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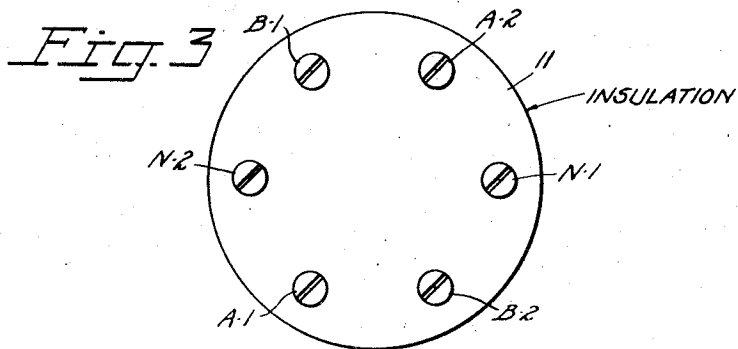
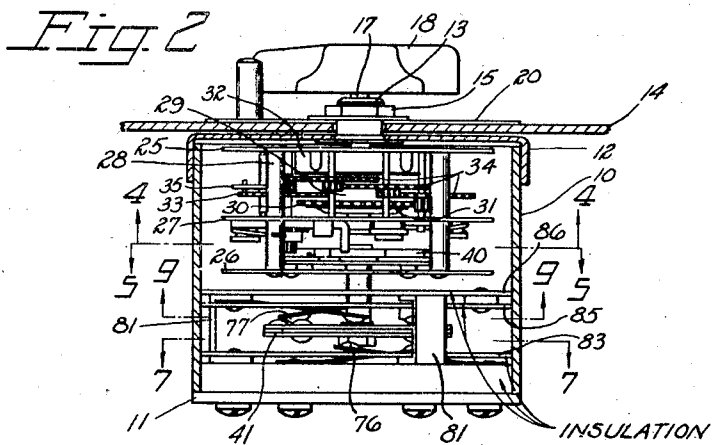
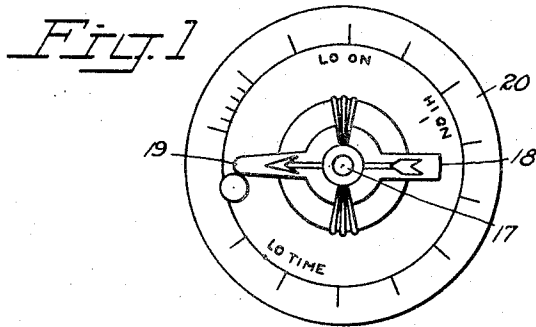
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2,434,471

