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TIME SWITCH WITH MULTIPLE MANUAL AND AUTOMATIC CONTROLS

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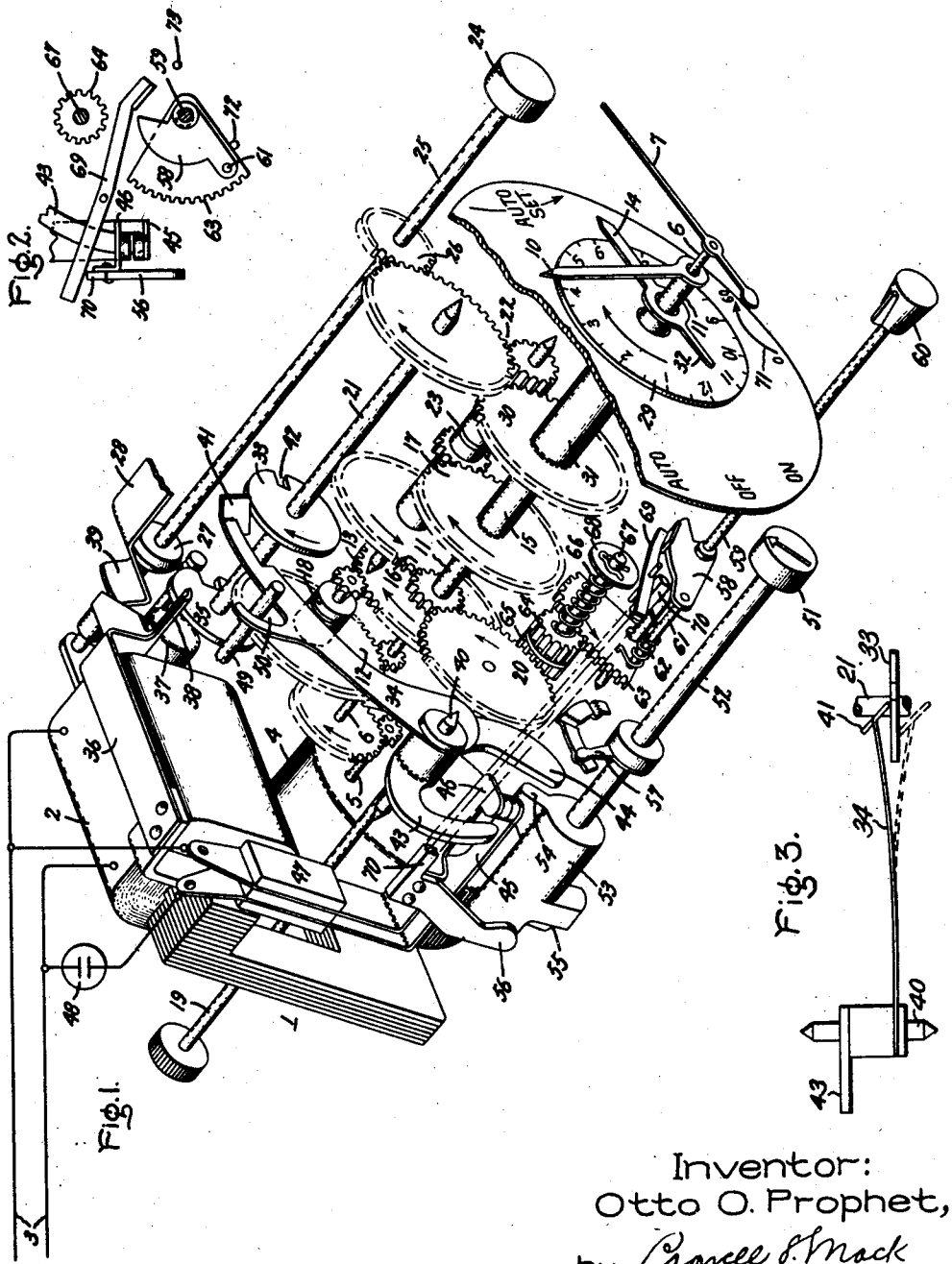


Fig. 1.

Fig. 2.

Fig. 3.

