March 12, 1935. L. WELSER 1,993,949

AUTOMATIC ELECTRICAL TIMING DEVICE

Original Filed Nov. 13, 1931 2 Sheets-Sheet 1

Fig. 1.

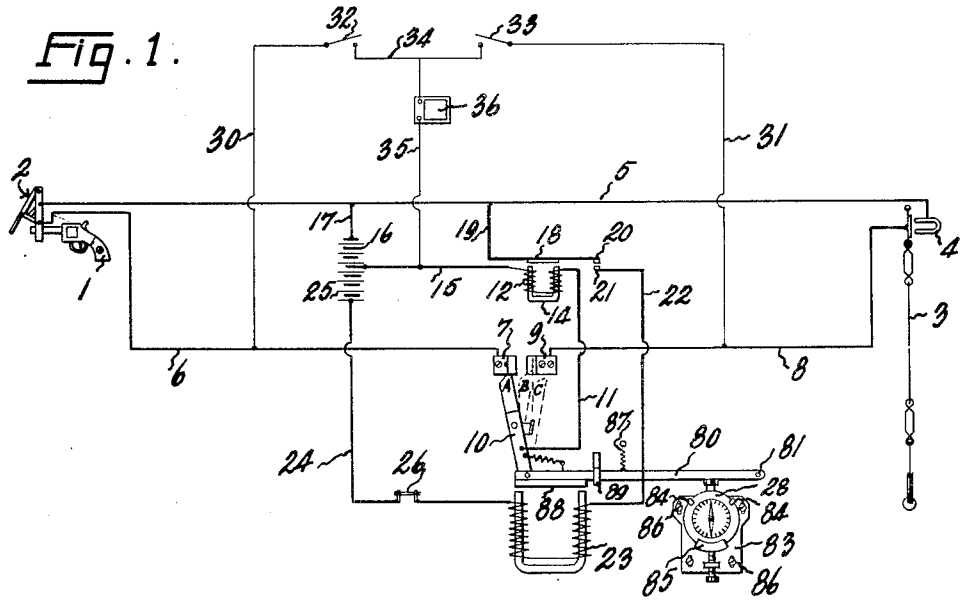


Fig. 2.

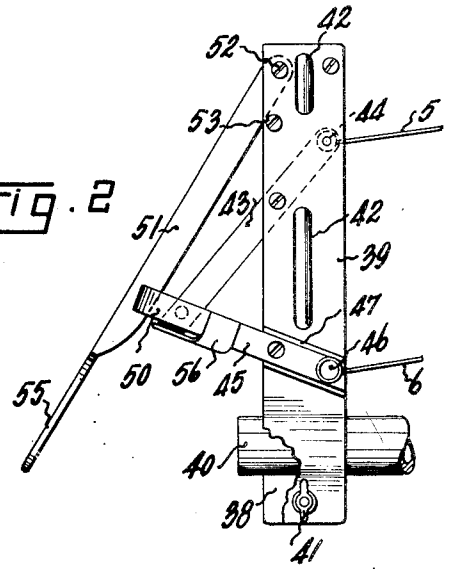
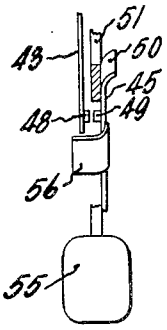


Fig. 3.



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Fig. 4.

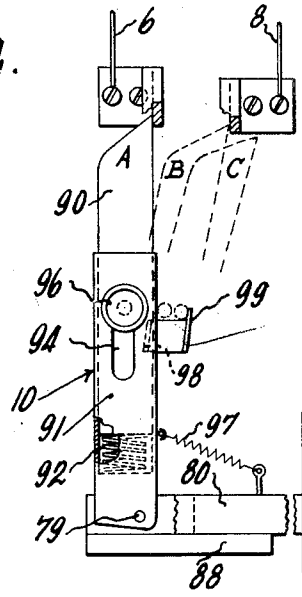


Fig. 5.

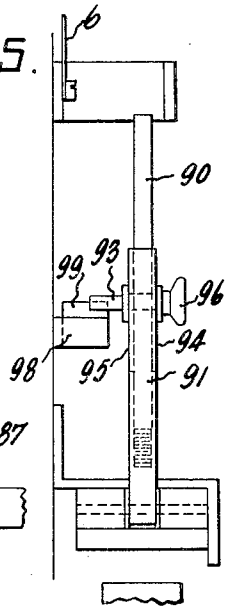


Fig. 6.