ELECTRIC TIME SWITCH

Filed March 19, 1946

3 Sheets-Sheet 1



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3 Sheets-Sheet 3

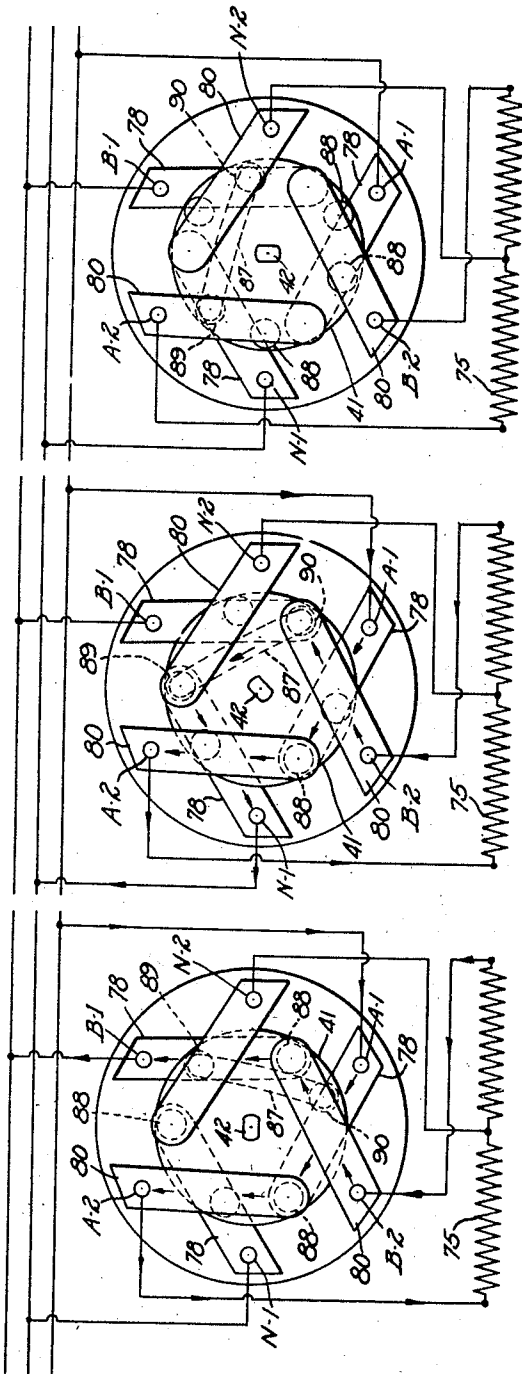


Fig. 15

Fig. 16

Fig. 17

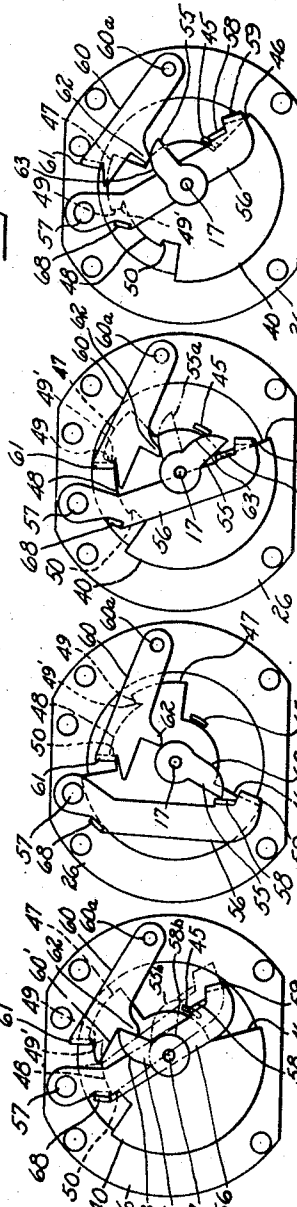


Fig. 11

Fig. 12

Fig. 13

Fig. 14

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UNITED STATES PATENT OFFICE

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ELECTRIC TIME SWITCH

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14 Claims. (Cl. 161—1)

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This invention relates to electric time switches for throwing the current off and for selectively establishing a plurality of circuits. As an instance of a use to which the device of the present invention may be applied, reference may be had to the control of a heating element or heating elements of an electric range, but it is understood that the device is not limited to that particular application.

It has been found desirable, in connection with a hot plate of an electric range, for example, to establish at least two circuits, one for low heat and one for high heat and to maintain a low heat condition indefinitely or for a predetermined selected time and also to maintain a high intensity of heat for a predetermined period of time so as to sear or preheat the food being cooked and then automatically to establish a low heat for an indefinite period of time.

An aim of the invention is to provide a simple and effective electric time switch which may be very easily and readily set and by means of which the above-mentioned conditions and operations may be effectively carried out.

A further aim of the invention is to provide an improved time switch having a single manually settable member through the operation of which the switch may be turned on and off and the two circuits may be established, the timing mechanism being so associated with the manually settable member as to control the automatic operations or functions of the device in the desired manner and sequence.

A further object of the invention is to provide an improved timing device comprising a controlled member having an inoperative position and two operative positions, a settable shaft for moving the controlled member to its several positions, and a timing device acting through the settable member, the arrangement being such that the controlled member may be maintained indefinitely or for a predetermined selected period of time in one position, and the member may be maintained in a second position for a predetermined selected period of time after which the member is automatically moved to the first position in which it is maintained.

A still further object of the invention is to provide an electric switch which is very simple in construction, which is compact, which may be economically made, and which is effective in operation.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the fea-

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tures of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

In the accompanying drawings wherein I have shown, for illustrative purposes, one embodiment which the present invention may take:

Figure 1 is a front view of my improved device;

Fig. 2 is a top view thereof with the casing broken away;

Fig. 3 is a rear view;

Fig. 4 is a perspective view taken generally on line 4—4 of Fig. 2 and shows certain of the elements through which the controlled member is operated and controlled;

Fig. 5 is a front view of the controlled member or latch plate, this view being taken substantially on line 5—5 of Fig. 2;

Fig. 6 is a transverse sectional view through the construction shown in Fig. 5, the same being taken on line 6—6 of that figure;

Fig. 7 is a view through the switch taken substantially on line 7—7 of Fig. 2 and shows in front view the rear fixed contacts of the switch;

Fig. 8 is a front elevational view of the rotary switch unit;

Fig. 9 is a sectional view through the switch taken substantially on line 9—9 of Fig. 2 and illustrates, in rear elevation, the front series of fixed contacts;

Fig. 10 is a transverse sectional view through the rotary switch unit, the same being taken substantially on line 10—10 of Fig. 8;

Fig. 11 shows the controlled member or latch plate and associated parts in the position which they have when the switch is off;

Fig. 12 is a similar view but showing the parts in the relation which they have when the device has been set to maintain the switch in "low" position for an indefinite period of time;

Fig. 13 is a similar view but showing the parts as having been moved to the position which they have at the completion of setting the device for automatic operation at high heat for a predetermined period of time after which the latch plate automatically assumes the "low heat" position shown in Fig. 12;

Fig. 14 is a similar view showing the parts in the position which they are given at the end of the operation of setting the device for low heat for a predetermined period of time; and

Figs. 15, 16 and 17 are diagrammatic views of the switch and a two-part heating element which it is adapted to control, the switch being respec-

tively shown in "off," "low," and "high" positions.

