

FIG. 1

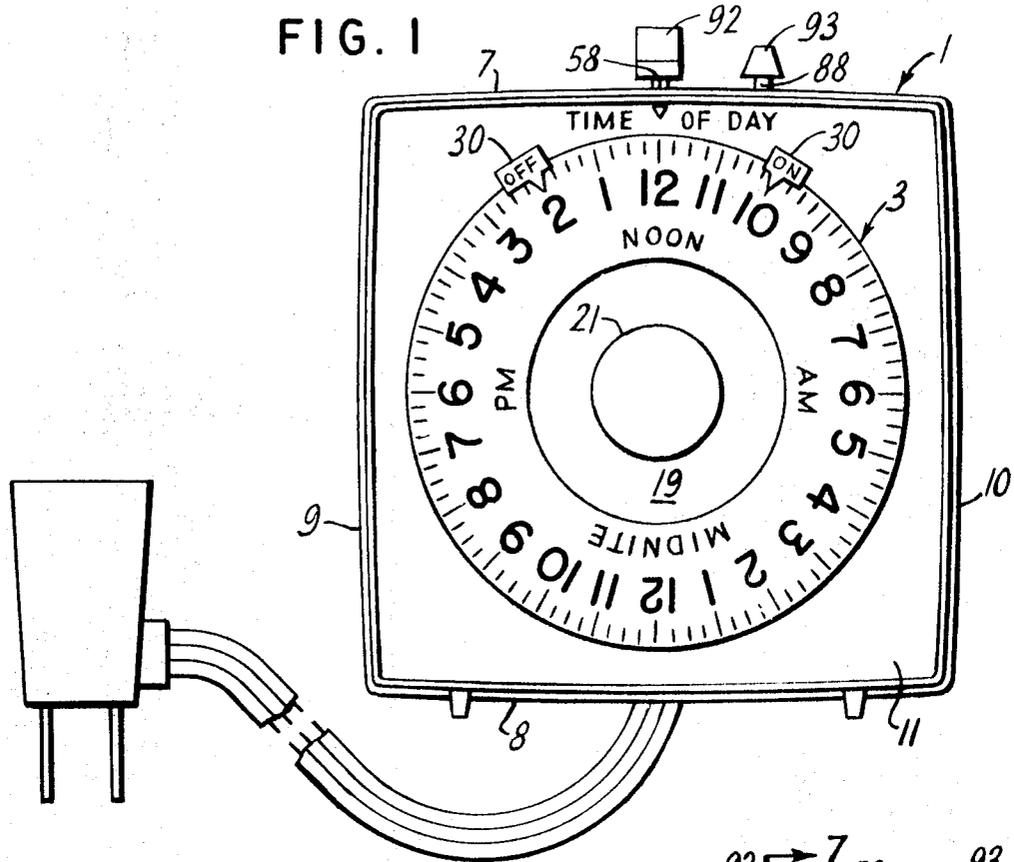


FIG. 2

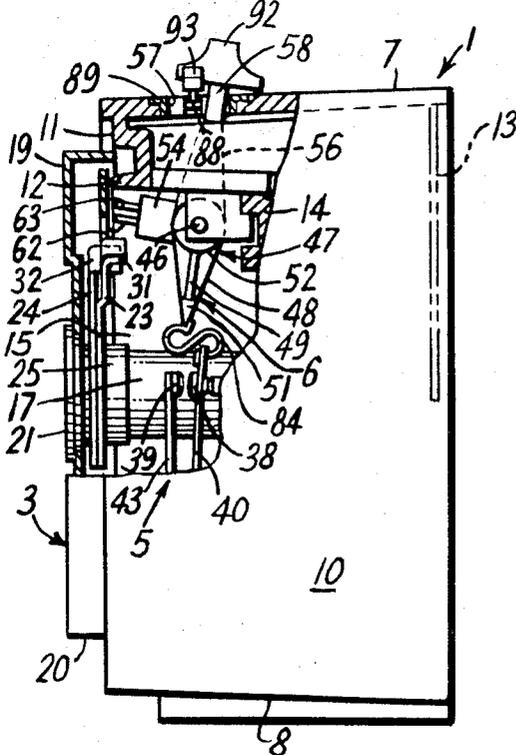
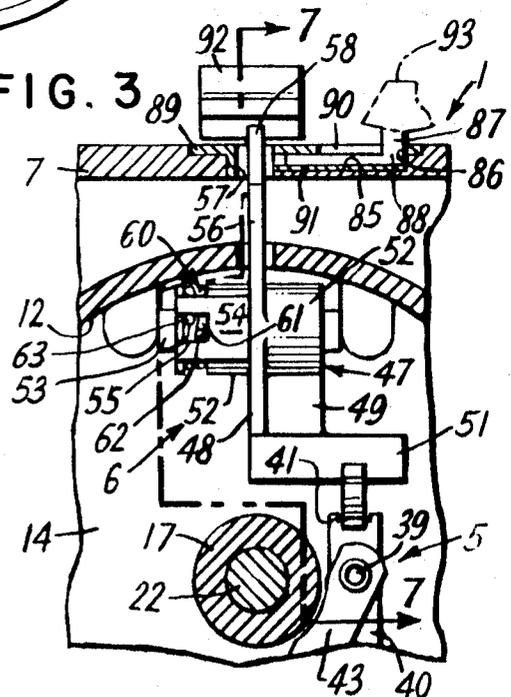


