Oct. 29, 1940.

B. F. FLEGEL

2,219,589

AUTOMATIC ELECTRIC TIME SWITCH

Filed Sept. 13, 1939

2 Sheets-Sheet 1

Fig. 1.

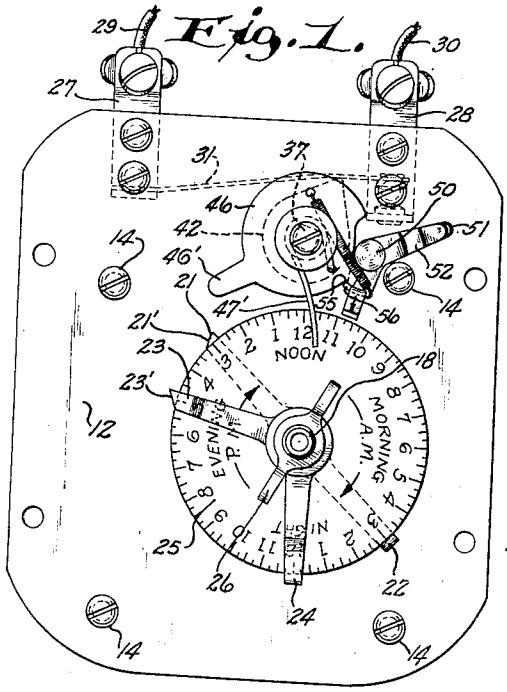
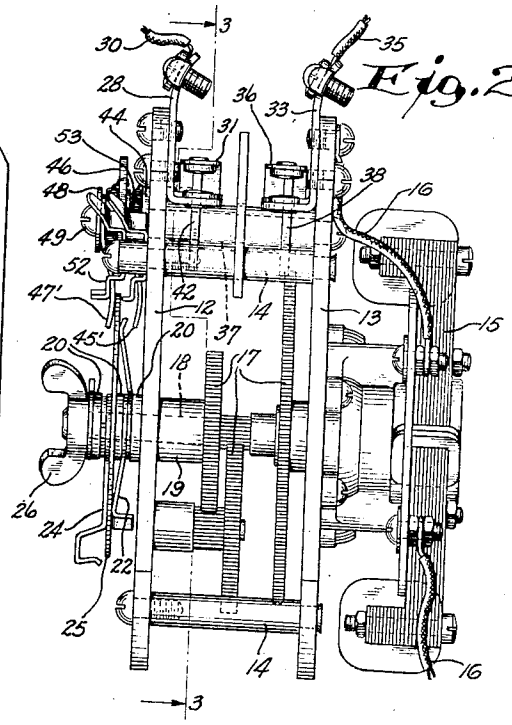


Fig. 2.



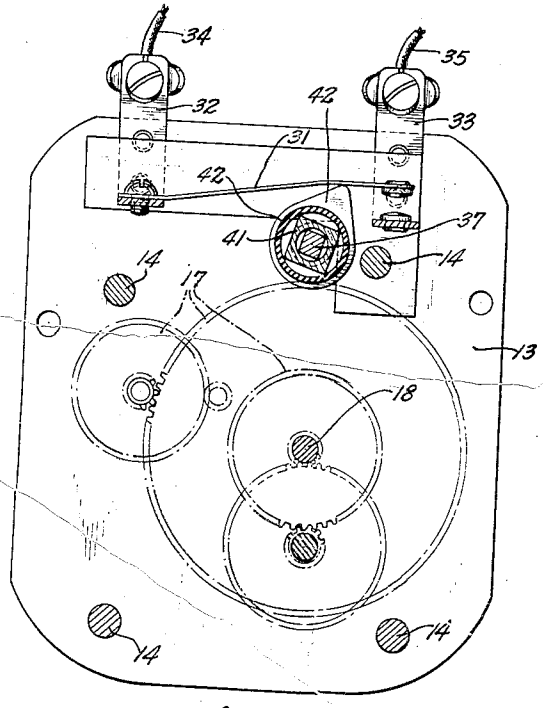


Fig. 3.

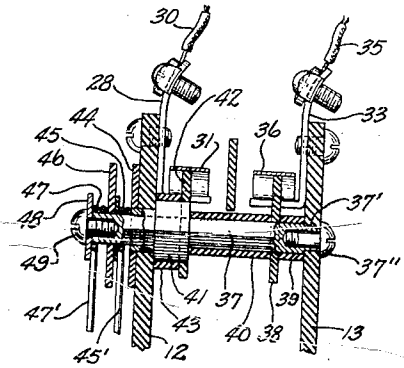


Fig. 4.

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Fig. 5.