Referring to the drawings in detail, my improved device is shown as being housed within a casing which, for illustrative purposes, is disclosed as comprising a cylindrical shell 10, a base 11 of insulating material secured to the rear end of the shell, and a cap 12 connected to the forward end of the shell. The front closure or cap 12 has a central forwardly-extending externally-threaded sleeve 13 which may be employed for mounting the device on a panel 14. The sleeve extends through an opening in the panel and is secured in place therein by a nut 15. The shaft 17, which is employed to set the device and which is adapted to be driven by the timing mechanism as hereinafter described more in detail, extends through the sleeve 13 and is provided at its forward end with a handle or knob 18 provided with a pointer 19. The pointer cooperates with a dial 20 which may be clamped against the panel 14 by the nut 15.

Within the casing is a frame comprising a front plate 25, a rear plate 26 and an intermediate plate 27 maintained in spaced apart parallel relation by posts or pillars 28. The shaft or arbor 17 extends through and is journaled in plates 25 and 27. The timing or clock mechanism for driving and controlling the speed of the shaft is located between these plates. It includes a sleeve 29 journaled on the shaft 17; a main gear 30 fixed to the sleeve; a friction clutch member 31 between the gear 30 and the shaft; a driving or clock spring 32, one end of which is connected to the shaft 17 and the other end of which is connected to the front plate 25; and an escapement for controlling the speed at which the clock arbor is driven during a timing operation. The clutch member 31 is conveniently shown as being in the form of a resilient disk fixed to the arbor or shaft 17 and frictionally bearing against the rear face of the main gear 30. The escapement is shown as having the conventional escapement wheel 33 and a pallet wheel 35 having the usual pins cooperating with the escapement wheel. The escapement wheel 33 is connected to the main gear 30 by a gear train 34. With this arrangement it will be understood that when the handle 18 is manually turned in either direction, the clutch will slip, and when the handle is manually turned in a setting direction (clockwise with respect to Fig. 1), the spring will be wound up. The handle, having been set and released, the spring will tend to rotate the shaft counterclockwise. When the shaft is free to rotate, its speed of rotation counterclockwise is controlled by the escapement, it being understood that the clutch member 31 constitutes a driving connection between the shaft and the main gear at such times.

Rotatably carried by, but forwardly of, the rear plate 26, in axial alignment with the shaft 17, is a controlled member or latch plate 40 to which a rotary unit 41 of the switch is connected. This switch will be described more in detail later, it being understood, however, that a switch of any suitable type may be employed which is capable of being turned on and off and which is capable of selectively establishing two circuits. In the present illustrative disclosure, the latch plate is fixed to the forward end of a stem 42 journaled in the rear plate 26; and plate or disk 43 is fixed to the forward face of said plate, but spaced slightly therefrom. The rotary switch unit 41 is secured to the rear end of this stem. Between the plates 26 and 43 is a spiral spring 44, the outer end of which is secured to the plates, and

the inner end of which is connected to the stem, the spring being so arranged as to normally urge the latching plate counterclockwise towards its "off" position as shown in Figs. 5 and 11. Extending forwardly from the plate 43 is an abutment 45 against which a radial edge 46 on the latch plate is adapted to engage when the latch plate is in "off" position. The latch plate has a concentric land or edge 47 followed by a second land 48 of less diameter than land 47. Between the lands is a shoulder 49 which is slightly inclined with respect to a radius passing through the center of the latch plate and the outer edge of the shoulder, this for a purpose hereinafter described more in detail. At the inner edge of the shoulder 49 is a corner or edge 49'. At the rear end of the land 48 is a generally radially extending shoulder 50.