FIG. 3



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FIG. 4

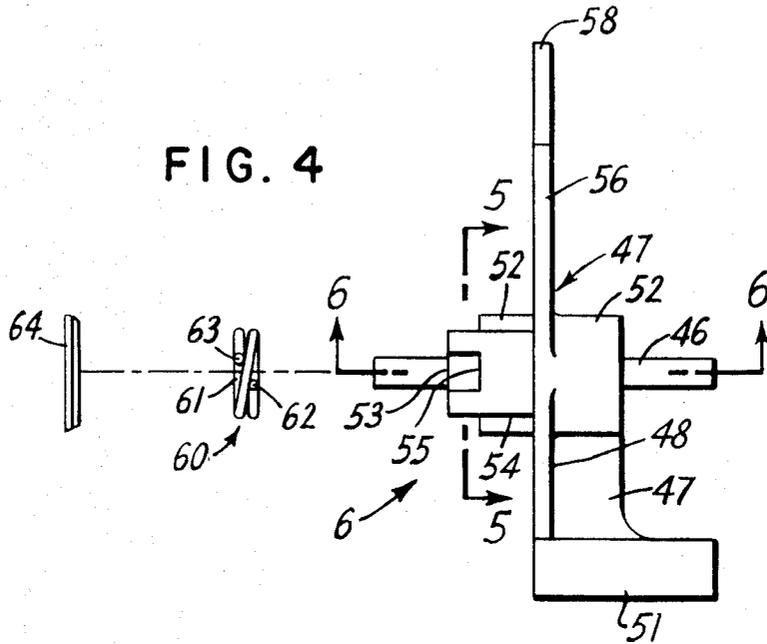


FIG. 5

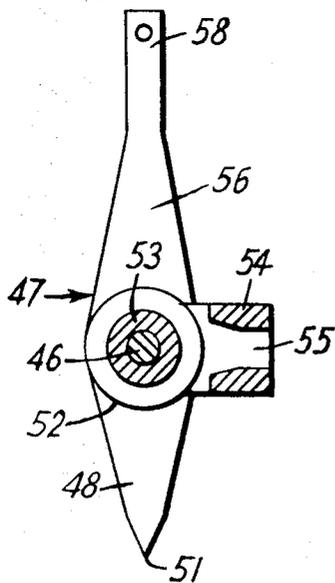
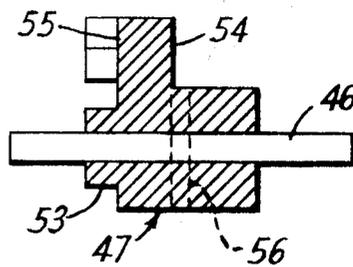
