March 11, 1969 S. POLONSKY ET AL 3,432,625

TIMER SWITCH

Filed April 13, 1967 Sheet 1 of 2

FIG. 1

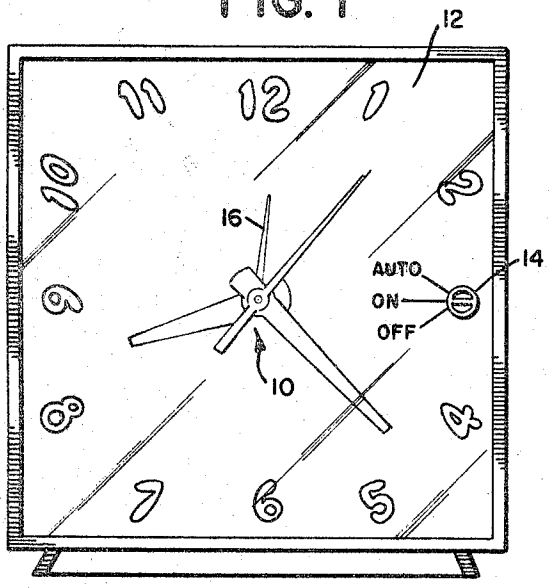
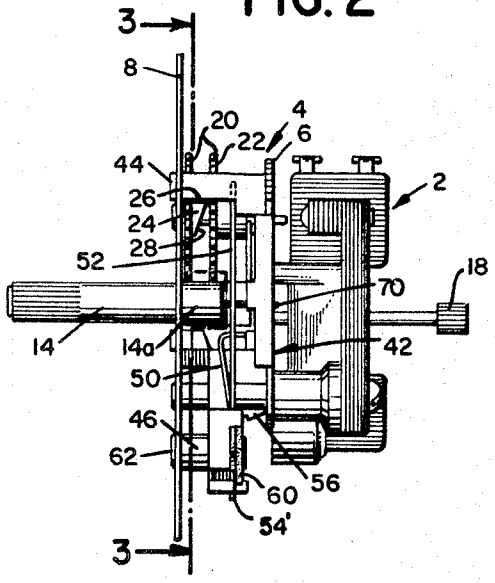