The latch plate 40 is selectively set to either of its operative positions by the shaft 17 through a driver 55 secured to the rear end of the shaft and a connector or lever 56 pivoted to the intermediate plate 27 by a pivot pin 57. The body portion of the lever is adapted to move in a plane between the driver 55 and the latch plate. It has, adjacent its free end, a rearwardly extending lug 58 projecting into the plane of movement of the driver so as to be engaged thereby when the shaft is turned in a direction to set the device to either of its operative positions. This lug is so positioned that the driver may ride past the same when the driver is turned from the position shown in Fig. 13 to that shown in Fig. 14 and in which latter position the latch plate and switch are maintained in "low" position for a predetermined selected period of time. As the driver 55 rotates counterclockwise toward "off" position, it cams the lug 58 to the 58b position (Fig. 14) corresponding to the 55b position of the driver and finally swings past the lug; and spring 65 (Fig. 4) returns the connector 56 to normal position shown in Fig. 11. The lever or connector 56 has at its outer end a forwardly extending ear 59 projecting into the plane of the latch plate and adapted to engage the radial edge 46 thereof when the shaft 17 is turned in a setting direction (clockwise with reference to Fig. 11 and counterclockwise with respect to Fig. 4).

The latch plate 40 is adapted to be held in either of its adjusted operative positions by a latch 60 pivoted at 60a to the intermediate plate 27 and having on its free end a rearwardly directed wing or holding lug 61 adapted to ride upon the lands 47 and 48 and engage behind the shoulders 49 and 50. The latch 60 is further provided between its ends with a projection 62 lying in the plane of and adapted to be engaged by the driver 55. The forward or leading edge of the driver is generally radially disposed and its rear or following edge 63 is curved so as to constitute a cam. The latch 60 is normally urged towards the driver by a spring 64 coiled about the pivot 60a of the latch and having its opposite ends respectively anchored to the latch and one of the posts 28. The connector 56 is normally urged to the position shown in Figs. 4 and 11 by a spring 65 secured to the intermediate plate 27 by a stud 66. This spring has two arms which straddle a fixed pin 67 and a lug 68 provided on the connector adjacent its pivot. The arms are crossed between the stud 66 and the pin 67. Therefore, when the driver 55 displaces the connector 56 either side of the position shown in Fig. 11, the spring 65 returns the connector to said position.

As previously stated, the switch may be of any

suitable sort having an "off" position, a position for establishing one circuit, such as a circuit of low heat intensity, and a third position for establishing another circuit, such as a circuit of high heat intensity. The switch shown in the drawings is of novel construction and will be described later more in detail. In Figs. 15, 16 and 17, the switch is shown, for illustrative purposes, as employed for controlling the current from a three-line supply system to a two-part heating unit 75 of a hot plate of an electric range or the like. In Fig. 15, the switch is in "off" position so no current flows through the heating unit. Fig. 16 shows the switch in its first operative position, that is, in "low" position, in which the two parts of the heating unit are connected in series across the neutral wire and one of the outside lines. Fig. 17 shows the switch in its second operative or "high" position in which the two parts of the element are connected in series across the outside lines.

The operation of the mechanism so far described is briefly as follows: The normal or "off" position of the mechanism is shown in Fig. 11 wherein the latch plate or controlled member 40 is urged by the spring 44 against the abutment 45, and the main spring 32 maintains the driver 55 in engagement with the projection 62 of the pivoted latch 60. When it is desired to manually set the mechanism to its first operative or "low" position, the knob is turned clockwise through substantially 90° so that the driver 55 is rotated from the position shown in Fig. 11 to that shown in Fig. 12, with the result that, due to the engagement of the driver against the lug 58 of the connector 56 and the engagement of the ear 59 against the radial edge 46 of the latch plate, the latch plate will be rotated to the position shown in Fig. 12. When the latch plate is so rotated, the holding lug 61 of the latch 60 will ride on the land 47 and then drop down onto the land 48 behind the shoulder 49. Upon release of the knob, the shaft and driver will be driven by the clock spring 32 counterclockwise under the control of the escapement mechanism until the driver 45 reaches the position 55a shown by broken lines in Fig. 12 and wherein the driver is in engagement with the projection 62 of the latch. Furthermore, the spring 44 will urge the latch member counterclockwise so that the lower corner or edge 49' of the shoulder 49 is pressed against the lug 61. The parts will now remain indefinitely in this position, that is, until the knob is manually turned counterclockwise to "off" position. It is observed that the spring 64 associated with the latch 60 presses the latch inwardly to its holding position shown in Fig. 12, and the edge 49' of the shoulder on the latch plate is pressed against the lug 61 by the spring 44, the line of pressure being perpendicular to the right face of lug 61. This line, which represents the force applied by the spring 44 through the latch plate 40 to the latch lever 60 tending to rotate the lever counterclockwise (Fig. 12) about its pivot, is located a substantial distance above the pivot. Therefore, spring 44 has relatively great effect in opposing the unlatching movement of the lever 60 through the force applied between the edge 49' and the lug 61. Furthermore, the surface 49 is so inclined that, clockwise movement of the lever 60 from the position shown in Fig. 12 requires clockwise movement of the latch plate 40 before the lower right-hand edge of lug 61 begins to ride on surface 49. Therefore, at the outset, the force of spring 44 is increased slightly. The force of spring 44 and the

force of spring 64 combine to maintain the latch member 60 in latching position against the action of the clock spring 32 which, through the driver 55, tends to disengage the latch. When the cooking operation is completed, the knob is manually turned counterclockwise to "off" position, with the result that the driver, due to its engagement with the projection 62, will move the latch outwardly, whereupon the parts will again assume the "off" positions shown in Fig. 11.