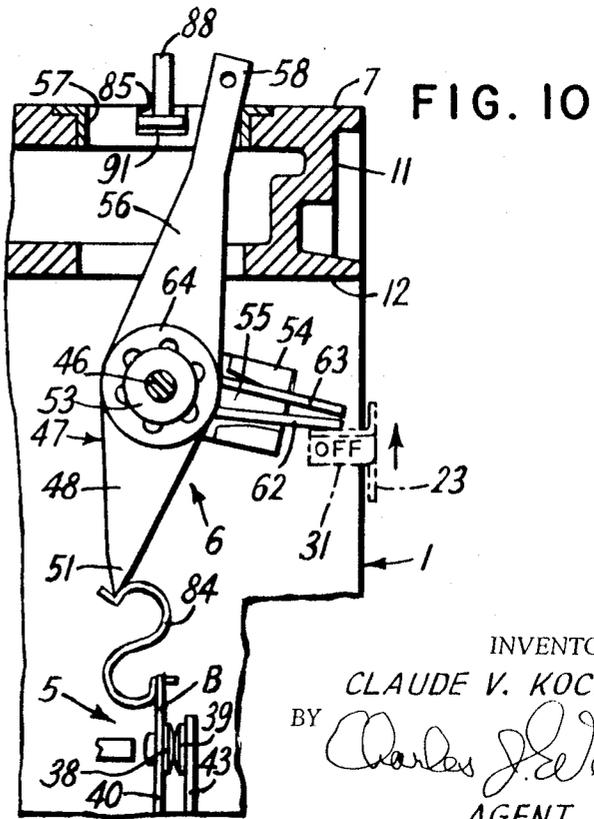
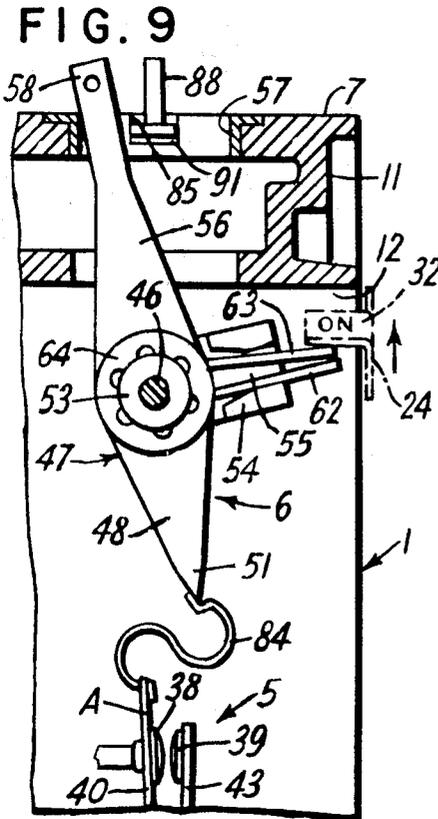
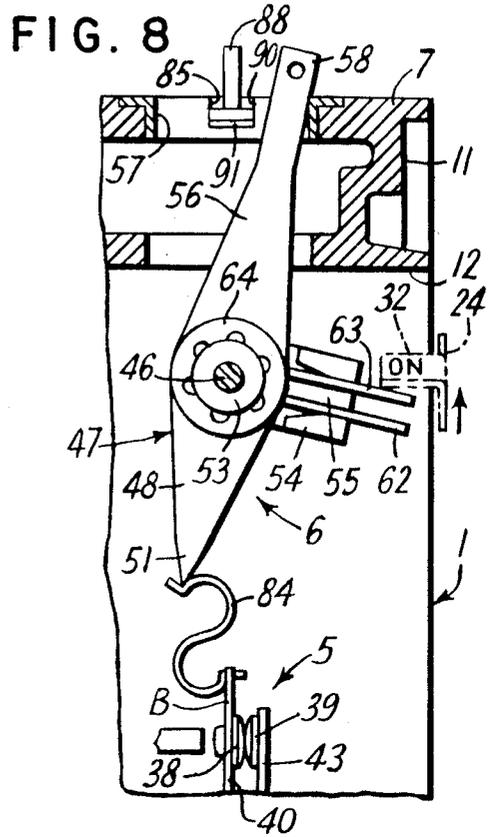
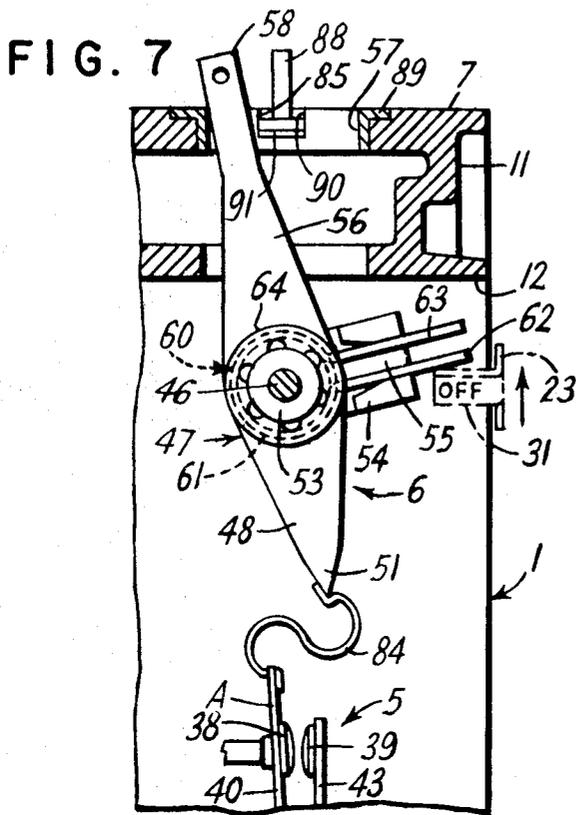