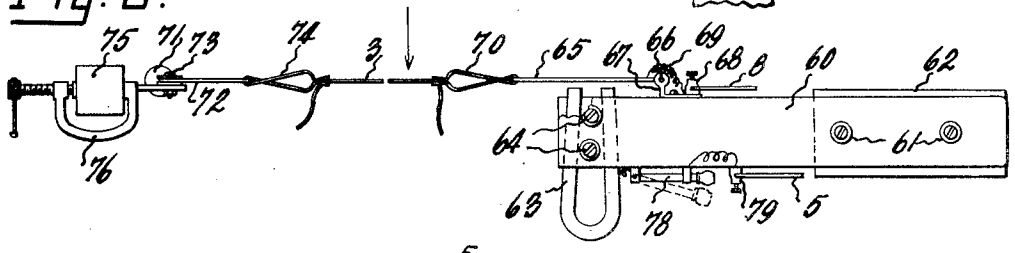
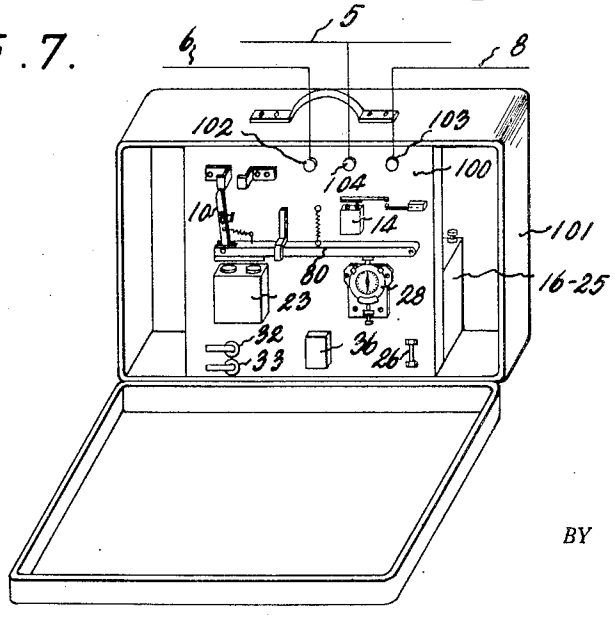


Fig. 7.



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UNITED STATES PATENT OFFICE

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AUTOMATIC ELECTRICAL TIMING DEVICE

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Application November 13, 1931, Serial No. 574,854
Renewed February 6, 1934

10 Claims. (Cl. 161—18)

My invention relates to automatic electrical timers and more particularly to a timer for use in races for determining the time taken by a contestant in covering a predetermined course.

Foot races, for example, are customarily started by the firing of a pistol and ended by the runner breasting a tape stretched across the finish line, the time consumed by the runner in covering the course being determined by means of a split second stop watch held in the hands of an official who starts the watch at the sight of the smoke from the pistol and stops it when he sees the runner breast the tape. It has long been recognized that this method of timing is subject to very substantial errors due to variation in the reaction time of the individual operating the watch, and various devices for automatically timing races have been proposed. As far as I am aware none of these devices previously proposed has been practically successful, because of inherent defects in the devices rendering their operation unreliable, or because of their bulk or their excessive cost.

It is the principal object of my invention to provide an automatic electrical timing device which shall be exceedingly accurate and at the same time compact, and which does not require elaborate special devices at the starting and finishing point of the race, being operable in connection with the usual starting pistol and finish tape. A further object is to provide a device of this character which can be manufactured at a cost sufficiently low to make it available for even small schools and athletic associations. Other and more specific objects of my invention will be apparent form the following specifications and claims.

In the accompanying drawings which illustrate one embodiment of my invention as applied to foot races:

Fig. 1 is a diagrammatic view of the apparatus;

Fig. 2 is a detail view of the actuating mechanism attached to the starting piston;

Fig. 3 is a detail view of the switch associated with the pistol, looking from the left of Fig. 3, parts being omitted;

Fig. 4 is a detail view of the switch associated with the watch actuating member;

Fig. 5 is a view of the structure shown in Fig. 4 as viewed from the left of said figure;

Fig. 6 is a detail view of the actuating switch associated with the finishing tape; and

Fig. 7 is a view showing the manner in which the timing apparatus may be housed in a small portable case.

