third switch blades 54 and 56 and keeps them separated so that all three contacts 57, 58 and 59 cannot be in simultaneous contact. As the switch contact 58 is movable into engagement with either the contact 57 or the contact 59, the entire arrangement becomes a single pole double throw switch.

The upper face 49 controls switches in essentially the same manner as the lower face 48. The third and fourth cams 50 and 51 control fourth to eighth switch blades and designated by reference numbers 66 to 70, inclusive. These switch blades 66 to 70 each have one end mounted to and insulated from the left side wall 26 and on the free end thereof carries fourth to eighth contacts respectively, designated by reference numbers 71 to 75, inclusive. Cam followers 76 and 77 are carried by the fourth and fifth switch blades 66 and 67 respectively, and cooperate with the third and fourth cams 50 and 51 respectively. The fifth contact 72 is a double sided contact for cooperation alternately with the contact 71 or 73. The switch blades 66, 67, and 68 therefore form a single pole double throw switch. An insulator pin 78 maintains the contacts 71 and 73 separated. Another insulator pin 79 effects parallel movement of the switch blades 67 and 69 and still another insulator pin 80 effects parallel movement of the switch blades 68 and 70. The insulator pins 79 and 78 insure movement of the contacts 74 and 75 in accordance with movements of the contacts 72 and 73. Therefore double pole operation is obtained on one throw of the switch blade 67.

The peripheral cam 45 controls a main switch 83. This main switch has a switch blade 84 with a cam follower 85. A fixed contact 86 is carried for cooperation with a movable contact 87 carried on the free end of the switch blade 84. A notch 88 is provided in the peripheral cam 45. When the cam follower 85 is in the notch 88, the contacts 86 and 87 are open. When the cam follower 85 is riding the circular periphery of the cam 45, then the contacts are closed. A manual switch 91 is controlled by the axial movement of the shaft 33. This manual switch includes a fixed contact 92 and a movable contact 93 carried by the free end of a switch blade 94. The switch blade 94 has a crimped portion 95 engaging a washer 96 fastened to the shaft 33. Thus as the washer 96 is moved axially, the switch blade 94 is moved to open and close the contacts 92 and 93.

The Figures 9 to 12 show the first and second cams 46 and 47 on the lower face 48 which operate on switch blades 54 and 55. In the Figure 9, the cam follower 61 is shown engaging the basic surface of the rotary cam disk 44 and the cam follower 62 is shown engaging a step .062 inch on the second cam 47. In this condition, the three contacts 57, 58 and 59 are separated. In Figure 10, the first cam follower 61 is still engaging the basic cam surface of the cam disk surface 44, whereas the second cam follower 62 is also cooperating with this same basic surface. A small space 98 exists between the cam follower 62 and the basic surface of the cam 44 and this insures that the contact 57 supports the contact 58 for good electrical contact therebetween. Figure 11 shows that the first cam follower 61 has ridden up one of the inclined planes 52 to a step .125 inch above the basic cam surface with the contacts 57 and 58 remaining in physical contact. The Figure 12 shows the first cam follower 61 in engagement with the basic cam surface and the second cam follower 62 engaging a step .125 inch above the basic cam surface, hence the contacts 58 and 59 are in electrical contact.

The Figure 20 is a schematic electrical diagram and a diagrammatic showing of the cams and switches showing how the complete timer may be utilized. One application of the timer is in conjunction with an automatic washing machine for household use, wherein the washing, rinsing, and spin dry features are combined. A thirty-six minute operating cycle for such a washing machine is used for purposes of explanation. In the Figure

20, the timer motor 27 and speed reducing drive 28 have been illustrated as driving the rotary cam disk 44. Further this cam disk has been shown as being operable from the manual knob 40 through the one way clutch 32. Alternating current is shown as being supplied at leads 101 and 102 with the lead 101 going through the manual switch 91 and then through the main switch 83 to a terminal 103. Between the lead 102 and the terminal 103, a washing machine motor 104 is connected. The timer motor 27 is also connected between the lead 102 and terminal 103. In the operation of the automatic washing machine various solenoids are used for controlling valves and other elements and a clutch solenoid 105 is connected between the terminal 103 and lead 102 by means of the switch contacts 57 and 58. A spin motor 106 is connected between the lead 102 and terminal 103 by the switch contacts 58 and 59. An A-B solenoid 107 is also connected between the leads 102 and terminal 103 by the contacts 74 and 75. A hot water solenoid 108 is connected between the lead 102 and terminal 103 by the switch contacts 72 and 73. A cold water solenoid 109 is connected between the lead 102 and terminal 103 by the contacts 71 and 72. All of these motors and solenoids are controlled by the cam operated switches and it will be noted that the manual switch 91 and main switch 83 are in series to control the electrical energization to the remaining cam operated switches.

