Aug. 5, 1941. E. F. SWENSEN 2,251,429

TIME SWITCH

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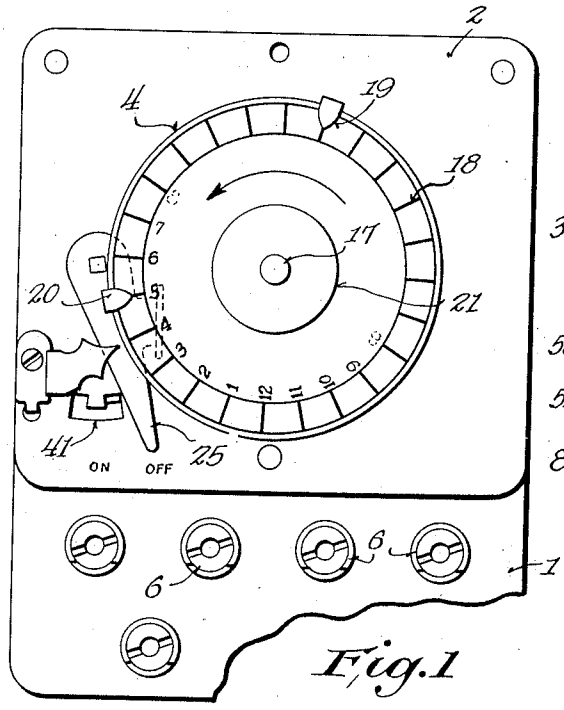