FIG. 2



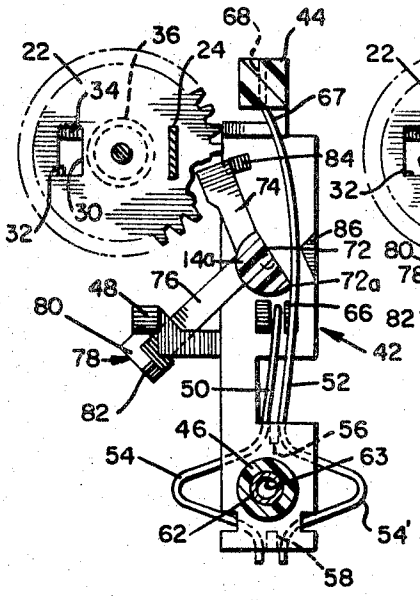


FIG. 3

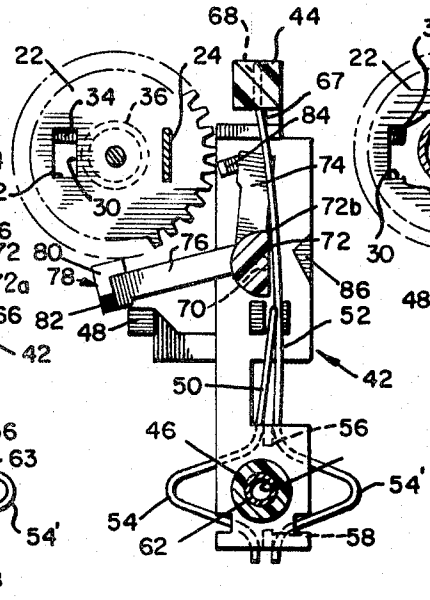


FIG. 4

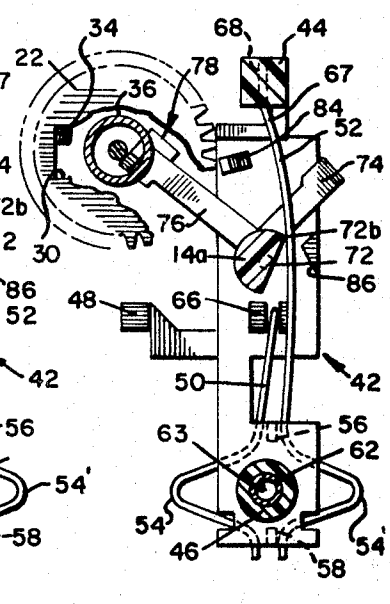


FIG. 5

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FIG. 6

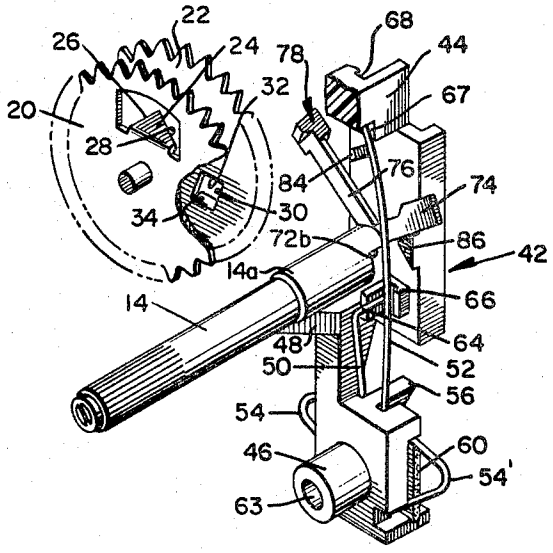


FIG. 7

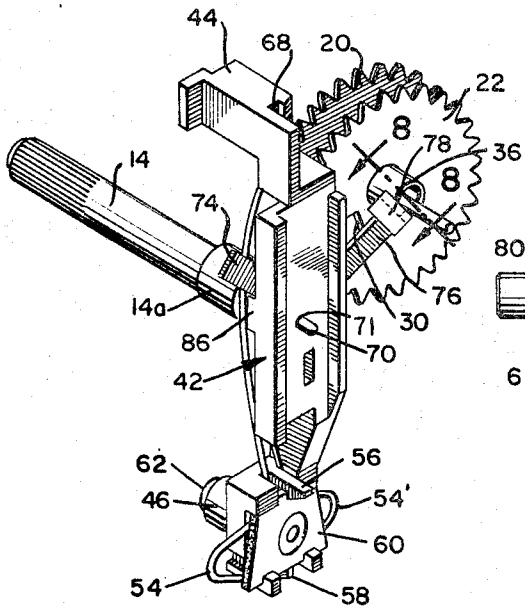
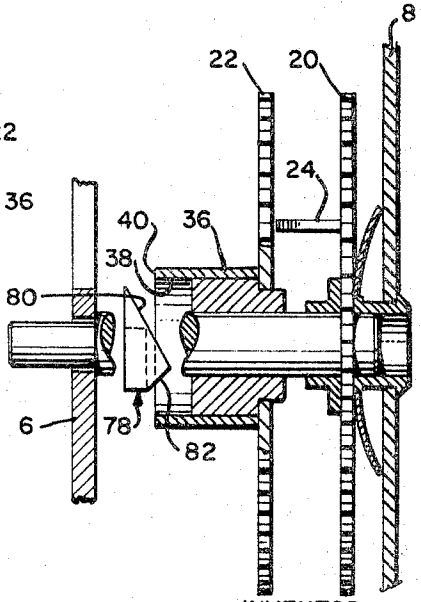


FIG. 8



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TIMER SWITCH

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Int. Cl. H01h 7/08, 43/00

ABSTRACT OF THE DISCLOSURE

A timer switch assembly having a selector shaft which is biased to a closed circuit "on" condition by one of a pair of elongated switch contact wires, and which may be maintained in either such "on" condition or in an "automatic-off" open circuit condition against this bias by a timer controlled latch member or in an "off" open circuit condition against this bias by a manually positionable latch member.