The program chart of Figure 19 will help to explain the sequence of operation desired for the contacts 57, 58 and 59. This program chart shows a thirty-six minute cycle with a total of six switches being operated by the rotary cam disk 44. The first column is labeled "Washing Machine Motor and Timer" and this switch is the main switch 83. The next column is labeled "Clutch" and is controlled by the switch consisting of contacts 57 and 58. The next column is labeled "Spin Motor" and this is controlled by the switch consisting of the contacts 58 and 59. The fourth column is labeled "Cold Water" and is controlled by the switch consisting of contacts 71 and 72. The fifth column is labeled "Hot Water" and is controlled by the switch consisting of the contacts 72 and 73. The sixth column is labeled "A-B" and is controlled by the switch consisting of contacts 74 and 75. On the Figures 6 and 7 around the periphery of this cam disk are shown various points at which different switch contact conditions are effected. These points are designated in minutes with thirty six minutes corresponding to 360 degrees revolution of the cam disk 44. The diagrammatic showing in Figure 9 corresponds to the starting condition just before the main switch 83 is closed. This would be at about the one minute point. The notch 88 is 15 degrees in width which is 1.5 minutes in time. Thus if the cam follower 85 cams out of the notch 88, then the switch 83 is closed at the 1.5 minute point as is shown in the first column of the program chart in Figure 19. As will be seen in Figures 6 and 9, the first cam follower 61 is riding the basic cam surface and the second cam follower 62 is riding a step of .062 inch on the second cam 47. This difference in elevation of the cam followers of $\frac{1}{16}$ of an inch establishes the switch contact 58 in a neutral open position. At the 5.5 minute point, there is a sharp shoulder 53 off which the second cam follower 62 drops, hence closing the contacts 57 and 58. This is the condition shown in Figure 10 and the Figure 19 shows that the clutch commences operation at the 5.5 minute point. The clutch contacts 57 and 58 remain closed until the 20.5 minute point. At about the 18 minute point, the first cam follower 61 gradually moves up the inclined plane 52 to a step of $\frac{1}{8}$ inch. This is the condition shown in Figure 11 and does not change the electrical condition of having the contacts 57 and 58 engaged. At about the 20 minute point a .125 shoulder on the second cam 47 comes into position underneath the second cam follower 62 but remains slightly spaced there-

from so that the contacts 57 and 58 remain in engagement. At the 20.5 minute point, the first cam follower 61 drops off a shoulder 53 and then the second cam follower 62 engages the .125 inch step on the second cam 47 so that the first and third contacts 57 and 59 move downwardly with a snap action to quickly break the contacts 57 and 58 and to quickly make the contacts 58 and 59. At the 24 minute point, the second cam follower 62 drops off the .125 inch step to a .062 inch step and thus the conditions of Figure 9 are once again obtained. This stops the spin motor 106. At the 28.5 minute point, the second cam follower 62 again drops off this .062 inch step to again obtain the conditions shown in Figure 10 which energizes the clutch solenoid 105. At about 29.5 minutes, the first cam follower 61 rides up an inclined plane to a step of .125 inch. It drops off this step at the 31.5 minute point and the second cam point follower 62 is held up by a .125 step to achieve the conditions shown in Figure 12 to change from clutch to spin motor. The spin motor 106 remains energized until the 36 minute point at which the cam follower 85 drops into the notch 88, thus opening the main switch 83 and de-energizing everything.