Fig. 1

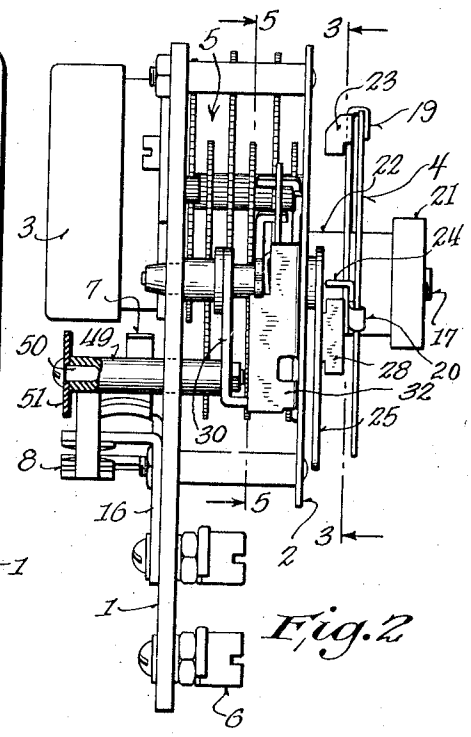


Fig. 2

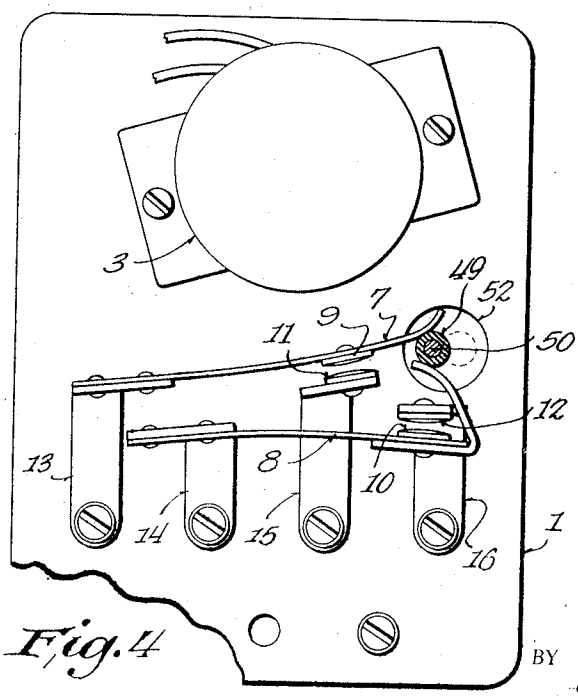


Fig. 4

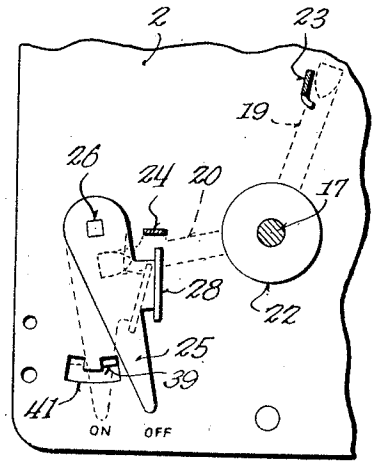


Fig. 3

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Fig. 5

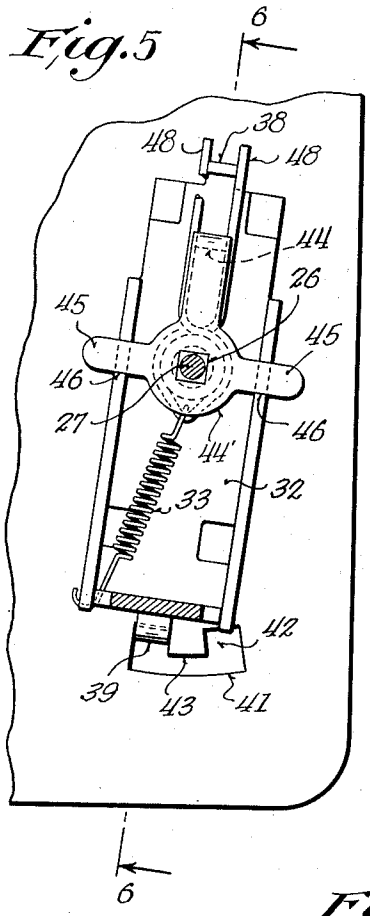


Fig. 6

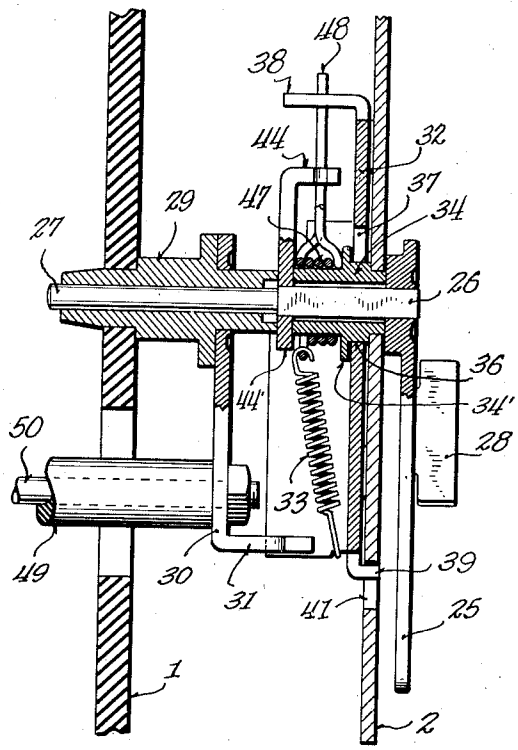
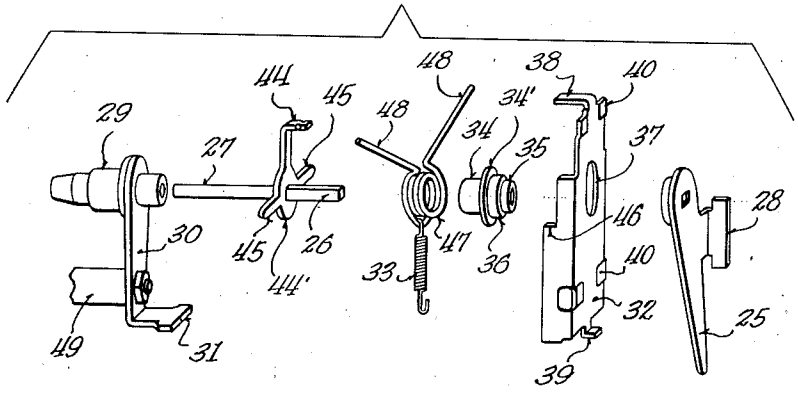


