This invention relates to a rotary electric switch particularly adapted for application to an alarm clock to function as a time controlled switch, and to the combination of such a switch with an alarm clock.

The primary objects of the invention are: to provide such a switch which may be applied to and supported solely by a rotary element, as for instance the usual alarm winding stem of an alarm clock and which, in its preferred application, may be substituted for the usual winding key of said stem without requiring any other changes or permanent alterations in the clock construction; to provide such a switch which is actuated by rotary movement of said alarm winding stem and which cooperates with a suitable stationary stop which may consist of one of the setting knobs projecting from the rear face of the clock; to provide such a switch which may be set to either make or break an electric circuit at any given time, and which may alternatively be manually actuated either to make or break the circuit whenever desired.

Such a switch comprises a rotor carried by and movable with the alarm winding stem and a housing rotatable on said rotor, the housing having relatively axially spaced contacts disposed for rotary movement into or out of engagement with a conductor bar carried by the rotor, whereby the conductor bar may close a circuit between said respective contacts.

It is accordingly a further and more specific object of the invention to provide in such a switch a stop pin or element which may be interchangeably positioned to arrest the rotary movement of the rotor either when the switch is open or when it is closed, and which in either position cooperates with the rotor to reset same and simultaneously rewind the alarm stem following actuation of the switch.

A still further object is to utilize the same stop element or pin aforementioned to cooperate with a stationary stop on the clock and maintain the switch against bodily rotation as the rotor therein is subjected to rotary movement.

In addition, my invention contemplates the novel utilization of a conventional electric plug as part of the switch mechanism, the arrangement being such that the usual conductor prongs of the plug are made to function as switch contacts or brushes in cooperation with the relatively movable conductor bars of the rotor.

Further incidental objects and advantages will be apparent from the detailed description hereinafter following in conjunction with the accompanying drawings.

In this application I show and describe only the preferred embodiment of my invention, simply by way of illustration of the practice thereof as by law required. However I recognize that my invention is capable of other and different embodiments and that the several details thereof may be modified in various ways, all without departing from my said invention. Accordingly, the drawings and description hereinafter are to be considered as merely illustrative of my invention and not as excluding other adaptations or embodiments thereof.

In the accompanying drawings:

Figure 1 represents a view of the preferred embodiment of the invention, taken partly in elevation and partly in section on the line 1—1 of Figure 4, looking in the direction of the arrows;

Figure 2, a section on the line 2—2 of Figure 1, looking in the direction of the arrows, and showing the associated electric plugs in elevation;

Figure 3, a section through the switch of the invention as same will appear when applied in operative relation to a usual alarm clock, the latter being shown in rear elevation;

Figure 4, a section on the line 4—4 of Figure 1, looking in the direction of the arrows;

Figures 5 and 6 respectively are views similar to Figure 4, but showing the parts in different operative positions;

Figures 7 and 8 respectively are also views similar to Figure 4, but showing the several operative parts of the switch in still different operative positions.

Referring now in detail to the accompanying drawings, in Figure 3 I have shown my invention as operatively applied to a conventional mechanical alarm clock having on its rear face a usual winding key 4 for the main spring of the clock and a centrally disposed hand setting knob 2 for properly setting the clock hands.

The alarm mechanism of such a clock is of any conventional spring actuated type embodying a setting knob 3 and a rotary winding stem 4, both projecting from the rear face of the clock. As is usual, the winding stem 4 unwinds with its associated alarm spring when the latter is released at the time the alarm goes off.

In the type of clock shown by way of exemplification of the preferred use and adaptation of the invention, the stem 4 is rotatable in a counterclockwise direction to wind the alarm spring, hence is provided with left handed threads to cooperate with a similarly threaded conventional winding key (not shown), the arrangement being
the usual one whereby winding of the alarm serves to tighten the threaded engagement between the stem 4 and its winding handle.

The switch of the invention comprises a preferably cylindrical rotor 5 which in operation is coaxially mounted on the alarm winding stem 4 in any suitable manner for rotary movement therewith.

In the preferred embodiment of the invention the rotor 5 replaces or is substituted for the usual alarm winding key, and to this end is provided in its forward axial end with a left hand threaded socket or bore 5c to receive the similarly threaded stem 4.

Relatively diametrically opposed electrical contacts or conductor bars 6—6 are embedded or otherwise fixed on the rotor 5 and insulated from each other, this being accomplished in the preferred embodiment by forming the rotor 5 of an insulating material such as Bakelite. Preferably the bars or members 6—6 project somewhat beyond the cylindrical surface of the rotor 5 for purposes hereinafter appearing, and terminate short of the ends of the rotor.