FIG. 6



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SWITCH ACTUATING MEANS

This invention relates generally to time switches and more particularly to switch actuators therefor.

The time switch in which the present invention is embodied is shown, described and claimed in U.S. Pat. No. 3,260,807 which was granted July 12, 1966 to R. D. Rulseh and W. H. Pierson, and is assigned to the same assignee as is the present application. Although the switch actuator means of the aforementioned patent operates in a satisfactory manner, improved and more precise switch actuation and control is derived by use of the switch actuating means made in accordance with the present invention. The novel switch actuating means has fewer parts to facilitate manufacture which is also less costly and results in greater reliability.

An object of the present invention is to provide an improved past center snap action time switch actuating means of fewer parts, less costly and less complicated construction not readily subject to malfunction.

Another object of the present invention is to provide the foregoing switch actuating means comprising essentially a single actuating lever and a wireform cam follower.

Although but a single embodiment of the invention has been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes may also be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

FIG. 1 is a front elevational view of a time switch embodying the invention of the present application.

FIG. 2 is a side elevational view of the time switch of FIG. 1 with a portion thereof broken away to show the switch actuating means therein made in accordance with the present invention.

FIG. 3 is an enlarged fragmentary sectional view of the time switch of FIGS. 1 and 2 illustrating the novel switch actuating means in front elevation.

FIG. 4 is an exploded front elevational view of the novel actuating means.

FIGS. 5 and 6 are sectional views taken on lines 5-5 and 6-6, respectively, of FIG. 4.

FIGS. 7 to 10 are fragmentary sectional views taken on line 7-7 of FIG. 3 each illustrating a different condition.

Referring now to the drawings and particularly to FIGS. 1 to 3, the time switch of this invention includes a housing 1, a dial 3, a motor and gear train therefor (not shown), an electrical switch 5, and a switch actuator 6.

Housing 1, which provides a support for the other components of the time switch, is molded from plastic material, providing a generally rectangular top wall 7, bottom wall 8 and sidewalls 9 and 10 integral with the top and bottom walls. At the front of the housing 1 is a front wall 11 with a centrally located circular opening 12. A flat plate 13 is attached to the rear of the housing 1 with screws so that the plate can be removed for access to the housing, the flat plate being disposed generally parallel with front wall 11. Parallel with front wall 11 is a partition 14 formed integral with the housing that divides the housing into a front chamber 15 and a rear chamber. Partition 14 provides flat mounting surfaces parallel with both front wall 11 and flat plate 13 for mounting the various elements of the time switch in the housing. Projecting from partition 14 is an integral tubular spacer member 17 that is concentric with circular opening 12 in the front wall 11. Tubular spacer 17 is integral with partition 14 and has a flat transverse annular end which faces dial 3.