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TIME SWITCH WITH MULTIPLE MANUAL AND AUTOMATIC CONTROLS

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My invention relates to time switches and one of its objects is to provide a manual on, automatic off switching mechanism, wherein the on time is adjustable when the switch is initially closed and at any time during the on period, the on switching operation and time adjusting operation being performed by a single control button. A further object of my invention is to combine the abovementioned features with a manual or automatic on, manual off time switch mechanism, and wherein all of the various switching operations are performed on the same switch contacts at different selected times without interference. My invention is particularly useful where the switching mechanism is employed to control a radio receiving set in that the radio may be turned on automatically at any predetermined time, to be turned off manually when desired; it may be turned on manually, to be left on until turned off manually; or it may be turned on manually, to be turned off automatically at an adjustable time thereafter, or manually before it would otherwise be turned off automatically should that become desirable.

The features of my invention which are believed to be novel and patentable will be pointed out in the claims appended hereto. For a better understanding of my invention, reference is made in the following description to the accompanying drawing in which Fig. 1 represents a perspective view of an electrically driven clock and time switch in which my invention has been incorporated, Fig. 2 represents certain details of the manual on, automatic off operating and time adjusting mechanism included in Fig. 1, and Fig. 3 indicates the manner in which an automatic switch operating cam follower is flexed sidewise by its cam and prevents automatic lifting of the cam lever and blocking of the cam.

Referring now to the drawing, there is illustrated an electrically driven alarm and switch operating clock in many respects similar to that described in United States Patent No. 2,421,986—June 10, 1947, to Bohman, assigned to the same assignee as the present invention. At 1 there is a self-starting synchronous electric motor for driving the clock and associated parts at a constant speed. The coil 2 of the motor is supplied from a regulated frequency source of supply 3. At 4 is a gear casing in which gearing is provided to reduce the motor speed and from which the driving shaft 5 extends. Shaft 5 is geared to second hand shaft 6 to drive the latter at one revolution per minute in a clockwise direction. A second hand 7 is attached to the forward end

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of such shaft to indicate on the usual clock dial. A minute hand 10 on minute hand shaft 11 is driven from shaft 6 through reducing speed gears at 12 and 13 to rotate in a clockwise direction at one revolution per hour. An hour hand 14 on hour hand shaft 15 is driven from minute hand shaft 11 through reduction gears at 16 and 17 to rotate in a clockwise direction at one revolution in twelve hours. At 18 is a friction clutch in the minute hand gear train to permit the minute and hour hands to be set, this being accomplished by manually turning the shaft 19 from the rear of the clock, such shaft being geared to the minute hand shaft 11 through a gear at 20, which gear rotates continuously when the clock is in operation and is utilized for the additional purpose of operating the automatic off switch controlling mechanism as will be described. At 21 is an alarm cam shaft driven at one revolution in twelve hours in a clockwise direction through the gearing at 16 and 22. This drive includes a friction clutch at 23 to enable the alarm cam shaft 21 to be set with respect to clock time, such setting being accomplished by turning a button 24 on a shaft 25 when the latter is geared to shaft 21 through gear 26. The shaft 25 has another function because it may be pushed to the rear from the position shown to demesh gear 26 and shut off the audible alarm through the cone 27 on shaft 25 cooperating with a shut-off lever 28.

For the purpose of coordinating the time setting of the alarm shaft 21 with respect to clock time, the alarm shaft is geared to a graduated and rotatable alarm time dial 29 through gear 30 and a hollow shaft 31. The alarm time dial is at the center and concentric with the clock dial, and rotates at the same speed and in the same direction as the hour hand. An indicator 32 extending diametrically opposite to and from the hour hand indicates on dial 29 the time for which the alarm is set.