The main circuit arrangement is shown in Fig. 1 and will first be described. The starting pistol shown at 1 is provided with a switch mechanism generally indicated by the reference character 2. Switch 2 is normally open but is adapted to be closed, as later described, by discharge of the pistol. The finish tape is shown at 3 and is provided with switch mechanism generally indicated at 4, which switch also is normally open but adapted to be closed, as later described, by the breasting of the tape by the runner. One terminal of switch 2 is connected by a lead 5 to a terminal of switch 4. The second terminal of switch 2 is connected by a lead 6 to a contact member 7 and the second terminal of switch 4 is connected by a lead 8 to a contact member 9 spaced from contact 7. A switch blade 10 is initially held in contact with member 7 as indicated at A and is connected by a lead 11 with the field coil 12 of a relay 14. The other terminal of coil 12 is connected by a lead 15 to one terminal of a battery 16, the other terminal of which is connected to lead 5 as at 17. The armature 18 of relay 14 is connected by a lead 19 to lead 5 and carries a contact point 20 adapted upon actuation of the relay to engage contact point 21 which is connected by a lead 22 to one terminal of a magnet coil 23. The other terminal of coil 23 is connected by lead 24 to the terminal of a battery 25 which is in series with battery 16. A fuse 26 is preferably placed in lead 24. Energizing of coil 23 operates, as later fully described, to start a stop watch 28 and simultaneously draw switch blade 10 from contact member 7 and into contact with member 9.

Considering the circuit so far described, it will be seen that prior to the discharge of the pistol the circuit of the relay coil is broken by the open gun switch 2 and that the circuit of coil 23 is broken by the open relay switch 20—21. Discharge of the pistol closes switch 2, thus energizing the relay causing switch 20—21 to close, thus energizing coil 23 to start the watch 28 and break the contact of blade 10 with member 7 and moving it into contact with member 9, as indicated by dotted line at B. It will be seen that movement of blade 10 from contact 7 breaks the circuit of relay 14 through the gun switch, thus reopening relay switch 20—21 and deenergizing coil 23.

The contact of blade 10 with member 9 places the field coil 12 of relay 14 in circuit with the open switch 4 associated with the tape 3. This circuit is traced from switch 4 through lead 8, contact 9, blade 10, lead 11, coil 12, lead 15, battery 16 and lead 5 back to the switch. It will

thus be seen that when switch 4 is closed, by the runner breasting the tape, relay 14 is again actuated, thus closing relay switch 20—21 and re-energizing magnet coil 23 to stop the watch 28, simultaneously moving blade 10 to position C out of contact with member 9, again opening the relay circuit, and consequently opening switch 20—21 to deenergize coil 23.

While not essential to the operation of the device, I prefer to provide a test circuit which is shown in Fig. 1 in light lines to better distinguish it from the main circuit. This test circuit comprises leads 30 and 31 connected respectively to leads 6 and 7 and respective switches 32 and 33. The other poles of switches 32 and 33 are connected together by a lead 34. Lead 34 is also connected to lead 15 by a lead 35 in which is placed a buzzer or other signal 36. It will be obvious that if switch 2 is properly open, closing of switch 32 will produce no sound from the buzzer but that if switch 2 is closed, closing switch 32 will cause the buzzer to sound. Similarly closing switch 33 will cause the buzzer to sound if switch 4 is closed, but not if the latter is open.