The Figures 13 to 18, inclusive, show the action of the switch blades 66 through 70 as controlled by the third and fourth cams 50 and 51 on the upper face 49. The action of the switch blades 66, 67 and 68 is quite similar to the action of the switch blades 54, 55 and 56 for double throw operation with the switch blades 69 and 70 added in order to effect the actuation of the extra set of contacts 74 and 75. As seen in Figure 13 with the cam follower 76 engaging the third cam 50 at a step of .062 inch and the cam follower 77 engaging the fourth cam 51 at a step of .125 inch, all contacts are separated. This is the condition at about the one minute point with the main switch 83 off. At about the two minute point with the main switch 83 on, the program chart shows that the hot water and A-B solenoids 108 and 107 should be energized. Figure 14 shows that this is the case since the cam follower 76 has now dropped off the .062 inch step to the basic cam surface, thereby closing contacts 72 and 73 and closing contacts 74 and 75. Figure 15 shows the condition at about the 5 minute point wherein both cam followers have ridden up an inclined plane to a step .062 inch more than previously. At the 5.5 minute point, the cam follower 77 drops off the .187 inch step to a step of .125 inch. This rapidly breaks all contacts previously closed and de-energizes the solenoids 107 and 108. At the 22.5 minute point the cam follower 76 drops off the .062 inch step to again achieve the condition shown in Figure 14 which energizes the solenoids 107 and 108. This condition is shown as lasting for 1/2 minute at which time the cam follower 77 drops down to .062 inch step to achieve the condition shown in Figure 16 with solenoids 106 and 107 de-energized. At the 23.5 minute point, the cam follower 77 drops off this .062 inch step to achieve the conditions shown in Figure 17 whereat the contacts 71 and 72 are engaged to energize the cold water solenoid 109. At about the 30 minute point, the cam follower 76 rides up an inclined plane to a step of .125 inch off which it drops at 31 minutes. A step .125 inch high catches the cam follower 77, hence the conditions of Figure 13 are again achieved with the cold water solenoid 109 being de-energized. At 32.5 minutes, the cam follower 76 drops off .062 inch step again duplicating the conditions of Figure 14 to energize the solenoids 107 and 108. This lasts for 1/2 minute whereat the cam follower 77 drops to a step .062 inch to be in the condition shown in Figure 16 whereat the solenoids 107 and 108 are de-energized. This condition remains until the 36 minute point when the main switch 83 opens.

The manual knob 40 may then be used to rotate the cam disk 44 through 15 degrees of arc in order to start

another cycle of operation. During this 15 degrees of arc the cam followers 76 and 77 ride up inclined planes to steps of .062 and .125 inch respectively, in order to be in position to start another cycle.

A study of Figures 13 to 18 will show that when the cam follower 77 is cooperating with a cam step which is .062 inch higher than the cam step or surface cooperating with the cam follower 76, then all contacts 71 through 75 are separated and opened. This may be seen in Figures 13 and 16. When the cam follower 77 is cooperating with a cam step .125 inch higher than the cam step or surface cooperating with the cam follower 76, then the contacts 72 and 73 and the contacts 74 and 75 are closed. This condition is shown in Figures 14 and 15. When the two cam followers 76 and 77 are cooperating with cam steps or surfaces at the same level, then the contacts 71 and 72 are in contact and this condition is shown in Figures 17 and 18. It will be noted that in these latter two figures, the cam follower 77 is not actually touching the cam, rather there is a small space therebetween and this is done to insure adequate contact pressure between the contacts 71 and 72.

The operation of the switch blades 71 to 75 shows that the cam disk operates on only one side of these switch blades, yet they are able to achieve both a snap action make and a snap action break of the contacts. Further by establishing a plurality of steps, the various contacts may drop off a shoulder at any time interval thereafter, even a very short time interval, so that a snap action break and make may occur very close together if desired. This is a distinct improvement over the prior art wherein the make and break of the switch contacts could not be closer together than one-half minute periods. Still further, it will be seen that the rotary cam disk 44 has a slow movement as driven by the speed reducing drive or manually, yet snap action make and break of the contacts is always achieved. The Figure 20 shows that the electrical energization to the solenoids 105, 107, 108 and 109 and the spin motor 106 is led through the series combination of the manual switch 91 and the main switch 83. This means that at the end of the 36 minute cycle when the main switch 83 opens, all the solenoids and motors will be de-energized. This is an added feature which prevents attempting to do the physically impossible requirement of having all of the shoulders on the cams 46, 47, 50 and 51 be perfectly aligned so that everything is de-energized at a given instant by the cam followers dropping off these shoulders.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A snap acting switch, comprising a base, first and second contact members carried by said base and constructed for mutual cooperation, first and second cam means movable relative to said base parallel to a first path, a first cam follower arranged to cooperate with said first cam means to relatively move said first member and said first cam along a second path, a second cam follower arranged to cooperate with said second cam means to relatively move said second member and said second cam means along a third path generally parallel to said second path, first means relatively urging together said first cam follower and first cam means along said second path, second means relatively urging together said second cam follower and second cam means along said third path, first surface means on said first cam follower and first cam means to gradually relatively move said first cam follower