When it is desired that the switch operate for a predetermined selected period of time in "high" position, and then for an indefinite time in "low" position, the knob is turned clockwise to an extent depending upon the selected period of time during which it is desired that the switch remain in "high" position, the extent of rotation being more than 90° but being less than that at which the driver will pass beyond the lug 58 of the connector. Fig. 13 shows the parts in the position which they have when the operation of setting the device in "high" position is completed. The operation is similar to that described in setting the switch to "low" position, except that the latch plate is rotated to a greater extent so that the holding lug 61 will engage behind the shoulder 50 at the rear end of the land 48. The clock spring 32 will now rotate the driver counterclockwise from the position shown in Fig. 13, and the speed of rotation is controlled by the escapement. When the cam edge 63 of the driver engages the projection 62 of the latch, the driver will move the latch outwardly, thus disengaging the holding lug 61 from the shoulder 50. Thereupon, the spring 44 associated with the latch plate 40, will rotate the latch plate counterclockwise through the distance of the length of the land 48, whereupon the edge 49' on the latch plate will engage against the holding lug 61 so that the parts will now be in the position shown in Fig. 12 and in which position they will be maintained indefinitely, that is, until the handle or knob is manually turned to "off" position. When the driver at the end of the timing period engages the projection 62, the force of the clock spring overcomes the force of the spring 64 and the frictional engagement between the holding lug and the shoulder 50, but the force of the clock spring is not sufficient to disengage the latch from the latch plate when the parts automatically assume the position shown in Fig. 12.

When it is desired to set the mechanism in its first or "low" position for a timing operation, the knob is turned beyond the range of preselected high setting positions so as to move the driver to the position shown in Fig. 14. When the driver is so moved, it will cause the latch plate to rotate to the approximate position shown in Fig. 13 and, upon continued rotation of the driver, it will pass beyond the lug 58. The outer end of the driver will engage the edge 60' of the latch 60, with the result that the lug 61 is disengaged from the shoulder 50 and is moved outwardly to a position where the inner end of the holding lug 61 lies in the path of movement of the inclined shoulder 49. When the lug is thus disengaged from the shoulder 50, the spring 44 will turn the latch plate counterclockwise to its first or "low" position shown in Fig. 12 and in which position it is held due to the engagement of the shoulder 49 against the holding lug 61. The knob may now be turned counterclockwise to any position of adjustment depending upon the time cycle desired, it being clear that, when the knob is turned, the clutch, comprising the gear 30 and the mem-

ber 31, will slip. The knob having been set and released, the driver will now be slowly driven by the clock spring and when the driver engages the projection 62 of the latch, the latch is moved outwardly so as to release the latch plate, with the result that the spring 44 will move the latch plate and the switch unit connected thereto with a snap movement to "off" position, which is shown in Fig. 11. The driver may thus disengage the latch from the latch plate because the force of the clock spring, acting through the driver, is greater than the combined forces comprising the force of the spring 64 and the friction between the inclined shoulder 49 and the holding lug 61. Furthermore, the lower right-hand edge of lug 61 now engages the surface 49. Therefore, the force line, representing the action of plate 40 by spring 44 upon the lug 61, is a line perpendicular to surface 49 and intersecting the contacting edge of lug 61. It will be noted that this force line will pass slightly below the pivot of lever 60. Therefore, the spring 44 tends to unlatch rather than to maintain the lever 60 in latching position. Therefore, the resistance to unlatching is substantially less than in case of the conditions shown in Fig. 12.

It is seen that, when the switch is set into either of its operative positions, there is a slow make between the contacts. However, when the circuits are broken, either automatically or manually, the contacts are separated with a snap action so that arcing at such times is minimized.