Referring to Figs. 2 and 3, the switch 2 is shown as comprising a support formed of two strips of metal 38 and 39 suitably bolted or otherwise secured together and having their ends shaped to embrace the end of the barrel 40 of the starting pistol, a wing nut 41 being provided to clamp the support to the barrel. Ribs as shown at 42 may be struck in the strips 38 and 39 to increase its stiffness. A spring contact member 43 is secured to the rear face of strip 38 and is provided with a binding post 44 to which lead 5 is attached. A second spring contact member 45 is secured to the outer face of strip 39 and is provided with a binding post 46 to which lead 6 is attached. Member 45 and its binding post are insulated from strips 38 and 39, as indicated at 47. Members 43 and 45 carry contact points 48 and 49 respectively, which are normally held in contact by the spring of the members. Member 45 is extended beyond the contact points as at 50 and the portion 50 is adapted to be engaged by a lever 51, pivoted intermediate the strips 38 and 39 as at 52, and thereby holding point 59 out of contact with point 48 as best shown in Fig. 4. The edge of portion 50 is curved outwardly to facilitate engagement with the lever 51. Bolt 53 limits the downward movement of lever 51. The free end of lever 51 is provided with a flat spade or plate 55, which, when the parts are in the position shown in Figs. 2 and 3, is in line and adjacent the mouth of the pistol barrel. Upon discharge of the pistol, lever 51 is driven outwardly, releasing member 45 and permitting points 48 and 49 to contact, thus closing the circuit, the circuit remaining closed until lever 51 is again swung into engagement with member 45.

The points 48 and 49 are preferably of platinum and to protect them from the corroding gases of the pistol discharge, a curved guard plate 56 is secured to member 45 with its free end positioned beneath the contact point.

As best shown in Fig. 6, switch 4 is carried by a wooden bar 60 adapted to be secured by any suitable means, such as screws 61, to the top of a post 62 of a height to maintain the tape 3 at standard elevation. The free end of bar 60 is forked to receive a permanent magnet 63 which is held in adjusted position in the fork as by bolts 64. A soft iron armature 65 is pivoted at 66 to a bracket 67 secured to bar 60 and provided with a binding post 68 for connection to lead 8 of the main circuit. A pigtail 69 is preferably provided to directly connect the armature 65 to bracket 67. The free end of armature 65 is provided with a spring clip 70 which grips one end of tape 3 with sufficient strength so that the armature 65 is held spaced from magnet 63 by a weight 71 secured to a cord 72 which passes over a pulley 73 and is secured to the opposite end of the tape by a clip 74 similar to clip 70. Pulley 73 is secured at proper height to a post 75 by a suitable clamp 76. It will be understood that magnet 63 is adjusted so that armature 65 is held just clear of the magnet by the tautness of the tape and that when the tape is breasted by the runner coming in the direction of the arrow in Fig. 6, the armature 65 will contact with the magnet 63. Magnet 63 is connected, preferably through a switch 78, to a binding post 79 to which lead 5 of the main circuit is connected. Switch 78 is opened while the tape is being placed in position and is then closed.

Referring to Figs. 1, 4 and 5, blade 10 of the watch operating switch is pivoted at 79 to the watch operating bar 80, which is preferably constructed of some light material, such as aluminum or wood. The bar 80 is pivoted as at 81 to an instrument board 100 (Fig. 7) or other suitable support, and rests on the operating stem of a split second stop watch 28, adjustably held in any suitable clamping means such as a plate 83 provided with fixed clamping members 84 and a movable clamping member 85. Plate 83 is held to its support by screw and slot connections 86 by which it may be adjusted as a unit with respect to bar 80. Bar 80 is held in raised position by the spring in the stem of the watch and a spring 87. The free end of bar 80 is provided with an armature 88 positioned over the poles of magnet 23. A guide 89 is preferably provided for maintaining the movement of bar 80 in a vertical plane. Blade 10 is preferably formed in two parts, comprising a contact blade 90, preferably made of aluminum, which telescopes within the casing 91, a spring 92 positioned between the bottom of the casing and blade 90 acting to normally hold the latter in extended position. A transverse pin 93 carried by blade 90 and extending through slots 94 and 95 on opposite sides of the casing, limits the outward movement of the blade with respect to the casing. The outer end of pin 93 is provided with a knob 96 for ease in manipulating the blade. A spring 97 strained between casing 91 and bar 80 tends to swing blade 10 in a clockwise direction around its pivot 79. With the parts in initial position, as shown in Figs. 1 and 4, contact blade 90 is held against contact member 7 by spring 97.