Background of the invention

This invention relates to timers, such as alarm clock movements, and more particularly to improved timer switch mechanisms therefor for rendering such timers capable of actuating controlled devices, such as radios, alarms, electrical appliances and similar devices, at a predetermined time.

It is well known in the timer control, such as "clock-radio," prior art to provide three-position timer switches having the usual "off," "on" and "automatic-off" positions. One well known timer switch of this type employs coaxially mounted gear driven rotatable latch members having interacting cam surfaces for causing relative axial movement of the latch members at a predetermined time for actuating a switch for a controlled mechanism. In such timer switches, means must be provided to translate the axial movement of the gear driven latch members to a suitable motion of a switch member for closing a pair of switch contacts at a predetermined time. One such means known to the prior art is a torsion spring which biases a selector shaft and "automatic-off" control lever to their normal "on" position. The torsion spring is operationally disposed relative to the switch and timer so that when the timer is set in "automatic-off" position the control lever is latched by one of the latch members. When the predetermined time is reached the interacting cam surfaces permit the latch members to move relatively axially and the control lever is disengaged from the latch members and urged by the torsion spring to the "on" position for closing the timer switch contacts. This type of well known timer switch comprises a plurality of structural components which causes the assembly to be relatively expensive to manufacture and assemble.

Accordingly, it is the primary object of this invention to provide an improved timer switch comprising a minimum of parts which are readily assemblable for producing an inexpensive, yet reliable, timer switch.

Summary of the invention

To accomplish this object, in one form, a timer switch is provided which comprises: a timer, which may be a known clock movement mechanism; a switch; a gear driven rotatable latch means operationally connected to the timer; a selectively manually rotatable selector shaft for actuating the switch and movable from a central "on" position to an "off" position, by movement of the shaft in one direction of shaft rotation, and to an "automatic-off" position, by movement in the opposite direction of shaft rotation; and a pair of switch contacts forming parts of the switch, one of which comprises a formed resilient electrically conductive wire for biasing the selector shaft

from both the "off" and "automatic-off" positions to the central "on" position.

Brief description of the drawings

Other objects and further details of that which we believe to be novel of our invention will be clear from the following description and claims taken with the accompanying drawings wherein:

FIG. 1 is a front elevational view of the clock face of a timer control incorporating the timer switch of our invention;

FIG. 2 is a side elevational view of the timer control, including the timer switch mechanism;

FIG. 3 is an enlarged sectional view taken substantially on line 3—3 of FIG. 2, showing the timer switch subassembly in its "off" position;

FIG. 4 is an enlarged view similar to FIG. 3, showing the timer switch subassembly in its "on" position;

FIG. 5 is an enlarged view similar to FIG. 3, showing the timer switch subassembly in its "automatic-off" position;

FIG. 6 is an enlarged front perspective view of the timer switch shown in its "automatic-off" position;

FIG. 7 is an enlarged rear perspective view of the timer switch subassembly shown in its "automatic-off" position; and

FIG. 8 is an enlarged side elevational view of the gear driven latch members and the "automatic-off" detent cam.