Referring now to the switch mechanism per se, the same comprises generally the rotary unit 41 disposed between two series of three stationary contacts, the contacts of one series being indicated by the numeral 76 and those of the other series by the numeral 77. The contacts of each series are angularly disposed about the axis of rotation of the unit, and the contacts of one series are respectively aligned or paired with those of the other series. The contacts 76 are carried by spring arms 78 which are connected to the base 11 by terminal posts A-1, B-1 and N-1. The contacts 77 are carried by spring arms 80 which are connected to U-shaped brackets 81 which, in turn, are connected to the base 11 by terminal posts A-2, B-2 and N-2. Secured to the rear arms of the brackets is a disk or baffle plate 83 provided with slots 84 through which the free ends of the arms 78 extend. A like plate 85 is secured to the rear faces of the forward arms of the brackets 81. There is also provided between the timing mechanism and the switch a baffle plate 86 of insulating material, the same here being shown in Fig. 2 as secured to the forward faces of the forward arms of the brackets 81.

The rotary switch unit 41 comprises a disk of insulating material and a series of contacts carried thereby. In the present instance, the disk is laminated, comprising three layers, the central one of which is slotted so as to accommodate a jumper 87 comprising a strip of copper or the like. The unit has four contact members 88 with a contact to each side of the disk. The opposite ends of the jumper are connected to contacts 89 and 90, one of which extends only beyond one side face of the disk, and the other of which extends only beyond the other side face of the disk. It will be observed that, with the arrangement described, these two contacts 89 and 90 are electrically connected together by the jumper which is housed within the disk, an arrangement which is very simple and effective.

When the switch is used in connection with a

three-wire supply system and a two-part heating unit, it may be electrically connected as shown in Figs. 15, 16 and 17 which show the switch, respectively, in "off," "low," and "high" positions. In Fig. 15, the contacts carried by the rotary unit are all displaced with respect to the fixed contacts 76 and 77 so there is no current flow. When the switch unit is turned clockwise one step to the "low" position shown in Fig. 16, one of the double-ended contacts 88 is between and in engagement with contacts associated with the posts A-1 and A-2 and the contacts 89 and 90 associated with the jumper 87 are respectively in contact with the fixed contacts associated with the posts N-1 and B-2. The parts of the heating element 75 are thus connected in series across the neutral or ground wire and one of the outside lines, the current flow being indicated by arrows. When the switch unit is in the "high" position shown in Fig. 17, the pairs of fixed contacts associated with the posts N-1 and N-2, A-1 and A-2, and B-1 and B-2 are bridged by three of the interposed double-ended contacts 88 carried by the switch unit. When the parts are in this position, the two sections of the heating element 75 are connected in series across the outside lines and the current flow is indicated by the arrows.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim as my invention:

1. An electric time switch for controlling two circuits and comprising a manually operable control member and having in sequence the following circuit controlling positions, (1) "off," (2) "first circuit on," (3) "second circuit on," and settable in positions from which the member is to be moved automatically toward position #1, a timer for moving the member automatically toward position #1, switch means operated by said member and having off position corresponding to position #1 and having circuit-making positions corresponding to positions #2 and #3 of the member, spring means tending to return the switch means to position #1, latch means for retaining the switch means in positions #2 or #3 and having provisions for latching the switch means in position #2 when released from position #3 and for offering greater resistance to the unlatching operations at position #2 than at position #3, and a mechanism capable of operation through manually-effected movement of said member toward position #1 for releasing the latch means when the switch means is at positions #2 or #3 and capable through the timer-effected movement of the member to release the latching means when the switch means is at position #3 but incapable at position #2 wherein the latching means offers greater resistance to unlatching than at position #3 whereby timer-controlled release of the latching means when the switch means is at position #3 results in spring-effected movement of the switch means

to position #2 from which it can be released only by manual control.

2. An electric time switch according to claim 1 further characterized by the provision for the control member of an additional circuit-controlling position, namely, (4) "first circuit on," and by the provision of means responsive to a movement of the member in proximity to position #4 for effecting release of the latch means retaining the switch means in position #3 whereby it is spring actuated to position #2 and for effecting such reduction in the resistance offered by the latch means to the latch releasing operation when the switch means is at position #2 that release of said latch means at the #2 position of the switch means is effected by timer-operated return of the member to #1 position, whereby movement of the member to #4 position conditions the switch for timer-controlled return of the switch means to off position.

3. An electric time switch for controlling two circuits and comprising a movable contact unit having, in sequence, three positions, namely, (1) "off," (2) "first circuit on," (3) "second circuit on," a spring for urging the contact unit toward "off" position, means for retaining the unit in either "on" position when so moved and comprising a latch element spring-urged toward latching position and a latch plate attached to the unit and providing stop surfaces, respectively, to be engaged by the latch element when the unit is located in either "on" position, a manually operable control member, means operated thereby for imparting to the contact unit movement in one direction from "off" toward the "on" positions and retractable in the opposite direction to permit spring return of the contact unit toward "off" position when unlatched, a device responsive to certain retractive movements of the member for disengaging the latch element from the stop surfaces of the latch plate, and a timer for effecting retraction of the member from a position manually set, that stop surface of the plate engaged by the latch element when the unit is in position #2 being so shaped as to provide, under conditions of normal engagement by the latch element, such resistance to the unlatching operation as to prevent operation of the device to retract the latch element in response to operation of the timer, whereby the contact unit cannot move toward "off" position further than position #2 unless the device is manually operated to overcome said resistance.