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and said first cam means along said second path against the opposition of said first urging means, second surface means on said first cam follower and first cam means to permit said first urging means to effect rapid relative movement therebetween along said second path in two discrete steps to effect rapid relative movement between said first and second members in a first direction, and third surface means on said second cam follower and second cam means to permit second urging means to effect rapid relative movement therebetween along said third path to effect rapid relative movement between said first and second members in a direction opposite to said first direction.

2. A snap acting switch, comprising a base, first and second contact members carried by said base and constructed for mutual cooperation, first and second cam means movable relative to said base parallel to a first path, a first cam follower arranged to cooperate with said first cam means to relatively move said first member and said first cam along a second path, a second cam follower arranged to cooperate with said second cam means to relatively move said second member and said cam means along a third path generally parallel to said second path, first means relatively urging together said first cam follower and first cam means, second means relatively urging together said second cam follower and second cam means, first surface means on said first cam follower and first cam means mutually cooperating as said first cam means moves along said first path to gradually relatively move said first member and said first cam means along said second path against the opposition of said first urging means, second surface means on said first cam follower and first cam means mutually cooperating as said cam means moves along said first path to permit said first urging means to effect rapid relative movement therebetween in two discrete steps to effect rapid relative movement between said first and second members in a first direction, and third surface means on said second cam follower and second cam means mutually cooperating as said cam means moves along said first path to permit said second urging means to effect rapid relative movement therebetween in two discrete steps to effect rapid relative movement between said first and second members in a direction opposite to said first direction.

3. A snap acting switch having a base, first and second contact members carried by said base and constructed for mutual cooperation, first and second cam means movable relative to said base, first and second cam followers arranged to cooperate with said first and second cam means, respectively, and to move said first and second members, respectively, means to urge said members in a first direction for cooperation with said cam means, the mutual cooperation between said members establishing that movement of said second member in said first direction brings said members into physical cooperation and that movement of said first member in a direction opposite to said first direction brings said members into physical cooperation, said cam means being movable along a direction transverse to said first direction, first surfaces on said cam means establishing at least three different dimensions along the path of movement of said members, second surfaces on said first cam means and cam follower to permit said urging means to rapidly move said first member in said first direction as said first cam means is moved along said transverse direction, and third surfaces on said second cam means and cam follower to permit said urging means to rapidly move said second member in said first direction as said second cam means is moved along said transverse direction.

4. A switch including, a base, first, second, and third spring blades carried in that order by said base, first, second, and third contact means carried by said first, second, and third spring blades, respectively, and mutually insulated, said first and second contact means and said second and third contact means positioned for mutual

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cooperation, first and second cam followers on said first and second spring blades, respectively, first and second cam means constructed for cooperation with said first and second cam followers, respectively, means for establishing movement of said third spring blade with movement of said first spring blade, said cam means having sharp shoulders, means for urging together said first and second cam means and said first and second cam followers, respectively, said sharp shoulders cooperating with said second cam follower to establish a snap action break of said second and third contact means and a snap action make of said first and second contact means, said sharp shoulders cooperating with said first cam follower to establish a snap action break of said first and second contact means and a snap action make of said second and third contact means.