Coaxially mounted on rotor 5 for relative rotary movement about the axis thereof is a hollow switch housing 7 of Bakelite or other insulating material. Preferably such a housing comprises a cylindrical medial portion 7a and annular ends or bearings 7b—7b fixedly secured thereto, these being rotatably journaled on the ends of the rotor 5 and thereby supporting the medial section 7a in spaced relation about said rotor. If desired, the end portions of the rotor received within the bearings 7b—7b may be of slightly reduced diameter, whereby the shoulders defined at their juncture with the larger diameter medial portion of said rotor will abut against the bearings 7b and prevent relative endwise movement between the rotor 5 and its housing 7.

Two relatively axially aligned axially spaced pairs of relatively diametrically opposed brushes or contacts 8—8 and 9—9 carried by the housing 7 project inwardly thereof, the contacts 8—8 and 9—9 in each pair being opposite sides of the rotor 5 for simultaneous cooperation with the respective conductor bars 6—6, whereby each contact 8 or 9 may be electrically connected with its axially aligned contact 5 through one of the conductor bars 6 when the housing 7 and rotor 5 are disposed in the proper rotary positions relative to each other.

In order to best adapt my invention for practical use I have found it desirable to provide the annular rear bearing 7b of the housing with openings therethrough on opposite diametrical sides of the rotor axis for the reception and frictional retention of the contact prongs of a usual electric plug 10, whereby the inwardly projecting ends of these prongs will extend inwardly on diametrically opposite sides of the rotor 5 to function as the aforementioned contacts 8—8 in cooperation with the conductor bars 6—6.

The two wires of an electric cord 10' conveying current from any desired source are electrically connected to the respective contacts or prongs 8—8 in usual manner, as in Figure 2.

The contacts or brushes 8—9 in the preferred embodiment extend across the hollow interior of housing 7 on opposite sides of rotor 5, and may be supported by embedding their respective ends in the housing 7, their respective medial portions being in diametrically opposed relation and in axial alignment with the respective contacts 8—8, whereby the conductor bars 6—6 will simultaneously engage or disengage both sets or pairs of said contacts.

The usual conductor prongs 11—11 of an electric plug 12 are inserted through openings in the side of body or housing 7 into engagement with the respective contacts 9—9, the arrangement being such that the contacts 9—9 serve as extensions for these said prongs 11—11. The usual two-wire cord 12' of this plug 12 may be disposed in circuit with any usual electrical appliance or device, such as a radio, stove, washing machine, electric motor or the like, whose operation is to be controlled by the switch of my invention.

Alternatively insertible through either of two relatively angularly disposed substantially radial sockets 14 or 15 respectively in the housing 7 is a stop pin 16, the inner end of which projects into the path of relative rotary movement of a suitable projection or stop, which may comprise one of the radially projecting conductor bars 6, carried by the rotor 5.

One of said sockets 15 is located at such an angular position (just to one side of the diametrical plane of contacts 8—8 and 9—9) that the pin 16 when inserted therein will engage its cooperating stop or conductor bar 6 of the rotor at the time said conductor bars 6—6 engage the respective contacts 8—8 and 9—9 to close the switch, as in Figure 1.

The other of said sockets 14 is located at such an angular position on the housing 7 (preferably at substantially right angles to socket 15) that the pin 16 when inserted therein will engage one of the stops 16 to arrest the relative rotary movement between housing 7 and rotor 5 at a time when the bars 6—6 are out of engagement with the contacts 8—8 and 9—9. (See Figure 3.) At this time it will be apparent that the switch is in open position.

The outer end of stop pin 16 projects radially from housing 7 for engagement with a suitable stop which may consist of the alarm setting knob 3 fixedly positioned on and projecting from the rear face of the clock.

Where one of the conductor bars 6 is employed as the internal stop for cooperation with the pin 16, said pin will be suitably insulated, as by a covering of insulating material 16b at its outer end, to avoid any short circuits arising from the engagement between said pin and the knob 3, and also to avoid the electrical shocking of the operator during manual manipulation of the pin 16.

It will be understood that the alarm stem 4 is wholly or partially wound, preferably by its usual winding key, before the rotor 5 is threaded onto the stem 4.

In using the switch of the invention in association with a conventional alarm clock to close a circuit through an electrical appliance at a predetermined time, the alarm is set by means of the knob 3 to go off at the desired time.