The circular dial 3 is stamped from sheet material and has a generally flat exposed face 19 and a short peripheral wall 20 that projects in a direction away from exposed face 19. Dial 3 is fixed to an enlarged end 21 of a shaft 22 so that the dial rotates with the shaft which is located at the dial center and projects through a circular opening in tubular spacer 17, slightly beyond partition 14. A pair of trippers 23 and 24 are mounted for movement on shaft 22 and relative to dial 3. Each

tripper is stamped from springy sheet metal and is in the form of a flat arm having an enlarged end that is provided with a central bore of compatible diameter with the portion of shaft end 21 on which the trippers are mounted. The trippers 23 and 24 are prevented from moving axially of shaft 22 by a retainer or collar 25 that presses the trippers toward the underside of dial 3, when the collar is mounted on the shaft as shown in FIG. 2.

Trippers 23 and 24 extend radially from shaft 22 and are disposed in adjacent parallel planes that are parallel with dial 3 and are spaced only slightly from the undersurface of the dial. As shown in U.S. Pat. No. 3,260,807, each tripper extends radially of the dial and has a U-shaped end into which the terminal edge of peripheral wall 20 extends. The terminal edge of wall 20 is provided with ratchet teeth that coast with struck-up fingers in the base of each of the U-shaped ends of the trippers to positively drive the trippers in a clockwise direction when the dial 3 is rotated by the motor. The free leg of each of the U-shaped ends of trippers 23 and 24 is provided with a plastic material pointer 30 of L-shaped cross section, one leg of the L being parallel with wall 20 and the other leg of the L, which tapers to a point, extending slightly inwardly across the exposed face 19 of the dial 3.

Tripper 23 is formed with a trip lug 31 and tripper 24 is formed with a trip lug 32, each trip lug projecting perpendicularly away from dial 3. Trip lug 31 is closer to the center of dial 3 than trip lug 32, and the circular paths traversed by the trip lugs when the dial 3 is rotated are concentric. In the embodiment illustrated, trip lug 31 operates to automatically move the actuator means 6 to a position in which the contacts of switch 5 are open, whereas trip lug 32 operates to move the actuator means 6 to its other position in which the contacts of switch 5 are closed.

The pointers 30 indicate the preset or predetermined time at which the trippers will operate the switch, and also provide members engageable by the fingers of the user of the time switch to preset the time at which the trippers will operate the switch. Adjustment of the trippers is accomplished by pushing the desired pointer toward face 19 of the dial to disengage finger from ratchet teeth whereupon the pointer can be moved circumferentially in either direction to set the tripper for operation of the switch at any desired time.

The motor (not shown) is a self-starting alternating current synchronous motor of the type normally used in timing devices, which includes a self-contained reduction gear unit, is coupled through a gear train with a conventional helical spring one-way clutch (not shown) to drive the shaft 22 and the dial 3 at the rate of one revolution a day. The exposed face 19 of the dial is provided with suitable indicia to indicate each of the 24 hours of the day, so that the trippers can be properly set for operation of the switch at the desired time. The motor is disposed in a rear chamber of the housing 1 and is secured to partition 14 by suitable threaded fasteners.

Switch 5 includes a movable contact 38 and a stationary contact 39. Movable contact 38 is secured to an electrically conductive flat spring contact arm 40 at a position slightly spaced from an end of the arm that has a U-shaped notch 41. The other end of arm 40 is fixed to a surface of a wall of the housing (not shown), the surface being disposed in a plane parallel with front wall 11 and partition 14 and spaced therebetween.