Fig. 7



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Fig. 8

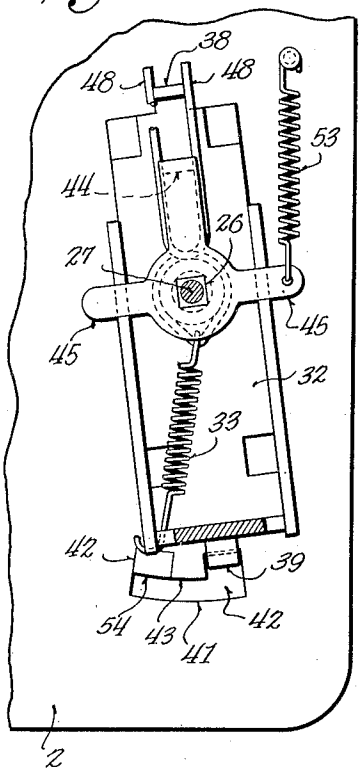


Fig. 9

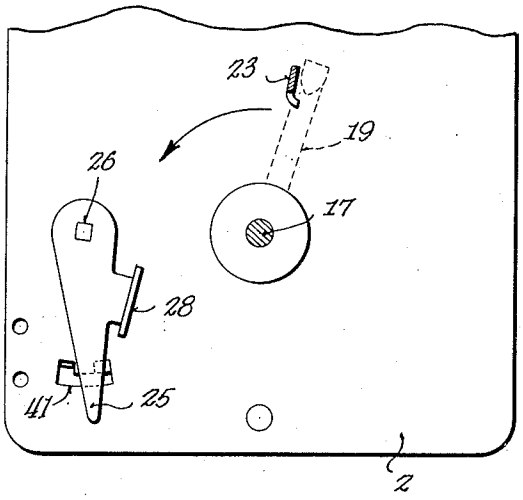
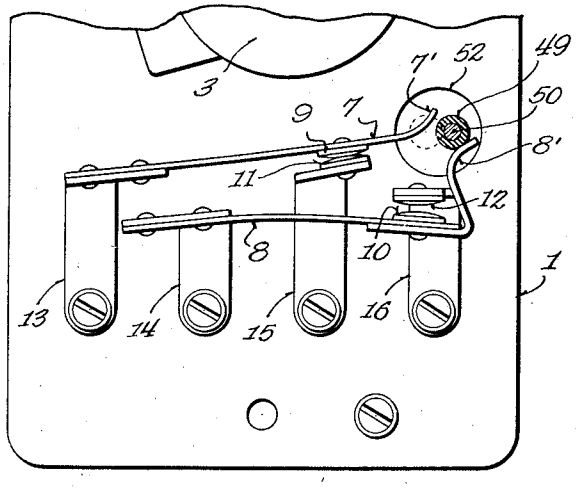


Fig. 10



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Patented Aug. 5, 1941 2,251,429

UNITED STATES PATENT OFFICE

2,251,429

TIME SWITCH

Emil F. Swensen, Manitowoc, Wis., assignor to Paragon Electric Company, Chicago, Ill., a corporation of Illinois

Application May 31, 1940, Serial No. 338,073

11 Claims. (Cl. 200—39)

This invention relates to time switches.

Objects of this invention are to provide a time switch which is equipped with a timing dial and with trippers, in which the trippers are provided with operating means all of which are located on the rear side of the timing dial and each of which operating means successively engages a portion of a switch operating arm to sequentially operate the switch.