Description of the preferred embodiment

With particular reference to the drawings, there is illustrated in FIGS. 1 and 2 an improved timer control in the form of a known alarm clock and, therefore, alarm clock nomenclature will be used to describe it. The alarm clock comprises a self-starting synchronous electric motor 2, which is connected in a conventional manner to a known gear train 4 of the clock for driving the clock movement at a predetermined regulated speed. The motor 2 is mounted upon a base plate 6 which supports a portion of the gear train in operative relation to the driving gear of the electric motor 2. A support plate 8 is spaced from and secured parallel to the base plate 6 for supporting a portion of the gear train and a plurality of relatively movable coaxial concentric time indicating shafts (not shown) upon which are secured the usual hour, minute and second time indicating hands generally designated by the numeral 10, all the foregoing in a known manner. These hands 10 can best be seen in FIG. 1 in relation to the clock face 12 which has imprinted thereon in addition to the usual clock indicia, the control setting indicia having relation to the improved timer switch (AUTO, ON, OFF) positioned so as to be adjacent the end of the manually operable selector shaft 14 of the timer switch when the latter is assembled to the clock. The usual alarm setting indicator 16 disposed adjacent to the clock face is controlled by the selectively manually operated control setting knob 18, which positions the usual alarm set cam gear 20 and is coupled to the indicator 16 by a conventional gear set.

Alarm set cam gear 20 cooperates with the axially movable hour hand cam gear 22, and the pair cooperate to comprise a timer latch wherein the gears 20 and 22 may be moved relatively axially at a predetermined time to unlatch a latched element. A projecting tab-like cam portion 24, which is preferably struck from the body of the cam gear 20, is disposed normal thereto and projects toward the gear 22 (see FIG. 6). Cam portion 24 includes an abrupt axially extending edge 26 and a sloping edge 28. The hour hand cam gear 22 has a slot 30 cut into its body forming an abrupt wall 32 and an inclined ramp

34 which may be struck therefrom. It will be readily understood by those skilled in the art that the cam gears 20 and 22 are normally kept separated by the cam portion 24, and that when the clock movement drives the hour hand cam gear 22 one complete revolution to a position where the abrupt cam edge 26 becomes aligned with the slot wall 32, at a predetermined time fixed by the preselected setting of the gear 20, the cam portion 24 will enter the slot 30 enabling the cam gear 22 to be moved axially towards the cam gear 20. This is the unlatching condition of the gears 20, 22. Continued rotation of the hour hand cam gear 22 relative to gear 20 in normal operation of the clock causes the sloping edge 28 of the projecting cam portion 24 to cooperate with the ramp 34 of the slot 30, to once again move the gears apart. Latch means for cooperating with a latchable switch control lever is disposed upon the cam gear 22 and includes a hub 36 counterbored at 38 and having a circumferential lip 40 (see FIG. 8). The effect of the controlled relative axial movement of the gears 20, 22 is to provide for the automatic actuation of the improved electrical switch assembly of our invention by unlatching a switch control lever at a predetermined time.

In the form of the invention shown in FIGS. 3–7, there is provided a novel switch subassembly for operative association with the described alarm clock movement. The switch subassembly comprises an elongated switch block 42, preferably made of moldable plastic or a like electrically insulating material. The block 42 is of unique configuration for operatively supporting the switch elements and for supporting the selector shaft 14 for rotation, and is rigidly mountable upon the frame member 8 and spaced therefrom by the three foot members 44, 46 and 48. Foot member 44 depends from the main portion of block 42 and is formed to pass through an opening in the support plate 8, and is aligned with depending foot member 46 which is secured to the plate 8, as by riveting, while the foot member 48 is also formed to pass through an opening in the support plate 8 and is offset from the other two members for stabilizing the mounting of block 42.

The switch elements which are mounted upon block 42 comprise two formed contact wires, a shorter wire 50 and an elongated wire 52, each of which is provided with a substantially V-shaped end section 54, 54', respectively, for serving as switch solder terminals for conductors for connecting the switch in the circuit of the controlled device. The V-shaped sections 54, 54' are mounted upon the block 42, and are maintained separated by being received in appropriate notches on opposite sides of the formations 56 and 58 formed at the lower end of the block 42 on a rearwardly facing portion thereof. A cover 60 made of a suitable insulating material is placed over the V-shaped sections 54, 54' when so disposed, and is secured to the switch block 42 for securing the contact wires 50 and 52 in place. An eyelet type rivet 62 passes through the cover 60, the bore 63 formed through the foot member 46 and through an aperture formed in the support plate 8, both for securing the cover 60 to the switch block 42 and for maintaining the switch block in place on the plate 8.