When magnet 23 is first energized by the discharge of the pistol, as previously described, armature 88 and bar 80 are drawn down, starting the watch and simultaneously drawing blade 90 from contact with member 7 which instantly breaks the circuit, deenergizing magnet 32 and permitting bar 80 to rise under the influence of the spring 87 and the spring in the watch stem. Blade 90, however, has been swung out of line with contact 7 under the influence of spring 97 and its clockwise movement has been arrested midway between members 7 and 9 by contact of pin 93 with a check member 98. Check member 98 is so dimensioned that in the upward movement of the blade, pin 93 remains in contact with the check until it has risen to a height to engage contact 9 when it clears the top of the check, and the blade

then snaps into engagement with contact 9 under the influence of spring 97. With blade 90 in contact with member 9, the magnet 32 is now in circuit with the open finish switch 4 and, as previously described, when the latter switch is closed by a runner breasting the tape, magnet 32 is again energized to draw bar 80 downward a second time thus again depressing the watch stem and stopping the watch, which indicates the runner's time over the course. On this second downward movement of bar 80, blade 90 is drawn downward out of contact with member 9 thus again breaking the circuit of magnet 32. In its downward movement, pin 93 passes to the right of check 98 and is moved by spring 97 in a clockwise direction out of line with member 9 and against a second stop 99 with which it remains in contact as it again rises, as shown in dotted lines at C.

The device is re-set for another operation by opening and resetting switches 2 and 4 and returning blade 10 to its initial contact with member 7, which latter is accomplished by grasping knob 96 and pressing blade 90 into casing 91, thus moving pin 93 below check 98 so that the blade may be swung counterclockwise to its initial position.

The various parts of the timing mechanism proper may be mounted on any suitable support. As shown in Fig. 7, the parts are shown assembled on a panel 100 of wood, rubber or the like, mounted in a carrying case 101, the batteries 16—25 being housed behind the panel. Binding posts 102 and 103 are provided on the panel for connection to leads 6 and 8, respectively, with a binding post 104 to which lead 5 is connected.

As will be obvious, the device is compact and easily portable, and can be manufactured at a relatively low cost. In practice the device has proved of remarkable accuracy and uniformity and I have found that the relay 19 substantially reduces the amount of current required for a reliable and uniform operation of the parts. The reactance time is the same for both start and finish,—that is, the time between the discharge of the gun and the starting of the watch and the time between the closing of the tape switch and the stopping of the watch is the same since the same operation of relay 19, magnet 23, bar 80 and member 90 occurs at both the start and stop. One therefore exactly cancels the other.

While I have described my timer with particular reference to the timing of foot races, it will be obvious that it may be applied to swimming or other races by substituting appropriate means for the tape. Although in the illustration described the timer is shown in portable form, and portability is one of the advantages of my arrangement, it will be understood that it may, if desired, be installed as a permanent adjunct of the race course.

What I claim is:

1. A timing device comprising a stop watch, an actuator for said watch, an electro-magnet for moving said actuator, an electric circuit for energizing the magnet including a relay, a normally open starting switch, a normally open finish switch, and a two-way switch controlled by said actuator for initially placing the relay in circuit with the starting switch and operative upon movement of the actuator in response to the closing of the starting switch to place the relay in circuit with the finish switch.

2. A timing device comprising a stop watch, means for actuating said watch, an electro-magnet for actuating said means, an electric relay for energizing said magnet, a normally open starting switch adapted to be closed by operation of a starting signal, a normally open finish switch adapted to be closed by a contestant reaching the finish line, a two-way switch member operably connected to said means and initially positioned to place said starting switch and relay in circuit whereby closing of the starting switch will actuate said means to start the watch and simultaneously move said two-way switch to place said relay in circuit with the finish switch and open the relay circuit through the starting switch whereby said means will again be actuated to stop the watch upon closure of the finish switch.

3. A timing device comprising a stop watch, a pivoted lever positioned across the stem of the watch, an electro-magnet for moving the lever into operative contact with the watch stem, an electric relay for energizing the magnet, a normally open starting switch adapted to be closed by operation of a starting signal, a normally open finish switch adapted to be closed by a contestant reaching the finish line, a two-way switch member pivoted to the free end of the lever and initially positioned to place the starting switch and relay in circuit whereby closing of the starting switch will energize the magnet to draw the lever into actuating contact with the watch stem to start the watch and simultaneously move the two way switch to place the relay in cricuit with the finish switch and open the relay circuit through the starting switch, whereby the magnet will again be energized to stop the watch upon closure of the finish switch.