Further objects are to provide a construction in which the switch actuated from the trippers has a quick break and quick make, in which means are provided for storing up energy in the switch operating means and thereafter suddenly releasing this energy for causing a quick motion of the switch, and in which a very simple switch operating means or assembly is provided which may be quickly assembled.

Further objects are to provide a time switch in which a switch operating arm is accessible exteriorly of the front plate or face plate and may be manually operated without interfering with its correct successive operation by the respective trippers of the timing dial, but in which, if it is desired, the switch may be manually operated at any time, the switch operating arm also having the additional function of serving as a switch position indicating means.

Further objects are to provide a time switch in which any number of switches may be operated by the timing mechanism without any change in the main body of the mechanism itself and with a very simple and slight change in the switch parts themselves.

Further objects are to provide a time switch construction in which either a single or a plurality of switches may be provided which may simultaneously open and simultaneously close, or in which one of the switches may open while the other switch closes, and to provide a construction in which the switch operating means may be temporarily positively locked in either of two positions in one form of the invention, or may be temporarily locked in one position and may be momentarily operated to move to the other position in another form of the invention, the invention readily lending itself to such change with a minimum of alteration of the parts so that substantially the same structure may be provided for both forms of the invention and the change-over from one form to the other may be made in a very simple and inexpensive manner.

Embodiments of the invention are shown in the accompanying drawings, in which:

Figure 1 is a face view of the device, with a part broken away and with the device removed from the box or housing.

Figure 2 is a side view of the structure shown in Figure 1, partly in section.

Figure 3 is a sectional view on the line 3—3 of Figure 2.

Figure 4 is a rear view, partly in section.

Figure 5 is a sectional view on the line 5—5 of Figure 2.

Figure 6 is a sectional view on the line 6—6 of Figure 5.

Figure 7 is an exploded view of the switch operator assembly.

Figure 8 is a view corresponding to Figure 5 showing a modified form of the invention.

Figure 9 is a view corresponding to Figure 3 showing the modified form of the invention illustrated in Figure 8.

Figure 10 is a view corresponding to Figure 4 showing a further form of the invention.

Referring to the drawings, it will be seen that the device comprises a time switch which is mounted on an insulating panel 1 normally housed in a casing or box, not shown, and which carries the outer plate 2, the motor 3 which may be a self-starting synchronous motor or other type of motive means, the timing dial 4 and the intermediate clockwork indicated generally at 5 mounted between the plates 1 and 2.

The plate 1 carries the terminals certain of which are indicated by the reference character 6 and also carries the movable switch arms 7 and 8, these switch arms being provided with movable contacts 9 and 10 which cooperate with the stationary contacts 11 and 12.

As the description proceeds, it will be appreciated that either one or a plurality of pairs of movable and stationary contacts could be provided. In the form shown two sets of such contacts are employed. The movable switch arms 7 and 8 are carried by the rigid arms of connecting members or supporting members 13 and 14 and the stationary contacts 11 and 12 are similarly carried by the stationary connectors or supporting members 15 and 16.

The synchronous motor drives the main shaft 17, see Figures 1 and 2, at a regular rate so as to provide one revolution of this shaft every twenty-four hours. Obviously if desired, a different rate of rotation could be provided and different motor means could be employed. However, in the form shown the shaft makes one revolution every twenty-four hours. It carries the removable timing dial 4 which is provided with graduations 18

and with a pair of trippers 19 and 20 which have pointers located on the outer face of the dial. Although one pair of trippers has been shown, it is obvious that any number of pairs may be provided. A clamping thumb nut 21 is screwed on the shaft 17 and clamps the dial and trippers in their adjusted or selected position on the shaft 17, preferably a nut or other member 22, see Figure 2, being rigidly carried by the shaft and against which the associated parts can be clamped.

The trippers 19 and 20 are each provided with operating means on the inner side of the dial. These operating means are indicated at 23 and 24 in Figures 2 and 3 and each operating means is adapted to selectively operate the switch operating arm 25. This switch operating arm 25 is carried by the squared portion 26 of a shaft 27, the major portion of the shaft being round as indicated in Figure 7 and the outwardly projecting portion 26 being square.