4. An electric time switch according to claim 3 further characterized by the provision of means responsive to movement of the control member to a certain position more removed from "off" than position #3 for causing the latch element to be retracted from the latch plate sufficiently to release the contact unit from position #3 to permit movement to position #2 and for so locating the latch element as to engage the latch plate stop surface of the #2 position in a manner such that the resistance to unlatching is substantially reduced whereby the device, when operated by the timer, is able to retract the latch element, whereby the first circuit is automatically opened after a predetermined lapse of time.

5. An electrical time switch for controlling two circuits and comprising a manually operable control member having in sequence the following circuit establishing positions, namely, (1) "off," (2) "first circuit on," (3) "second circuit on," (4) "first circuit on," and settable in positions from which the member may be moved

toward "off" position automatically, a timer for moving the member from a set position automatically toward "off" position, switch means operated by the member for establishing the circuits in accordance with movement of the control member from "off" toward its successive circuit-on positions, spring means tending to return the switch means to "off" position, latch means for retaining the switch means in "on" positions, a mechanism capable of operation through manual operation of the member for releasing the latch means in response to the return of the member in proximity to "off" position and capable of operation through timer-effected operation of the member under certain conditions, said latch means having provisions normally conditioned for release of the switch means from position #3 by the timer effected operation of the release mechanism, and said latch means being normally so conditioned, when the switch means is in position #2, that said latch means cannot be released by operation of the timer, and means responsive to movement of the control member to position #4 for conditioning the latch means for release by timer-effected operation of the latch release mechanism.

6. An electric time switch comprising a normally operable control member having an "off" position and two "on" positions for establishing the same circuit, a timer for returning the member to "off" position, a switch contact unit having an "off" position and one "on" position for establishing the circuit, means controlled by the member for moving the unit into its "on" position when the member is moved into either of its "on" positions, a spring for moving the unit to "off" position, means for latching the unit in "on" position, means operated by the timer for disengaging the latch means, said latching means being normally conditioned to prevent the unlatching of the unit by the timer when the member is in one of the "on" positions, and means operated by the member when moved into its other "on" position for conditioning the latch means for the unlatching of the unit by the timer.

7. An electric time switch comprising a normally operable control member having an "off" position and two "on" positions for establishing the same circuit, a timer for returning the member to "off" position, a switch contact unit having an "off" position and one "on" position for establishing the circuit, means controlled by the member for moving the unit into its "on" position when the member is moved into either of its "on" positions, a spring for moving the unit to "off" position, a latch plate connected with the unit, a latch element for engaging the plate and arresting movement of the unit by the spring toward "off" position, said plate and element normally cooperating in a manner such that retraction of the element backs the plate and the unit against the spring to increase the force thereof whereby the retraction of the latch element from the latch plate by the timer is prevented, and means operated by the member when moved into its other "on" position for conditioning the latch means for cooperation whereby the unlatching operation initially is accompanied by release of said spring whereby unlatching by the timer can be effected.

8. An electric time switch comprising a normally operable control member having an "off" position and two "on" positions for establishing the same circuit, a timer for returning the member to "off" position, a switch contact unit having an "off" position and one "on" position for estab-

latching the circuit, means controlled by the member for moving the unit into its "on" position when the member is moved into either of its "on" positions, a spring for moving the unit to "off" position, a latch plate connected with the unit, a pivoted latch element for engaging the plate and arresting movement of the unit by the spring toward "off" position, said plate and element normally cooperating in a manner such that the center line of action of the spring-urged plate against the element tends to rotate the element in the direction opposite to the unlatching direction whereby retraction of the latch element by the timer is prevented, and means operated by the member when moved into its other "on" position for so conditioning the engagement of the latch plate and the element that the center line of action of the spring-urged plate against the element tends to rotate the element in the unlatching direction whereby retraction of the latch element by the timer can take place.