5. A single pole double throw switch including, a base, first, second, and third spring blades carried in that order by said base, first, second, and third contact means carried by said first, second, and third spring blades, respectively, and mutually insulated, said first and second contact means and said second and third contact means positioned for mutual cooperation, first and second cam followers on said first and second spring blades, respectively, first and second cams constructed for simultaneous unidirectional movement, means for establishing movement of said third spring blade substantially simultaneously with movement of said first spring blade, each of said cams having sloping surfaces on the forward side of movement and having sharp shoulders on the rearward side of movement joining at least three different levels for snap action make and break of said contact means, means for urging together said first and second cams and said first and second cam followers, respectively, said sharp shoulders on said second cam cooperating with said second cam follower to establish a snap action break of said second and third contact means and a snap action make of said first and second contact means, said sharp shoulders on said first cam cooperating with said first cam follower to establish a snap action break of said first and second contact means and a snap action make of said second and third contact means.

6. A switch, comprising a base, first and second spring blades each having one end mounted on said base, first and second contact means mounted on a movable portion of said spring blades, respectively, said first and second contact means positioned for mutual cooperation and mutually insulated, first and second cam followers on said first and second spring blades, respectively, first and second cam means movable for cooperation with said first and second cam followers, respectively, means urging said spring blades and hence the respective cam followers toward said cam means, said cam means having first, second and third surfaces for cooperation with said cam followers, the direction from the levels of said first to said second to said third surface being a direction opposite to that in which said spring blades are urged, said first and second contact means being in physical contact upon said cam followers thereof being in cooperation with like numbered surfaces of said cam means, said first and second contact means being physically spaced upon said second cam follower being in cooperation with a cam surface having a designating number higher than the cam surface in cooperation with said first cam follower, said second and third surfaces having a sharp drop-off to a lower numbered surface on the rearward side of movement of said cam means to achieve a quick make and break of said contact means.

7. A switch, comprising a base, first, second and third spring blades each having one end mounted on said base and mutually insulated, first, second, and third contact means mounted on a movable portion of said spring blades, respectively, said first and second contact means and said second and third contact means positioned for mutual cooperation, first and second cam followers on

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said first and second spring blades, respectively, first and second cam means movable for cooperation with said first and second cam followers, respectively, insulating means engaging said first and third spring blades to prevent said first, second and third contact means from being in simultaneous contact, means resiliently urging said spring blades toward said first and second cam means, each said cam means having first, second and third surfaces for cooperation with said cam followers, the direction from the levels of said first to said second to said third surface being a direction opposite to that in which said spring blades are resiliently urged, said first and second contact means being in physical contact upon said cam followers thereof being in cooperation with like numbered surfaces of said cam means, said first, second and third contact means being physically spaced upon said second cam follower being in cooperation with a cam surface having a designating number one unit higher than the cam surface in cooperation with said first cam follower, said second and third contact means being in physical contact upon said second cam follower being in cooperation with a cam surface having a designating number two units higher than the cam surface in cooperation with said first cam follower, said second and third surfaces having a sharp drop-off to a lower numbered surface on the rearward side of movement of said cam means to achieve a quick make and break of said contact means.

8. A switch, comprising a base, first, second and third spring blades each having one end insulatively mounted on said base, first, second, and third contact means mounted on a movable portion of said spring blades, respectively, said first and second contact means and said second and third contact means positioned for mutual cooperation, first and second cam followers on said first and second spring blades, respectively, first and second cams movable in unison for cooperation with said first and second cam followers, respectively, an insulator pin carried by said first spring blade and positioned to engage said third spring blade to prevent said first, second and third contact means from being in simul-

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taneous contact, said spring blades having natural resiliency urging same toward said cams, said cams having only unidirectional movement, each of said cams having first, second and third surfaces for cooperation with said cam followers, the direction from the levels of said first to said second to said third surface of each cam being a direction opposite to that in which said spring blades are resiliently urged, said first and second contact means being in physical contact upon said cam followers thereof being in cooperation with like numbered surfaces of said cams, said first, second and third contact means being physically spaced upon said second cam follower being in cooperation with a cam surface having a designating number one unit higher than the cam surface in cooperation with said first cam follower, said second and third contact means being in physical contact upon said second cam follower being in cooperation with a cam surface having a designating number two units higher than the cam surface in cooperation with said first cam follower, said second and third surfaces of said first cam having inclined planes rising from said first surface thereof on the forward side of movement of said cam to move said first and third spring blades gradually against the natural resiliency thereof, said second and third surfaces of both cams having a sharp drop-off to a lower numbered surface on the rearward side of movement of said cams to achieve a quick make or break of two of said contact means.

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