The alarm cam shaft has two cams thereon, cam 33 for operating the switch lever 34, and cam 35 cooperating with the audible alarm vibrator lever 36. The audible alarm vibrator lever 36 is of resilient magnetic material, is secured at its left end to the magnetic core of the motor near the left end of coil 2 and extends to the vicinity of the magnetic core of the motor near the right end of the coil, and hence, is in shunting relation to a portion of the motor flux, and its right end will vibrate toward and away from the motor core material in synchronous relation with the alternating flux of the motor, if free to

do so, and will strike against a part 37 and produce an audible alarm. The lever 36 may be raised so as to prevent such audible alarm operation by the raised part of alarm cam 35 when such part is opposite the cam follower extension 38 of such lever as represented in Fig. 1, and may be released automatically to sound the alarm when the part 38 drops into the depression in cam 35 at a preset time. Also the audible alarm may be prevented from operating by pushing in on button 24 and thus moving shaft 25 and cone 27 to the rear from the position shown. When so moved, the cone 27 moves under a V-shaped depression 39 in lever 28 and raises the rear end of such lever, and the extremity of V-part 39 engages the underside of the right end of vibrator lever 36 and raises it, if it is otherwise free to vibrate, and thus prevents its audible vibration or stops such vibration, if vibrating.

The switch operating cam 33 on shaft 21 serves to allow switch operating lever 34 to rotate clockwise about its pivot point at 40 when its cam follower end 41 drops into the depression 42 in cam 33. Lever 34 has two branches 43 and 44 to the left of its pivot. The upper branch 43 serves to press down or release a resilient switch contact member 45 to open or close such contact against a cooperating resilient contract member 46. These contact members are secured by an insulating support at 47, are normally biased to a closed position and serve, when closed, to energize any appliance or circuit which may be plugged into the socket represented at 48. In the illustration the source of supply for this circuit constitutes the same source 3 as is used to energize the motor 1. In the condition of the parts as illustrated, lever 34 is raised by its cam 33, and branch 43 of such lever is pressing down on contactor 45 and holding it away from the normal position of contact 46 so that if contact 46 were in its normal position, the switch would be open. When the depression 42 in cam 33 rotates in line with cam follower part 41, the lever 34 will rotate clockwise sufficiently to allow contact 45 to close against contact 46 when the latter is in a normal position.

The depression 42 in cam 33 has nearly radially straight sides so it will not raise the lever 34 as it rotates past the operating point. Hence, this mechanism will serve to close the switch automatically at the time determined by the setting of the alarm cam shaft, but it will not thereafter open the switch automatically. However, to allow the cam 33 to continue rotating, the cam follower part 41 is set at an inclined angle to the plane of the cam so that it will be pushed out of depression 42 sidewise as the cam rotates as represented in Fig. 3, and the lever 34 will remain in its lowered position with the switch closed so far as the parts thus far described are concerned. The lever 34 is made sufficiently resilient in the direction of such sidewise movement as to permit the action described without difficulty or undue load on the clock. The pin at 49 which extends into a forked opening at 50 in lever 34 is to confine the oscillations of the lever to desired limits.

A manual operating button 51, its shaft 52, and its operating part of insulating material 53 also cooperates with the switch described. The shaft 52 has three rotary positions indicated by an arrow on button 51 and markings on the clock face as follows: "Auto" meaning that the switch is subject to the automatic on operation described; "Off" meaning that the switch is off or open and will not be closed by the automatic on operation described; and "On" meaning that the switch is closed or on and will remain in this condition until opened manually.

The shaft 52 is illustrated as being in the "Auto" position. If turned clockwise to "Off," a finger part 54 of part 53 will move against the lower branch 44 of the lever 34 and cause the lever to rotate counterclockwise to a position where cam follower part 41 will be raised above the high surface of cam 33 and will, therefore, return sidewise to an operating position with respect to the cam if not already in such position. Also branch 43 of the lever will be lowered, moving contact 45 downward so that the switch is normally open and it will not be closed in response to the previously described automatic closing action so long as button 51 remains at the "Off" position. When shaft 52 is turned further in a clockwise direction to the "On" position, a wedging cam surface at 55 on part 53 engages against a finger 56 secured to the upper resilient contact member 46 and moves the lower end of finger 56 toward the rear and the contact end of member 46 well downward into contact with contact member 45, even though the latter is depressed by arm 43. In this last operation finger 54 does not further rotate lever 34 through arm 44. This closes the switch and it will remain closed so long as the shaft 52 remains in the "On" position. An indexing device at 57 serves to retain the shaft 52 in any of the three positions to which it may be moved manually until forcibly turned to another of such positions. The two-contact switch here described is a simplification over the three-contact switch described in the Bohman patent above referred to.