9. An electric time switch comprising a shaft, a handle for moving the shaft manually, a timer for moving the shaft, a friction clutch connecting the timer with the shaft whereby the shaft may be set by the handle into positions for effecting circuit control and positions for determining the timing of a circuit, a rotatable switch unit coaxial with the shaft, a mechanism for imparting movement from the shaft in one direction to the switch unit to move it from "off" to "on" positions, a spring tending to return the switch unit to "off" position, a latch for retaining the switch unit in "on" position and a device operated by the mechanism, when moving in the direction opposite to that first-mentioned, for retracting the latch, said latch being normally conditioned to arrest operation of said device when the mechanism is being operated by the timer, and means responsive to movement of the handle into a certain other position for so conditioning the latch that it will be released by the device when the mechanism is operated by the timer.

10. An electric time switch comprising a shaft, a handle for moving the shaft manually, a timer for moving the shaft, a friction clutch connecting the timer with the shaft whereby the shaft may be set by the handle into positions for effecting circuit control and positions for determining the timing of a circuit, a rotatable switch unit coaxial with the shaft, a driver attached to the shaft, a connector for imparting movement from the driver in one direction to switch unit to move it from "off" to "on" positions, a spring tending to return the switch unit to "off" position, a latch plate attached to the switch unit and providing a latch-lever-engaging stop, a pivoted latch lever for engaging the stop of the plate, and a cam provided by the driver for engaging the latch lever to release it from the latch plate, said latch lever normally making such engagement with the latch plate stop that action of the driver to release the latch when the driver is timer-actuated is arrested, said driver, when moved by the handle in a direction opposite to latch-releasing direction, shifting the latch lever from normal latching position into a latching position from which it can be released by timer-effected return movement of the driver.

11. An electric time switch comprising a shaft, a handle for moving the shaft manually, a timer for moving the shaft, a friction clutch connecting the timer with the shaft whereby the shaft may be set by the handle into positions for effecting circuit control and positions for determining

the timing of a circuit, a rotatable switch unit coaxial with the shaft, a driver attached to the shaft, a connector for imparting movement from the driver in one direction to switch unit to move it from "off" to "on" positions, a spring tending to return the switch unit to "off" position, a latch plate attached to the switch unit and providing two latch-lever engaging stops corresponding to two circuit-making positions, a pivoted latch lever for engaging either stop in order to hold the switch unit in either of two circuit-making positions, and a cam provided by the driver for engaging the latch lever to release it successively from the latch plate stops.

12. An electric time switch comprising a shaft, a handle for moving the shaft manually, a timer for moving the shaft, a friction clutch connecting the timer with the shaft whereby the shaft may be set by the handle into positions for effecting circuit control and positions for determining the timing of a circuit, a rotatable switch unit coaxial with the shaft, a driver attached to the shaft, a connector for imparting movement from the driver in one direction to switch unit to move it from "off" to "on" positions, a spring tending to return the switch unit to "off" position, a latch plate attached to the switch unit and providing latch-lever engaging stops #1 and #2 corresponding to two circuit-making positions, a pivoted latch lever for engaging either stop in order to hold the switch unit in either of two circuit-making positions, a cam pivoted by the driver for engaging the latch lever to release it successively from the stops, said latch lever normally making such engagement with stop #1 that action of the driver to release the latch when the driver is timer-actuated is arrested, said driver, when moved by the handle into a position beyond that required to effect engagement of stop #2 with the latch lever, effecting retraction of the latch lever from stop #2 and the positioning of the latch lever relatively to stop #1 in a manner such that release of the latch lever from stop #1 can be effected by timer-effected return movement of the driver.

13. An electric time switch for controlling two circuits comprising a manually controlled member having, in sequence, the following positions, namely, (1) "off," (2) "first circuit, on," (3) "second circuit, time," (4) "first circuit, time," a switch unit under control by the member for establishing said circuits, a timer for returning the member to "off" position, a spring for returning the switch unit to "off" position, latch means for retaining the switch unit in its circuit-making positions, timer-operated means for releasing the latch means to permit spring-actuated movement of the switch unit from the #3 position, but ineffective normally to release the latch means to permit spring actuated movement of the switch unit from the #2 position, and means responsive to movement of the member to the #4 position for conditioning the latch means for timer-operated release of the latch means when the switch unit is at the #2 position.

14. An electric time switch for controlling two circuits comprising a manually controlled member having, in sequence, the following positions, namely, (1) "off," (2) "first circuit, on," (3) "second circuit, time," (4) "first circuit, time," a switch unit under control by the member for establishing said circuits, a timer for returning the member to "off" position, a spring for returning the switch unit to "off" position, latch means for retaining the switch unit in its circuit-making po-

sitions, said latch means being conditioned for automatic release when the member is moved to positions #3 or #4 but not conditioned for automatic release when the member is moved to position #1, and timer-operated means for automatically releasing the latch means when so conditioned by movement of the member to positions #3 or #4.

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