4. A timing device comprising a stop watch, an actuator for said watch, an electro-magnet for moving said actuator, an electric circuit for energizing the magnet including a relay, a starting switch adapted to be secured to the barrel of a pistol, a lever normally holding said switch open but adapted to be moved to switch closing position by the gases issuing from the pistol, a finish switch the members of which comprise a permanent magnet and an armature, said armature being normally held out of contact with the magnet by the tautness of a weighted finish tape but adapted to be moved into contact with the magnet to close the switch by a runner breasting the tape, a two-way switch controlled by said actuator for initially placing the relay in circuit with the starting switch and operative upon movement of the actuator in response to the closing of the starting switch to place the relay in circuit with the finish switch whereby the actuator is again moved upon closure of the finish switch.

5. A timing device comprising a stop watch, a pivoted lever positioned across the stem of the watch, an electro-magnet for moving the lever into operative contact with the watch stem, an electric relay for energizing the magnet, a starting switch adapted to be secured to the barrel of a pistol, a lever normally holding said switch open but adapted to be moved to switch closing position by the gases issuing from the pistol, a finish switch the members of which comprise a permanent magnet and an armature, said armature being normally held out of contact with the magnet by the tautness of a weighted finish tape but adapted to be moved into contact with the magnet to close the switch by a runner breasting the tape, a two-way switch member pivoted to the free end of the watch actuating lever and initially positioned to place the starting switch and relay in circuit whereby closing of the start-

ing switch will energize the magnet to draw the lever into actuating contact with the watch stem to start the watch and simultaneously move the two-way switch member to place the relay in circuit with the finish switch and open the relay circuit through the starting switch, whereby the magnet will again be energized to stop the watch upon closure of the finish switch.

6. A timing device comprising a stop watch, an actuator for said watch, an electro-magnet for moving said actuator, an electric circuit for energizing the magnet including a relay, a normally open starting switch adapted to be closed, and remain closed, by operation of a starting signal, a normally open finish switch adapted to be closed, and remain closed, by a contestant reaching the finish line, a switch mechanism controlled by said actuator for initially placing the relay in circuit with the starting switch and operative upon movement of the actuator in response to the closing of the starting switch to open the relay circuit through the starting switch and to place the relay in circuit with the finish switch, said switch mechanism being then operative upon movement of the actuator in response to the closing of the finish switch to open the relay circuit through the finish switch.

7. A timing device comprising a stop watch, an actuator to start and stop said watch, an electric circuit, including a relay, to control said actuator, a starting switch adapted to be closed by the operation of a starting signal to effect watch starting movement of the actuator, a finish switch adapted to be closed by a contestant reaching the finish line to effect watch stopping movement of the actuator, a movable switch member, a contact member to initially place the relay in exclusive circuit with the starting switch through the switch member, a second contact member to place the relay in exclusive circuit with the finish switch through the switch member, means connecting the actuator and the switch member to successively move the latter out of contact with said contact members upon successive watch operating movement of the actuator, and spring means to move the switch member into contact with said second contact member when the switch member is freed from the first contact member by the watch starting movement of the actuator and to move the switch member to a neutral position when the switch member is freed from the second contact member by the succeeding watch stopping movement of the actuator.

8. A timing device comprising a stop watch, an actuator for said watch, an electric circuit including a relay for controlling the actuator, a starting switch, a finish switch, a two-way switch for initially placing the relay in circuit with the starting switch and means automatically operative upon operation of the actuator in response to the actuation of the starting switch to actuate the two-way switch to place the relay in circuit with the finish switch.

9. A timing device comprising a stop watch, an actuator for said watch, an electric circuit including a relay for controlling the actuator, a two-way switch in the relay circuit, a starting switch and circuit connections whereby in the initial position of the two-way switch said starting switch is included in the relay circuit to control the relay, a finish switch and other circuit connections whereby in the second position of the two-way switch said finish switch is included in the relay circuit to control the relay and means automatically operative upon operation of the actuator in response to the operation of the starting switch to actuate the two-way switch to place the relay in circuit with the finish switch.

10. A timing device comprising a stop watch, an actuator for said watch, an electric circuit controlling said actuator and including a relay, a starting switch and a finish switch, a two-way switch and connections whereby the starting switch is initially placed in the relay operating circuit, and means automatically operable upon operation of the watch actuator to operate the two-way switch to place the finish switch in the relay operating circuit.

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