The other end 64 of wire 50 is bent substantially normal to its length in a plane normal to that of its V-shaped section 54, and is anchored in a seat 66 formed between formations on the switch block on an offset forwardly facing portion thereof. The contact wire 50 is approximately one-half the length of contact wire 52, hence the bent end 64 of contact wire 50 is located adjacent the mid-point of the contact wire 52. The contact wire 50 is therefore rigidly mounted to form a stationary contact element.

The free end 67 of the contact wire 52 extends upwardly to the upper end of the switch block 42, at which point it is positioned within the notch 68 formed in a rearwardly facing portion of the switch block, but it is unrestrained and capable of longitudinal movement therein. The notch 68 is located upon the switch block at a position for normally biasing the central portion of contact wire 52 against the adjacent fixed bent end 64 of the contact wire 50. It can be readily understood that the free end 67 of the wire 52 may reciprocate substantially longitudinally of its axis when a transverse force is exerted upon it causing it to be bowed away from the bent end 64, thereby constituting wire 52 a movable switch contact element.

The selector shaft 14 of the switch assembly passes through an opening in the support plate 8 and is positioned for selective rotation by means of an axial positioning pin 70, formed at its rearward end, which passes through and is seated in an end bearing opening 71 in the switch block 42. The shaft 14 is made of a nonmetallic plastic material and includes an enlarged shouldered portion 14*a* larger than the opening in plate 8 through which shaft 14 extends which abuts the rearward side of the plate 8, and a flattened cam surface 72, defining cam edges 72*a* and 72*b* for cooperation with the contact wire 52 to move it out of contact with wire 50, as will become apparent. An "off" position latching lever 74 is formed integrally with shaft 14 and extends radially from the axis of the shaft 14. A radially extending "automatic-off" position-latching lever 76 coplanar with the lever 74 and angularly spaced therefrom, is also formed integrally with shaft 14. The "automatic-off" lever 76 includes a detent 78 at its free end having inclined cam surfaces 80 and 82 for operative cooperation with counterbore lip 40 of hub 36 to be latched or unlatched relative thereto. The switch block 42 further includes a detent 84 for cooperating with latching lever 74 for maintaining the "off" lever 74 in its normal "off" position when it has been manually moved thereto. A limit post formation 86 is also formed on the switch block 42 for serving as a stop for the "off" lever 74 when the selector shaft 14 is rotated to its extreme clockwise or "automatic-off" position. The plastic material of which the latching levers 74 and 76 are formed allows them to flex in a direction normal to the plane of the levers during operation. This flexure allows the latching levers to pass over the detent 84 and lip 40 for retaining the selector shaft 14 in various positions to which it is manually adjusted by movement of shaft 14.

Referring now to FIG. 4, it can be seen that when the flattened cam surface 72 of shaft 14 is selectively disposed parallel to the mid-region of the movable contact wire 52, electrical contact is maintained between the contact wires 50 and 52, and the electrical circuit through the controlled device is closed. The mounting of the contact wires 50, 52 insures their engagement when unrestrained. This shaft position corresponds to the "on" condition.

When the shaft 14 is rotated from its FIG. 4 "on" position in a counterclockwise direction to its FIG. 3 position, the cam edge 72*a* of surface 72 engages the movable contact resilient wire 52 bowing it away from the fixed bent end 64 of contact wire 50 and causing the "off" latching lever 74 to be flexed and to pass over an inclined wall of the detent 84. The strain produced in movable contact wire 52 biases the cam edge 72*a* clockwise, but the detent 84 obstructs the end of lever 74 and prevents clockwise movement of shaft 14. Thus the shaft is maintained in position corresponding to the "off" condition of the switch.