When the portion 24 of the trippers approaches the operating arm 25 and the operating arm is in the full line position shown in Figure 3, such portion 24 will strike the upturned cam member 28 of the operating arm 25 and inasmuch as this portion is located off center with reference to the axis about which the arm 25 rocks, it is apparent that as the timing dial rotates, such operating arm 25 will be rocked into the dotted line position shown in Figure 3. However, when in this position the cam member or operating member 23 of the trigger arm 19 will ride on the left side of the cam member 28 of the operating arm 25 while said latter is in the dotted line position shown in Figure 3 and will thus rock the operating arm to its full line position shown in Figure 3.

The operating arm 25, which is also a switch position indicator, constitutes one portion of a switch operating assembly. The assembly is shown separated out in Figure 7 and is shown in its assembled form in Figures 5 and 6. The switch operating assembly is mounted between the rear plate 1 and the front plate 2 and includes a hub 29 which is freely mounted on the shaft 27 but which is rigid with the switch operator or lever 30, such lever having an outwardly turned portion 31 that fits between the side walls of a cradle or carriage 32. A flanged hub indicated generally at 34 is mounted on the squared portion 26 of the shaft. This hub is provided with a double shouldered portion, one portion 35 of which fits within the opening in the outer plate 2 and constitutes a bearing, and the other portion 36 of which is slidably received in the elongated slot or aperture 37 formed in the cradle so that the cradle is free to slide to a limited extent with reference to the hub 34.

It is preferable to slightly counterbore the member 29 adjacent the end of the squared portion 26 of the shaft so that clearance is provided for any burrs that may occur as a result of assembling the member 44' on the squared portion of the shaft. The squared portion of the shaft may stop flush with the outer end of the member 29 as shown in Figure 6, or it may extend a slight distance into the counterbore if so desired.

The cradle 32 is provided with a rearwardly turned tongue 38 at one end and with a forwardly turned latching tongue 39 at its other end and may be provided with a plurality of depressed pads or feet 40, see Figure 7, to reduce friction, such pads or feet sliding on the inner side of the plate 2.

The plate 2 is provided with an arcuate slot 41 which has notches 42 on opposite sides of a centrally located tongue 43 and normally the latching tongue 39 of the cradle fits within one or the other of the notches 42.

It is to be noted particularly from reference to Figure 7, that the squared portion 26 of the shaft rigidly carries a spider 44' having a spring actuating arm 44 and a pair of slide actuating arms 45. These slide actuating arms 45 normally abut the shouldered portions 46 formed on opposite side flanges of the cradle 32.

The member 34 is slipped over the squared portion 26 of the shaft during assembly and when the operating arm 25 is pressed onto the end of the shaft as shown in Figure 6, it rigidly holds the hub 34 between such arm 25 and the rigidly carried spider 44'. The flange 34' of the hub is positioned rearwardly of the cradle 32 and loosely holds the cradle against displacement and prevents the lug 39 of the cradle from being displaced from the arcuate slot 41.

A coiled spring 47 loosely surrounds the hub 34 and is provided with a pair of outwardly projecting arms 48. When the device is assembled, the arms 48 bear on opposite sides of the spring actuating member 44, see Figure 7, and the lug 38 of the cradle 32. They normally exert no tendency to rock the cradle, as is obvious from an inspection of Figure 5, as they merely bear on opposite sides of the two lugs 44 and 38, and though these arms 48 are urged in opposite directions to clamp or bind against the lugs 44 and 38, nevertheless there is no tendency to rotate the cradle with reference to the shaft 27 under normal conditions. The outer hooked end of the spring 33 is hooked over one of the side flanges of the cradle 32, as shown particularly in Figures 5 and 6.

It is apparent that as the timing dial rotates, that the switch operating arm 25 will be oscillated first in one direction and then in the other direction, thereby correspondingly rotating the shaft 27.