Then, with the stop pin 16 inserted into circuit closing position in the socket 15 of the switch housing 16, the switch housing and rotor are manually rotated away from the knob 3 in a counterclockwise direction until the pin 16 is in a substantially vertical position. At the end of this movement, the various parts will be positioned as shown in Figure 4, with the circuit through the switch closed.

Thereafter the pin 16 and housing 7 are swung...
back in a clockwise direction until the pin abuts against the stop or knob 3, as shown in Figure 5, leaving the conductor bars 6—the out of engagement with the contacts 8—8 and 9—9, with the switch thus open.

Subsequently, the setting off of the alarm will cause the alarm stem or shaft 4 and rotor 5 to rotate together in a clockwise direction until such movement is arrested by engagement between the stop pin 16 and one of the conductor bars 6—6 at which time the conductor bars 6—6 will engage the respective contacts 8—8 and 9—9 to close the switch and establish an electrical circuit through the electrical appliance associated with the plug 12.

In order to reset the switch for repeated use, with or without changing the time setting of the alarm, it is necessary only to again swing the housing 7 and pin 16 through a quarter revolution in a counterclockwise direction and then return same to their former position, with the pin 16 in rotary abutment with the stop knob 3 as in Figure 5. This will simultaneously rewind the alarm spring as well as reset the switch.

Where it is desired to use the switch for the purpose of opening a circuit to deenergize an electrical device or appliance at a given time, the alarm is set for actuation at such time in usual manner.

Then, with the stop pin 16 still in the socket 15 of the switch housing, the said housing, pin and rotor 5 are all rotated in a counterclockwise direction to the same position illustrated in Figures 1 and 4, at which time the switch is in closed position.

Following this, pin 16 is removed from socket 15 and replaced in socket 16 in abutment with the knob 3 as shown in Figure 7, leaving the switch in closed position.

Consequently, the housing 7 will remain stationary upon subsequent actuation of the alarm, while the ensuing clockwise rotation of the rotor 5 until one of the bars 6 abuts against stop pin 16 will cause the switch to assume an open position, as shown in Figure 7 with the movement of the contacts 8—8 and 9—9...

Thereafter, resetting of the switch for repeated use and rewinding of the alarm may be simultaneously accomplished by rotating the pin 16 and housing 7 for a quarter revolution in a counterclockwise direction and then returning it to its position wherein the pin 16 abuts against the knob 3, as in Figure 7.

Obviously the pin 16 and housing 7 may be manually swung about the rotor 5 to open or close the switch whenever desired, regardless of whether the pin 16 is positioned in socket 15 or in socket 16; accordingly the switch of the invention is well adapted for use as a manual manually controlled switch, as well as for its preferred use as a time switch.

It will be apparent that each pair of relatively axially spaced contacts 8—8 cooperate with their associated conductor bar 6 to make or break the circuit between said contacts 8—8, and accordingly that the illustrated preferred form of switch is in reality a double switch, or in other words functions as two complete switches, one in each branch of the circuit. Obviously therefore, one pair of such axially spaced contacts 8—8 and their associated bar 6 may be eliminated if desired, and the single remaining switch used to control, or be disposed in one branch of an electrical circuit.

Further, while I have described my invention as applied to the rotary winding stem of an alarm clock for use as a time controlled switch, it is by no means limited to such specific application or use, and may be applied to any rotary member and associated with any stop means corresponding to the knob 3, to either open or close an electrical circuit responsive to rotary movement of such member; for instance, it is contemplated that such a switch connected in the power circuit of the electric driving motor for a gasoline pump may be mounted on the rotary indicator shaft of the usual meter associated with such a pump for cooperation with a suitable stop on the indicator dial, thus to break said circuit and shut off the pump when a predetermined amount of gasoline has been delivered thereby. Other analogous applications of the invention will suggest themselves to those skilled in the art.

I claim:

1. A time controlled switch for a mechanical alarm clock having a rotary winding stem which is released and unwound during sounding of the alarm, a stop element being carried by said clock adjacent said stem, said switch comprising a rotor of insulating material coaxially mounted on said winding stem for rotary movement therewith, a pair of diametrically opposed axially extending conductor bars carried by said rotor, a hollow cylindrical insulated housing coaxially mounted on said rotor for rotary movement relative thereto, two relatively axially aligned axially spaced pairs of diametrically opposed contacts carried internally of said housing for simultaneous engagement and disengagement with said conductor bars, and a stop pin positionable in said housing to engage said conductor bar and arrest the relative movement of said rotor within said housing when the conductor bars are in engagement with said contacts to close said switch, said stop pin being alternatively positionable in said housing to engage said conductor bar and arrest the relative movement of said rotor when the conductor bars are out of engagement with said contacts with the switch thus in open position, said pin projecting externally from said housing for rotary abutment with said stop element and thereby maintaining said housing stationary during rotary movement of the said rotor and stem.