With reference to FIG. 5, the selector shaft 14 is illustrated after having been manually moved to the "automatic-off" position, the shaft having been rotated in a clockwise direction relative to the FIG. 3 "off" and FIG. 4 "on" positions. Such rotation of the shaft causes the cam edge 72*b* to bow the movable contact wire 52 away from the fixed bent end 64 of stationary contact wire 50, thereby opening the switch and the electrical circuit through the controlled device. The shaft 14 is maintained in the "automatic-off" position when it has been rotated

sufficiently to allow the detent **78** of latching lever **76** to be seated within the counterbore **38** of the hub **36** on the hour hand cam gear **22** (see FIG. 8). In order to seat the detent **78** in this manner, cam gears **20** and **22** must be separated by the cam portion **24**. Rotation of the selector shaft **14** causes the inclined cam surface **80** to ride over the circumferential lip **40** thereby flexing the lever **76** so that the detent **78** may snap into position in the counterbore **38**. The resilience of the lever **76** urges the hour hand cam gear **22** toward alarm set cam gear **20** so that when the portion **24** enters the slot **30** at the predetermined set time, the cam gear **22** will be moved axially toward the cam gear **20**, thereby releasing the detent **78** and lever **76**. Since the shaft **14** is biased toward its central "on" position by the resilient movable contact wire acting on the cam edge **72***b* when the shaft has been moved to the FIG. 5 "automatic-off" position, the shaft **14** is snapped counter-clockwise into its FIG. 4 central position upon release of the lever **76**.

It should be noted that the selector shaft **14** may be manually moved at any time from the "automatic-off" position (FIG. 5) back to the central FIG. 4 "on" position or beyond to the FIG. 3 "off" position without having to wait for the timer mechanism to operate through a timed cycle to release the lever **76**. This may be accomplished by the exertion of a counter-clockwise torque on the selector shaft **14** which forces the rear inclined cam surface **82** to ride over the lip **40**.

Having described our invention of an improved timer switch, it will be readily appreciated by those skilled in this art that a timer switch embodying our invention is both simple in design, low in cost of manufacture and ingenious in operation. Reliability of operation is of primary concern, although ease of assembly and minimum cost of manufacture are also important considerations that are satisfied by our invention while concomitantly satisfying the principal requirement of reliability.

It is to be understood that the present disclosure has been made only by way of example and that numerous changes in details of construction and the combination and arrangement of parts may be resorted to without departing from the true spirit and the scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A timer switch assembly comprising: a timing mechanism; latch means controlled by said timing mechanism; an electrical switch means including a stationary contact and a resilient movable electrically conductive wire contact, said wire contact being mounted so as to normally be biased into electrical engagement with said stationary contact but be movable out of engagement therewith; and a rotatable selector shaft selectively manually controlling the position of said wire contact relative to said stationary contact, said shaft having first means disposed when said shaft is in a predetermined position for permitting said wire contact to be in electrical engagement with said stationary contact, said shaft first means being selectively operable for displacing said wire contact from said stationary contact upon rotation of said shaft in one direction from said predetermined shaft position whereby said wire contact biases said shaft back toward its predetermined position, said shaft having further means cooperable with said latch means for maintaining said shaft in a rotated position, with said wire contact displaced from said stationary contact for a predetermined interval of time determined by said timing mechanism.

2. The timer switch assembly defined in claim **1** wherein said first means includes a flat portion which is located adjacent to said wire contact and includes a cam edge at one side which is movable to move said wire contact out of engagement with said stationary contact upon rotation of said shaft in the said one direction.

3. The timer switch assembly defined in claim **1** wherein said further means includes a lever carried by said shaft and extending substantially perpendicular to the axis of said shaft and having a detent at its free end for cooperating with said latch means for maintaining said shaft in such a rotated position.