If it is assumed that the shaft 27 is rotated in a counterclockwise direction as viewed in Figure 5, it is apparent that one of the arms 45 will force the slide 32 outwardly against the action of the spring 33. However, a slight degree of sliding motion is permitted the cradle 32 before the latching tongue 39 clears the stationary latching lug or tongue 43. During this rocking motion of the shaft 27, the lug 44 has moved to the left as viewed in Figure 5, and consequently has tensioned the spring 47 and has moved the left-hand arm 48 of such spring out of engagement with the lug 38, thus storing energy in the spring tending to rotate the cradle 32 in a counterclockwise direction. The cradle 32 slides outwardly until the latching lugs 39 and 43 are disengaged and thereafter snaps with a quick motion to the right, the spring 33 causing the cradle to travel inwardly and causing the latching lug 39 to seat itself within the other notch 42, thus locking the device against inadvertent motion.

If desired, the spring 33 may be so positioned that it assists the cradle 32 in rocking towards switch open position and thus may assist in the opening motion of the switches if so desired. The switch arms themselves have a certain inherent resiliency and tend to close so that a little more effort is required for operating the cradle during the opening motion of the switches than during

the closing motion thereof and this additional force may be supplied by the spring 33.

In order to operate the switch from the switch operator or lever 30, an insulating sleeve or member 49 is rigidly carried by the arm 30. This may be accomplished by providing a bolt or screw 50 which passes through the insulating sleeve 49 and rigidly clamps such sleeve to the arm 30, as shown in Figures 2 and 6, and if desired, an outer insulating washer 51 may be provided, as shown in Figure 2.

The wall 1 is provided with an opening 52 that clears the insulating sleeve 49 and such insulating sleeve projects through this insulating wall and engages the movable contact arms 7 and 8. The sleeve 49, when in the full line position shown in Figure 4, cooperates with the cam portions or curved portions of the arms 7 and 8 to simultaneously open both switches, and when in the dotted line position, allows both switches to simultaneously close.

It is apparent that as many switches as needed can be operated by successively spacing them rearwardly of the insulating plate 1.

It is to be noted particularly that these switches are opened and closed by a snap action and also it is to be noted that if desired, the operating arm 25 may be manually moved to the on and off position as indicated on the outer plate 2 in Figure 1, to thereby operate the switch to either on or off position with a snap action. Normally the operating arm and consequently the switches are automatically actuated by the trippers of the timing dial, as hereinabove described.

The switches need not necessarily be both simultaneously opened and closed but other arrangements could be had. For example as shown in Figure 10, a construction is illustrated in which when one switch closes, the other switch is opened. This is easily accomplished by merely providing the spring arm 8 with an outwardly turned portion 8' which, upon comparison with Figure 4, will be seen to be turned in the outer direction as compared with the structure shown in Figure 4. The arm 7 has the out-turned portion 7'. By these means it is apparent that when one switch closes, the other is opened.

It is to be noted particularly that the synchronous motor and the switch parts are all located rearwardly of the insulating plate 1 and consequently are separated off by this insulating barrier from the rest of the mechanism.

It will be seen that a novel form of time switch has been provided in which the trippers are set from the front side of the dial, and in which the trippers have their operating means located on the rear face of the dial, and in which a single portion of the switch operating arm is engaged and operated successively by the operating means of the trippers.

It will be seen further that the operating arm of the switch may be manually manipulated and will not interfere with the subsequent automatic operation of the switch operating arm by the trippers in their correct sequence. The trippers have their operating points at different radial distances from the center of the dial and one operating means acts to directly abut the corresponding member on the operating arm and the other operating means acts like a cam member, with such means on the operating arm.