2. A time controlled switch for an alarm clock having a rotary winding stem which is released and unwound during sounding of the alarm, a stop element being supported on said clock adjacent said stem, said switch comprising a rotor of insulating material coaxially mounted on said winding stem for rotary movement therewith, a pair of diametrically opposed axially extending conductor bars carried by said rotor, a hollow cylindrical housing of insulating material coaxially mounted on said rotor for rotary movement relative thereto, two relatively axially aligned axially spaced pairs of diametrically opposed contacts carried internally of said housing for simultaneous engagement and disengagement with said conductor bars, and a stop pin positionable in said housing to engage one of said conductor bars and arrest the relative movement of said rotor within said housing when the conductor bars and said contacts are in engagement with the switch closed, said pin projecting externally from said housing into rotary abutment with said stop element and thereby maintaining
said housing stationary during movement of said rotor and winding stem.

3. A time controlled switch as defined in claim 2 wherein one pair of said relatively diametrically opposed contacts comprises the prongs of an electrical plug extending axially into said housing on opposite sides of said rotor.

4. A time controlled switch for an alarm clock having a rotary winding stem which is released and unwound during sounding of the alarm, a stop element being carried by said clock adjacent said stem, said switch comprising a rotor insulated material coaxially mounted on said winding stem for rotary movement therewith, a pair of diametrically opposed axially extending conductor bars carried by said rotor, a hollow cylindrical housing mounted on said rotor for relative rotary movement therewith, an axially extending conductor bar carried by said rotor, a hollow housing mounted on said rotor for relative rotary movement about the rotational axis thereof, a pair of relatively axially spaced axially aligned contacts carried internally of said housing for simultaneous engagement and disengagement with said bar, a stop pin interchangeably positionable in said housing to engage the said bar and arrest the rotary movement of said rotor within said housing, and a stop pin when said contacts are in engagement with said bar, or when said contacts are out of engagement with said bar, said stop pin in either position projecting radially externally of said housing into rotary abutment with said stop element and thereby preventing rotary movement of said housing with said rotor during unwinding of said stem.

5. A time controlled switch as defined in claim 4 wherein one pair of said relatively diametrically opposed contacts comprises the prongs of an electrical plug extending axially into said housing on opposite sides of said rotor.

6. A time controlled switch for an alarm clock having a rotary winding stem which is released and unwound during sounding of the alarm, a stop element being carried by said clock adjacent said stem, said switch comprising a rotor mounted on said winding stem for rotary movement therewith, a pair of diametrically opposed axially extending conductor bars carried by said rotor and insulated from each other, a hollow housing mounted on said rotor for relative rotary movement about the axis thereof, two relatively axially aligned axially spaced pairs of diametrically opposed contacts carried internally of said housing for simultaneous engagement and disengagement with said conductor bars, and a stop pin positioned in said housing to engage one of said conductor bars and arrest the relative movement of said rotor within the said housing when the conductor bars are out of engagement with said contacts with the switch open, said pin projecting externally from said housing into rotary abutment with said stop element and thereby maintaining said housing stationary during movement of said rotor and winding stem in one direction.

7. A time controlled switch as defined in claim 6 wherein the said internal stop means of the housing is positioned to engage the cooperating stop means of said rotor and arrest the relative rotary movement between said housing and rotor when the switch is in opened position with said conductor bars and contacts out of engagement.

8. A time controlled switch for an alarm clock having a rotary winding stem which is released and unwound during sounding of the alarm, a stop element being carried by said clock adjacent the said stem, said switch comprising a rotor carried by said winding stem for rotary movement therewith, an axially extending conductor bar carried by said rotor, a hollow housing mounted on said rotor for relative rotary movement about the rotational axis thereof, a pair of relatively axially spaced axially aligned contacts carried internally of said housing for simultaneous engagement and disengagement with said bar, a stop pin interchangeably positionable in said housing to engage the said bar and arrest the rotary movement of said rotor within said housing, and a stop pin when said contacts are in engagement with said bar, or when said contacts are out of engagement with said bar, said stop pin in either position projecting radially externally of said housing into rotary abutment with said stop element and thereby preventing rotary movement of said housing with said rotor during unwinding of said stem.