Additional means are provided in accordance with my invention, operating on the same switch contacts 45—46 and utilizing the same timing motor manually to close the switch, when open, for an adjustable time period and permit the switch to open automatically at the end of such period without interfering with any of the previously described time or control settings, or any of the previously described operations except to the extent that the operation of such additional means temporarily takes over control of the switch.

Such additional means includes a cam 58 on a shaft 59 having a manual setting button 60 for turning the same. The cam 58 may be connected to the time train of the clock through a gear sector 63 on stud 61 extending from the cam, a pinion 64, and a pinion 65 coaxial with pinion 64 and connected thereto through a slip friction clutch. Pinion 65 is meshed with the gear 20 which is geared to the clock train and runs continuously. The necessary friction for clutch purposes between pinions 64 and 65 is supplied by a compression spring 66 on the shaft 67, on which pinion 64 may rotate and on which pinion 65 is fixed. Thus, the pinion 64 and spring 66 are mounted on shaft 67 between pinion 65 and a collar 68 with the spring under compression. Preferably, a thin metal washer is interposed between the pinions 64 and 65. Shaft 59 passes through the center axis of gear sector 63 somewhat loosely and a spring 62 coiled about stud 61 with one end secured to sector 63 and the other end engaging shaft 59 serves to hold the gear sector in firm meshing engagement with pinion 64 when these parts are intermeshed.

The cam 58 also has operating relation with the upper switch contact member 46, through a lever 69 pivoted between its ends and having one

end acting as a cam follower with cam 58, and the other end in contacting engagement with the upper side of an extension 70 of the finger 56, indicated by dotted lines in Fig. 1 and broken away to expose other parts. It is to be understood that the drawing shows a perspective and somewhat exploded and distorted view of the actual device for the purposes of clearer illustration. The shaft 59 extends through to the front of the clock at about the six o'clock position of the clock dial, and the operating button 60 therefor has an index indicating on a time scale at 71 consisting of an arc shaped arrow extending between values of 0 and 60, with the arrow pointing toward 60. In the example given, 60 refers to 60 minutes, and the mechanism now being described permits the switch to be closed manually to remain closed any desired length of time up to 60 minutes and then to open automatically.

The mechanism operates as follows: When not in use, the index on knob 60 will be pointing somewhere to the left of 0 on scale 71, and the gear sector 63 will be demeshed from pinion 64 and to the left thereof about as represented in Fig. 2, with the sector or cam resting against a limiting stop 72. Assume that the user wishes to close the switch for a period of 30 minutes or, if closed, to assure that it will remain closed for 30 minutes. He turns button 60 to the right until its index is halfway between 0 and 60 on scale 71. This simultaneously rotates gear sector 63 into mesh with pinion 64 and cam 58 into contact with lever 69 operating the lever which presses down on extension 70 and moves contact 46 downward to the fully closed position, if it is not already in such position. During such setting rotation of gear sector in mesh with pinion 64, the friction clutch between pinions 64 and 65 slips. After such setting the parts will be about as represented in Fig. 1. Now, as the clock advances, pinions 63 and 64 will both be driven by gear 20, and the direction of such drive is such as to rotate gear sector 63 to the left or counterclockwise at a rate which will require 30 minutes for its disengagement, at which time it drops to the position represented in Fig. 2, and the closing pressure of lever 69 on switch contact 46 is released and if not held closed by some other control, the switch will open. During the timing control operation afforded by gear sector 63, the time may be extended or reduced or eliminated entirely by the turning of button 60 in the proper direction. Any such adjustment simply slips the friction clutch between pinions 64 and 65 and extends or reduces the time setting accordingly.

A stop 73 is provided to prevent rotating gear sector 63 out of mesh beyond the maximum setting provided therefor. The stops 72 and 73 permit gear sector 63 to be rotated into mesh with gear 64 only from one side and in a direction opposite to that in which the gear sector will be driven by the clock.

Ordinarily, there will be no occasion to use this automatic "Off" feature when the switch is manually closed by the button 51, although in case the switch is closed by the use of button 51 in the "On" position when it becomes desirable to open the switch automatically at some subsequent time, button 60 may be set for such time and then button 51 turned to "Off." As thus used, the switch will remain closed until opened automatically at the desired time.