The contact arm 40 is so mounted to extend in a generally vertical direction from the lower part of the housing 1 to a location adjacent the horizontal centerline of the housing, and is disposed in a plane parallel with front wall 11 so that movement of movable contact 38 is in a direction toward and away from front wall 11. Stationary contact 39 is fixed adjacent the end of a rigid contact arm 43, the arm being formed of sheet metal having good electrically conducting properties. Contact arm 43 is bent to provide a flat portion that supports stationary contact 39 and a flat portion remote from stationary contact 39, the flat portions being essentially parallel (not shown). The flat portion of arm 43 remote from contact 39 is

fixed to the same wall surface as the arm 40. The other end of arm 43 is inclined relative to the arm 40 so their ends overlap and the contacts 38 and 39 are in spaced alignment.

It should be readily understood that the time switch as hereinbefore briefly described is essentially the same as is disclosed in the aforementioned U.S. Pat. No. 3,260,807, and provides the necessary environment for the present invention which resides in the switch actuator means 6 and its embodiment in such a time switch as will now be described.

Referring now to FIGS. 2 to 6, a shaft 46, disposed transverse to the axis of rotation of the shaft 22 and dial 3, extends through the body portion 52 of a lever 47 and is supported at its ends by the partition 14 within the circular opening 12. The lever 47 has a depending leg portion 48 which extends from the body portion 52 toward the switch 5 and terminates in a laterally enlarged end providing a blade or knife edge 51 extending to one side of the leg which is spaced from and substantially parallel to the shaft 46. The leg 48 is relatively thin and is provided with a transverse web 49 which extends between the body portion 52 and the blade edge 51.

The lever 47, preferably of a dielectric material, is provided with a relatively thin arm 56 which extends from the body portion 52 in a direction away from the leg portion 48. The arm portion 56, which is coplanar and axially aligned with the leg portion 48, extends through an opening in the partition 14 and a slot 57 in the wall 7 of the case 1, and terminates in an exposed free end 58 for receiving a knob 92. An S-shaped force transmitting spring 84 is retained under compression between the free end of the spring contact arm 40 and the end 51 of the leg portion 48 of the lever 47. The ends of the spring 84 are formed to provide seats, one to receive the bottom of the slot 41 of contact arm 40 and the other for the blade edge 51 at the end of the leg portion 48.

The body portion 52, on the side of the leg portion 48 opposite from the laterally enlarged knife edge 51, has a reduced end portion 53 and a nose portion 54 with an through slot 55 in the side thereof. The slot 55 is substantially coextensive with the reduced end 53 of the body portion 52 and extends through the nose portion 54 along an axis substantially normal to the axis of the leg portion 48 and arm portion 56 of the lever 47. As best shown in FIG. 5, the slot 54 has a pair of spaced substantially parallel walls which at their inner ends flare away from one another while the reduced end 53 of the body portion is spaced from the inner surface of the slotted nose portion 54.

A spring 60 has a coiled or wound body portion 61 and a pair of elongated legs 62 and 63 which extend generally radially from opposite ends of the coiled portion. The legs 62 and 63 are offset from one another by the winds or wraps of the coiled portion and normally diverge from one another when the spring 60 is relaxed. To install the spring 60 on the lever 47, the wound or coiled spring portion 61 is fitted on the reduced end 53 of the body portion 52, and the arms 62 and 63 are brought together and inserted into the slot 55. This tensions the spring 60 and the resulting force urges the arms 62 and 63 each against a different or opposite one of the parallel walls of the slot 55. The spring arm 62 and 63, which now are disposed in spaced substantially parallel relationship, extend through the slot 55 and past the nose portion 54, as shown in FIGS. 7 and 8. A sheet metal type retainer or disc 64 is pressed on to the reduced end 53 of the body portion 52 to retain the spring 60 in position.