9. A time controlled switch for an alarm clock having a rotary winding stem which is released and unwound during actuation of the alarm, a stop element being carried by said clock adjacent said stem, said switch comprising a rotor carried by said stem for rotary movement therewith, an axially extending conductor bar carried by said rotor, a hollow housing carried by said rotor for relative rotary movement about the rotational axis thereof, a pair of relatively axially spaced axially aligned contacts carried internally of said housing for simultaneous engagement and disengagement with said bar, stop means projecting radially from said rotor, and a stop pin positioned in said housing to engage the said stop means and arrest the rotary movement of said rotor within the said housing when said contacts are in engagement with said bar, and external stop means carried by said housing for engagement with said stop element to prevent rotary movement of said housing with said rotor during actuation of the alarm.

10. The combination defined in claim 9, wherein the said stop pin is positioned in the housing to engage the said stop means and arrest the rotary movement of the rotor within said housing when said contacts are out of engagement with said bar and the switch is thus in open position.

11. The combination with a rotary shaft of a switch actuated by the rotary movement thereof, said switch comprising a rotor carried by said shaft for rotary movement therewith, and an axially extending conductor bar carried by said rotor, a hollow housing carried by said rotor for rotary movement thereon, a pair of relatively axially spaced axially aligned contacts carried internally of said housing for simultaneous cooperation with said bar, stop means projecting radially from said rotor, and a stop pin positioned in said housing to engage the said stop means and arrest the rotary movement of said rotor relative to said housing in the closed position of said switch, said housing having an external stop thereon, and a cooperating stop element being supported adjacent said housing for engagement by said external stop to limit the rotary movement of said housing.

12. The combination defined in claim 11, wherein the stop pin is positioned in said housing to engage the stop means and arrest the rotary movement of said rotor when the switch is in open position with the contacts disengaged from said conductor bar.

13. A timing switch comprising a rotor adapted for mounting on the alarm winding stem of a clock for rotary movement therewith, a pair of diametrically opposed axially extending conductor bars carried by said rotor, a hollow cylindrical housing coaxially mounted on said rotor for ro-
tary movement relative thereto, two relatively axially aligned axially spaced pairs of diametrically opposed contacts carried internally of said housing for simultaneous engagement and disengagement with said conductor bars, and a stop pin positionable in said housing to engage said conductor bar and arrest the relative rotary movement between said rotor and housing when the conductor bars are in engagement with said contacts to close said switch, said stop pin being alternatively positionable in said housing to engage said conductor bar and arrest the relative movement of said rotor when the conductor bars are disengaged from said contacts with the switch in open position, said pin in either said position projecting radially from said housing for rotary abutment with a stationary stop element.

14. A timing switch comprising a rotor adapted for mounting on the alarm winding stem of a clock for rotary movement therewith, a pair of diametrically opposed axially extending conductor bars carried by said rotor, a hollow housing mounted on said rotor for rotary movement relative thereto, two relatively axially aligned axially spaced pairs of contacts carried internally of said housing for simultaneous engagement and disengagement with said bars, a stop carried by said rotor and an internally projecting stop pin carried by said housing for abutment with said stop to arrest the relative rotary movement between said rotor and housing when said contacts engage said conductor bars, said pin projecting radially externally of the housing.

15. A timing switch as defined in claim 14 wherein the stop pin is carried by the housing in a position to abut against said stop and arrest the relative movement of the rotor when the switch is in open position with the contacts disengaged from the said conductor bars.

16. A timing switch comprising a rotor adapted for mounting on a rotary shaft for rotation therewith, a hollow housing mounted on said rotor for rotation about the rotational axis thereof, a conductor bar carried by said rotor and extending parallel to the rotational axis thereof, and a pair of contacts carried by said housing interiorly thereof for simultaneous engagement and disengagement with said conductor bar, said contacts being relatively spaced apart and aligned in a direction parallel to the rotational axis of said rotor, and a stop projecting radially from said rotor, in combination with an internally projecting stop pin carried by said housing for abutment with said stop to arrest the rotary movement of said rotor within said housing when said contacts are engaged by the said conductor bar.

17. An electric switch as described in claim 16 wherein the stop pin is in a position to abut against said stop and arrest the movement of said rotor when said contacts are out of engagement with said conductor bar.

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