If it is desired to have only a momentary switching operation, this may be easily accomplished by the construction shown in Figures 8 and 9. In this form of the invention, the parts are all the same with the exception that an additional spring 53 is provided and also a small block 54 has a press fit in one of the notches 42. The spring 53, it will be noted, tends to rock the shaft 27 in a counter-clockwise direction as viewed in Figure 8. Normally the device occupies the position shown in Figure 8, but when the tripper 19 brings its portion 23 into engagement with the portion 26 of the switch operating arm 25, it rocks such arm against the action of the spring 53 and withdraws the lug 39 from the notch 42 within which it had been seated, and the switch is consequently caused to rock to its other position, but as soon as the cam member 23 passes the portion 26 of the operating arm 25, the shaft 27 is free to rock in a counter-clockwise direction under the influence of the spring 53 and the parts assume the position shown in Figure 8.

It is to be distinctly understood that either the arrangement shown in Figures 4 and 10 can be used with either of the forms of the invention as illustrated in Figures 5 and 8, for instance.

It will be seen further that the device is very simple and may be most readily assembled. During the assembly the spring is placed on the hub member and the hub member slipped over the squared portion of the shaft. Thereafter this much of the assembled mechanism is positioned within the channel of the cradle and subsequently the switch operator is placed on the round portion of the shaft. This entire assembly is then placed in position between the inner and outer plates.

It is also apparent that the trippers may be set wherever desired to cause the sequential operation of the switch at the desired times, and that the switch may be used to control electric signs or any other device desired.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A time switch comprising a pair of contacts, a switch operator for causing relative movement of said contacts, a sliding and rocking cradle for moving said switch operator back and forth, said cradle being slidable with reference to said operator without imparting motion to said operator, latch means released by the sliding motion of said cradle for locking said operator in either of two positions, spring means for rocking said cradle back and forth, an operating arm for storing energy in said spring means and for rocking said cradle, and time mechanism for rocking said operating arm.

2. A time switch comprising motor means, trippers driven by said motor means, a switch operating shaft oscillated by said trippers, a cradle associated with said shaft and having rocking and sliding motion, spring means between said shaft and said cradle for storing up energy tending to rock said cradle when said shaft is rocked, switch operating means driven from said cradle, said cradle having means for latching said cradle in either of two positions, and means on said shaft for sliding said cradle to release said latching means.

3. A time switch comprising timing means, motor means for driving said timing means, an electric switch, and a switch operating assembly including a rock shaft rocked from said timing

means, a sliding and rocking cradle, latching means for latching said cradle against rocking, spring means between said rock shaft and said cradle for storing up energy when said rock shaft is rocked, and means on said rock shaft for unlatching said cradle by sliding said cradle, said switch and said cradle being operatively connected to cause a quick make and break of said switch.

4. A time switch comprising timing means, motor means for driving said timing means, an electric switch, and a switch operating assembly including a rock shaft rocked from said timing means, a sliding and rocking cradle, latching means for latching said cradle against rocking, spring means between said rock shaft and said cradle for storing up energy when said rock shaft is rocked, means on said rock shaft for unlatching said cradle by sliding said cradle, and a switch operator rocked by said cradle, said cradle having sliding motion with respect to said switch operator.

5. A time switch comprising timing means, motor means for driving said timing means, an electric switch, a rock shaft, an operating arm oscillated by said timing means for rocking said rock shaft, a sliding and rocking carriage, a first spring means tending to hold said carriage against sliding, means on said rock shaft for sliding said carriage when said rock shaft is rocked in either direction, latch means normally holding said carriage against rocking and released when said carriage is slid against the action of said first spring means, a second spring means operatively connected to said rock shaft and carriage normally operatively inert with respect to said carriage and operative to bias said carriage for rocking motion when said rock shaft is rocked, and a switch operator slidably related to said carriage and operatively driven from said carriage.