An elongated recess 85 of rectangular cross section is formed in the top wall 7 transverse to the slot 57 through which arm portion 56 extends. Recess 85 intersects the slot 57 at one end and terminates at its other end with a vertical wall or surface 86. Disposed in recess 85 for rectilinear movement is a restraining member 87, formed from flat rigid sheet metal, that has an elongated rectangular leg 88 disposed in the recess and a rounded end portion projecting upwardly perpendicular to leg 88 to extend above the top surface of top wall 7. Recess 85 is so located that when restraining member 87 is moved to move rectangular leg 87 into slot 57, the rectangular leg is

midway between the front and rear sides of slot 57. Arm 56 of the lever 47 where it passes through slot 57 is so dimensioned that rectangular leg 88 can be moved between a side edge of leg 56 and the remote side of the slot 57 to prevent movement of the lever from whichever position it is in when the restraining member 87 is operated. Restraining member 87 is retained in recess 86 by a cover plate 89 having downwardly extending portions that frictionally engage with the ends of slot 57 to hold the cover plate in position.

Cover plate 89 has a slot 90 through which the round end of restraining member 87 extends. The edges of slot 90 limit the movement of restraining member 87. At the bottom of recess 85 is a leaf spring 91 that engages the bottom edge of rectangular leg 88 of restraining member 87. Spring 91 pushes leg 88 against the cover plate to frictionally retain restraining member 87 in that position to which it is moved manually.

As much as possible, the numbers identifying parts of the timer or time switch of U.S. Pat. No. 3,260,807 have been used herein to identify the same parts of the timer or time switch. The timer or time switch disclosed herein, except for the novel switch actuator means, is the same structurally and operatively as the timer or time switch of U.S. Pat. No. 3,260,807 which fully discloses such structure and operation, some of which is not repeated.

When the timer is operating, the motor (not shown) continuously rotates the dial 3 with the trippers 23 and 24 causing the trip lugs 31 and 32 to cam the actuating means 6 for opening and closing the contacts 38 and 39 at preselected OFF and ON times at which they are set as indicated on the dial 3 by the pointers 30.

Referring now specifically to FIGS. 7 to 10, contact arm 43 is substantially rigid or has only limited resiliency so the position of the contact 39 can be considered as being fixed. When the switch 5 is open or the contacts 38 and 39 are spaced from one another, the force exerted by the S-spring 84 maintains contact arm 40 in its OFF position; position A as shown in FIGS. 7 and 9.

At the preselected ON time to which the tripper 24 has been set, lug 32 engages and cams the spring arm 63 in a clockwise direction (as viewed in the drawings) causing the lever 47 of the novel actuating means 6 to rock or rotate on the shaft 46 and in unison with the spring 60 to assume its ON position as shown in FIG. 8. The force of the spring 60 under tension is sufficient to hold the arm 63 against the adjacent wall of slot 55 while engaged by the lug 32. This movement of the lever 47 causes a past-center snap actuation of the switch 5 by reversing the direction of the force of S-spring 84 on the contact arm 40 as the blade edge 51 travels from one side of that contact arm to the other. The force of the S-spring 84 causes the contact arm 40 to assume its ON position, position B in FIGS. 8 and 10, in which contacts 38 and 39 are closed or in engagement with one another.

The S-spring 84 will maintain contact arm 40 in its position B until the actuating means 6 is again operated to its OFF position. At the preselected OFF time to which the tripper 23 is set as indicated on the dial 3 by the OFF pointer 30, lug 31 engages and cams spring arm 62 in a counterclockwise direction (as viewed in the drawings) causing the lever 47 of the actuating means 6 to rock or rotate on the shaft 46 and in unison with spring 60 to again assume its OFF position. The force of spring 60 under tension is sufficient to hold the arm 62 against the adjacent wall of the slot 55 while engaged by the lug 31. The movement of lever 47 and the resulting reversal in direction of the force of spring 84 again provides a past-center snap actuation of the switch 5 which returns and maintains the contact arm 40 to its position A as shown in FIG. 7.

Of course, such past-center snap actuation of the switch 5 can be accomplished manually by grasping the knob 92 and rocking the lever 47 between its OFF and ON positions as shown in FIGS. 7 and 8, respectively.

Both automatic and manual operation of the switch 5 is prevented by grasping the knob 93 and moving the slidable restraining or lockout member 87 (to the left as viewed in

FIG. 3) away from the vertical surface 86 so the leg 88 thereof extends across the path of movement of the arm 86 of lever 47. The restraining or lockout member 87 prevents movement of the lever 47 from both its OFF and ON positions.