4. The timer switch assembly defined in claim **3** wherein: said latch means includes a first manually rotatable cam gear having an axial projecting portion, and a second cam gear having an aperture formed therein mounted in coaxial relationship with said first cam gear and axially movable with respect thereto, said second cam gear being rotated relative to said first cam gear by said timing mechanism, said projecting portion maintaining said cam gears separated until said projecting portion and said aperture are in registry for permitting relative axial closing movement of said cam gears at a predetermined time, and said second cam gear further including a central hub having a counterbore defining a circumferential lip; and said shaft lever detent is selectively disposable in said counterbore and retained therein by said circumferential lip when said second cam gear is spaced from said first cam gear by said projecting portion and when said shaft is rotated to such rotated position.

5. The timer switch assembly defined in claim **4** further including an electrical insulating body for carrying said electrical switch contacts and for locating said selector shaft for rotation, said body including a detent formation; and wherein one end of said wire contact is fixedly secured to said body and the other end is retained for substantially only longitudinal sliding motion relative to said body; said stationary contact includes a second wire contact having one end fixedly secured to said body adjacent to but electrically insulated from said fixed end of said wire contact, and having its other end bent and fixed in said body so that said bent end is substantially perpendicular to said wire contact, said wire contact being mounted to be normally biased toward and into engagement with said stationary contact; and said selector shaft includes a lever carried by and substantially perpendicular to the axis of said shaft for cooperating with said detent formation upon rotation of said shaft in the other direction from the predetermined position for maintaining said lever in a displaced position when so rotated, and said wire contact displaced from said stationary contact until said shaft is selectively rotated back to said predetermined position.

6. The timer switch assembly defined in claim **1** wherein said latch means includes a first manually rotatable cam gear having an axial projecting portion; and a second cam gear having an aperture formed therein mounted in coaxial relationship with said first cam gear and axially movable with respect thereto, said second cam gear being rotated relative to said first cam gear by said timing mechanism, and said projecting portion maintaining said cam gears separated until said projecting portion and said aperture are in registry for permitting relative axial closing movement of said cam gears at a predetermined time.

7. The timer switch assembly defined in claim **6** wherein: said second cam gear further includes a central hub having a counterbore defining a circumferential lip; and said selector shaft includes a lever extending substantially perpendicular to the axis of said shaft, said lever having a detent at its free end for introduction into said counterbore and retention by said circumferential lip when said second cam gear is spaced from said first cam gear by said projecting portion and when said shaft is rotated to such rotated position.

8. The timer switch assembly defined in claim **1** further including an electrical insulating body carrying said electrical switch contacts and mounting and locating said selector shaft for rotation.

9. The timer switch assembly defined in claim **8** wherein: said electrical insulating body includes a detent formation; and said selector shaft includes a lever extending substantially perpendicular to the axis of said shaft for cooperating with said detent formation for maintaining said lever in a displaced position when rotated and said wire contact displaced from said stationary contact upon

rotation of said shaft in a direction opposite to said one direction until said shaft is manually selectively rotated back to said predetermined position.

10. The timer switch assembly defined in claim **8** wherein one end of said wire contact is fixedly secured to said electrical insulating body and the other end of said wire contact is mounted for substantially only longitudinal sliding motion relative to said electrical insulating body; said stationary contact includes a wire having one end fixedly secured to said insulating body and having its other end bent and fixed in said electrical insulating body in position so that said bent end is substantially perpendicular to said wire contact; and said wire contact is mounted so as to be normally biased in electrical engagement with said stationary contact.

References Cited

UNITED STATES PATENTS

2,720,561	10/1955	Nelson	200—30
2,721,441	10/1955	Boyles	200—35
3,059,414	10/1962	Boyles	58—38
3,314,228	4/1967	Bowden	58—38

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