It is apparent that the automatic off feature and its use cause no interference with the time setting of the alarm shaft 21 or with the operation of the switch operating lever 34. In case the switch is closed by the automatic off device 60 at a time when the automatic "On" operation occurs, the switch will remain on after the automatic off operation occurs until the button 51 is turned from "Auto" to "Off." Ordinarily, the automatic off feature will be used when button 51 is in either the "Auto" or "Off" position with the switch open. It is particularly useful when used in combination with a radio receiving set. Suppose, for example, a person on retiring at night desires to listen to the radio for a short while but wants it to turn off in case he goes to sleep. He may set his alarm time to wake him in the morning by adjustment of knob 24 and set button 51 to "Auto." Then he may close the radio circuit by turning button 60 to the right for any desired period that suits his fancy, up to 60 minutes, and then forget about it. The radio will be turned off automatically at the selected time, although the user may have gone to sleep in the meantime. The automatic "On" alarm will function as intended in the morning without interference from the automatic off feature or its use. The parts which are added to permit the closure of the switch and the use of a radio or other appliance for a selected short period of time with automatic off control are relatively inexpensive and are designed so as to be added to the existing switch control mechanism without essential changes therein and without interfering with its other control features on the same switch contacts.

It is to be noted that in the combination described there is a single switch comprising first and second resilient contacts 45 and 46 normally biased to a closed position. There is an automatic switch closing means 34, 41, 42 operating on the first contact 45. There is a first manual means operated through button 51 which operates on both contacts for opening and closing the switch and also for conditioning the switch and automatic closing means for such automatic operation. There is an automatic switch opening means and a second manual means operated through button 60 and operating on the second contact 46 for closing the switch and conditioning the switch and automatic opening means for its automatic operation. The several controls are independent of and do not interfere with each other in their intended manner of operation, although since they all operate on the same switch, one control may anticipate or supersede another control. The time adjustments of the two automatic means are independent of each other and both may be conditioned for successive operations at different times.

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

1. In a time switch first and second resilient contacts forming a switch said contacts being normally biased to a closed position, the first contact being movable away from the second contact to an open switch position when the second contact remains in normal position, and the second contact being movable against the first contact to close the switch when the first contact is in said open switch position, a first manual means for independently moving both of said switch contacts as above described, a first automatic means for releasing said first contact when in its open switch position to allow it to move to normal position to close said switch if open, a second manual means for moving said second contact from normal position against the first contact when in said open switch position and a second automatic means for releasing said

second contact to allow it to return to normal position to open said switch when the first contact is in open switch position, the operations of said first and second manual means and the operations of said first and second automatic means being independent of each other, and means for independently adjusting the times for the operations of said two automatic means.

2. In a timing device a switch and means for manually closing said switch when open and maintaining it closed for a predetermined adjustable time and opening the same automatically at the end of such time, comprising a first gear continuously rotated by said timing device, a second gear connected in driving relation with said first gear through a slip friction clutch, a gear sector manually rotatable from a demeshed position and from one side only into and out of mesh with said second gear, a cam secured to said gear sector to rotate therewith, a cam follower lever cooperating with said cam and in operative relation with said switch such that when the gear sector is rotated into and out of mesh with said second gear the switch is closed and opened respectively by said cam and lever, the direction of rotation of said continuously rotating first gear being in such a direction as to rotate the gear sector out of mesh to open said switch, said clutch being adjusted to slip only

during the manual rotation of said second gear through said gear sector.

3. In a timing device a switch comprising first and second resilient movable contacts normally biased to closed position, a first automatic means operating on the first contact for closing the switch at a predetermined adjustable time, a first manual means operatable on both of said contacts for opening and closing the switch and conditioning said first automatic means and switch for automatic closing operation, a second automatic means operating on the second contact for automatically opening the switch at a predetermined adjustable time, and a second manual means operating on said second contact for simultaneously closing the switch, conditioning the second automatic means for automatic opening operation, and adjusting the time for such automatic switch opening operation.

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The following references are of record in the file of this patent:

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