With the actuating means 6 and spring 84 retaining switch 5 in its OFF or open condition, as shown in FIG. 9, at the preselected ON time, the lug 32 engages the spring arm 63. The restraining or lockout member 87 permits little or no movement of the lever 47 so the switch 5 remains OFF or open. The camming action of the lug 32 overcomes the torsional force of the spring 60 moving or deflecting the spring arm 63 which will return to its normal position against the adjacent wall of slot 55 when the lug 32 moves out of engagement and its camming effect is terminated.

Similarly, with the actuating means 6 and spring 84 retaining switch 5 in its ON or closed condition, as shown in FIG. 10, at the preselected OFF time the lug 31 engages the spring arm 62. The restraining or lockout member 87 permits little or no movement of the lever 47 so the switch 5 remains ON or closed. The camming action of the lug 31 overcomes the torsional force of the spring 60 moving deflecting the spring arm 62 which will return to its normal position against the adjacent wall of slot 55 when the lug 31 moves out of engagement and its camming effect is terminated.

By referring to the aforementioned U.S. Pat. No. 3,260,807, the same past-center snap actuation and actuation lockout of a switch can be derived by the novel switch actuating means 6 of the present application.

Although but a single embodiment of the invention has been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes may also be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

I claim:

1. In a time switch having a switch means and driven cam means for causing periodic repetitive operation of said switch means, switch actuating means the improvement comprising:
 - a lever mounted for movement on an axis between two positions;
 - a wireform member mounted on and retained in tension by said lever thereby causing said lever and member to move in unison;
 - said wireform member extending from said lever into the path of movement of said cam means and causing said lever to move from one of its positions to the other when said wireform member is engaged and moved by said cam means; and
 - force transmitting spring means disposed under tension between said switch means and lever thereby actuating said switch means when said lever moves from one of its positions to the other.
2. The time switch in accordance with claim 1 further including:
 - a case;
 - said lever having an arm portion and a leg portion each

disposed on the side of said axis opposite from the other; said arm portion extending through said case and providing an exposed free end for manually operating said switch actuating means; and

said leg portion terminating in a free end with a knife edge engaging said force transmitting spring means.

3. The time switch in accordance with claim 2, wherein said switch means includes at least one fixed contact, a spring contact arm fixedly mounted at one end and being free at its other end, and a contact mounted on said free end of said spring arm and being movable into and out of engagement with said fixed contact when said switch means is actuated;

said force transmitting spring means being an S-shaped flat wire spring formed with a seat at each end thereof; and

one of said seats being engaged by said knife edge of said lever and the other by the edge of the free end of said spring contact arm.

4. The time switch in accordance with claim 2 further including:

a lockout member operable to retain said lever from movement from either of its two positions to the other; and said wireform member being deflected by said cam means when said lever is retained against movement by said lockout member.

5. The time switch in accordance with claim 4, and said wireform member comprising a coiled body portion and a pair of elongated leg portions each extending from a different end of said body portion.

6. The time switch in accordance with claim 5, and:

said lever having an enlarged body portion through which said axis extends, and a nose portion spaced from said body portion;

said nose portion having a slot therethrough providing a pair of space substantially parallel walls;

said coiled body portion of said wireform member being disposed on said body portion of said lever; and

said elongated leg portions of said wireform member extending through said slot each engaging a different one of said pair of walls thereof and being retained under tension thereby.

7. The time switch in accordance with claim 6, wherein:

said cam means includes a pair of cam lugs which move along space parallel paths;

one of said leg portions of said wireform member extending into the path of movement of one of said cam lugs to be engaged thereby when said lever is in one of its positions; and

the other of said leg portions of said wireform member extending into the path of movement of the other of said cam lugs to be engaged thereby when said lever is in the other of its positions.

8. The time switch in accordance with claim 7, wherein:

said knife edge extends from one side of said leg portion of said lever substantially parallel to said axis; and

said wireform member is disposed on the side of said leg portion of said lever opposite from said knife edge.

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