6. A time switch comprising timing means, motor means for driving said timing means, an electric switch, an operating arm oscillated by said timing means, a sliding and rocking carriage, a rock shaft rocked by said operating arm and passing through said carriage, said carriage having sliding motion with respect to said rock shaft, a first spring means tending to hold said carriage against sliding, means on said rock shaft for sliding said carriage when said rock shaft is rocked in either direction, latch means normally holding said carriage against rocking and released when said carriage is slid against the action of said first spring means, a second spring means having a coiled portion encircling said rock shaft and having spaced arms tending to approach each other, said carriage having a lug located between said spaced arms, said rock shaft having means projecting therefrom and including a second lug located between the spaced arms of said second spring means, and a switch operator coaxial with said shaft and slidingly related to said carriage and rocked by said carriage when said carriage is rocked in either direction.

7. A time switch comprising a pair of spaced plates constituting a front plate and a rear plate, clockwork mechanism located between said plates, motor means for driving said clockwork mechanism, a timing dial located on the outer side of said front plate and having adjustable trippers, a rock shaft extending through said plates and having an operating arm on the forward side of said front plate successively oscillated by said trippers, said rock shaft having laterally projecting arms and having a projecting lug, a carriage slidable relative to said rock shaft and having abutments against which said laterally projecting arms engage and having a projecting lug in approximate alignment with the lug of said rock shaft, a first spring means tending to hold said carriage against sliding, a second spring means having a coiled portion concentric with said shaft and having projecting arms tending to approach each other and engaging said lugs, a switch operator having sliding relation to said carriage and concentric with said shaft and rocked when said carriage is rocked, said carriage having a latching portion normally received within a latching notch formed in a relatively stationary part of said time switch, and a switch having a movable arm located rearwardly of said rear plate, said switch operator including a projecting portion extending through said rear plate and adapted to engage the movable arm of said switch.

8. A time switch comprising a pair of spaced plates constituting a front plate and a rear plate, clockwork mechanism located between said plates, motor means for driving said clockwork mechanism, a timing dial located on the outer side of said front plate and having adjustable trippers, a rock shaft extending through said plates and having an operating arm on the forward side of said front plate successively oscillated by said trippers, said rock shaft having laterally projecting arms and having a projecting lug, a carriage slidable relative to said rock shaft and having abutments against which said laterally projecting arms engage and having a projecting lug in approximate alignment with the lug of said rock shaft, a first spring means tending to hold said carriage against sliding, a second spring means having a coiled portion concentric with said shaft and having projecting arms tending to approach each other and engaging said lugs, a switch operator having sliding relation to said carriage and concentric with said shaft and rocked when said carriage is rocked, said carriage having a latching portion normally received within a latching notch formed in a relatively stationary part of said time switch, and a plurality of switches located rearwardly of said rear plate and each having a movable arm, said switch operator having a projecting portion for engaging the movable arms of said switches and for simultaneously operating said switches when said switch operator is rocked.

9. A time switch comprising motor driven timing means, an electric switch, and a switch operating arm including a rock shaft rocked from said timing means, a sliding and rocking cradle, latching means for latching said cradle against rocking, spring means between said rock shaft and said cradle for storing up energy when said rock shaft is rocked, and means on said rock shaft for unlatching said cradle by sliding said cradle, said switch and said cradle being operatively connected.

10. A time switch comprising timing means, motor means for driving said timing means, an electric switch, and a switch operating arm including a rock shaft rocked from said timing means, a sliding and rocking cradle, latch means for latching said cradle in one position against rocking, spring means tending to restore said cradle, a second spring means between said rock shaft and said cradle for storing up energy when

said rock shaft is rocked, and means on said rock shaft for unlatching said cradle by sliding said cradle, said switch and said cradle being operatively connected.

11. A time switch comprising an insulating plate, motor means located rearwardly of said insulating plate, an electric switch located rearwardly of said insulating plate, clockwork mechanism located forwardly of said insulating plate and including a timing dial, tripping means carried by said timing dial and adjustable from the front of said dial timing dial, and a switch operating assembly including a rock shaft rocked from said tripping means, a sliding and rocking cradle actuated from said rock shaft, and means actuated by said cradle and operatively connected to said switch.

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