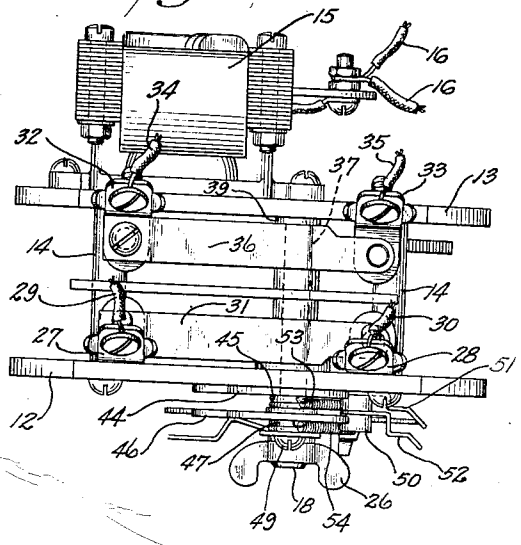


Fig. 6.

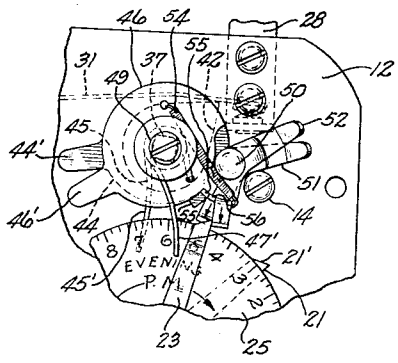


Fig. 8.

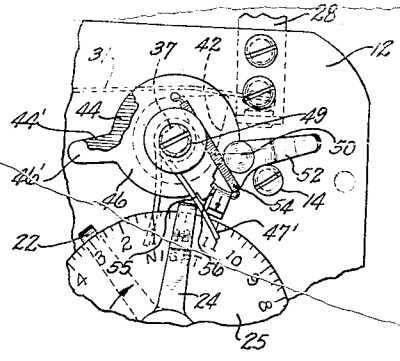


Fig. 7.

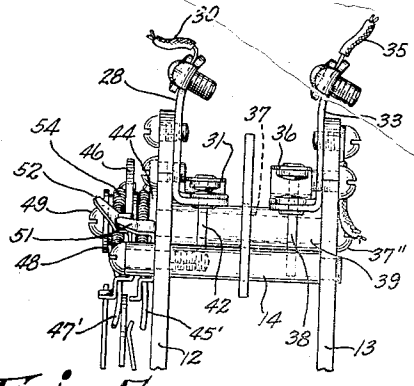
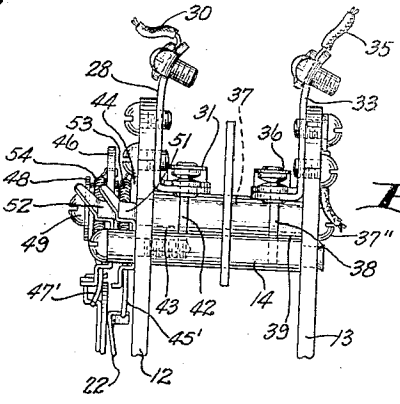


Fig. 9.



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Patented Oct. 29, 1940

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UNITED STATES PATENT OFFICE

2,219,589

AUTOMATIC ELECTRIC TIME SWITCH

Benjamin F. Flegel, Racine, Wis.

Application September 13, 1939, Serial No. 294,606

5 Claims. (Cl. 200—39)

This invention relates to improvements in automatic electric time switches.

Automatic time switches are employed to control electric circuits for the lights of store show windows, sign boards, etc. Ordinarily a time switch will control one or two circuits, but for two circuit control a single switch could only function to control the two circuits simultaneously and identically.

It is, therefore, a general object of the present invention to provide a unitary electric time switch which will automatically independently control two circuits in a plurality of combinations of modes and sequences of operation.

A further object of the invention is to provide an automatic time switch in which the contact actuating members are put under compression prior to the operation of the same, so that when the same are operated they move quickly and forcefully.

A further object of the invention is to provide an automatic time switch in which the mechanism may be manually operated at any time without affecting the time control of the switch.

A further object of the invention is to provide a multipole, duel circuit electric time switch which is extremely compact and simple mechanically and having an operating mechanism which builds up power and ultimately releases the same with a minimum of effort and wear on the moving parts.

A further object of the invention is to provide an automatic time switch which is of very simple construction, is strong and durable, is simple to adjust and operate, is inexpensive to manufacture and install, and which is well adapted for the purposes set forth.

With the above and other objects in view, the invention consists of the improved automatic electric time switch, and its parts and combinations as set forth in the claims, and all equivalents thereof.

In the accompanying drawings in which the same reference characters indicate the same parts in all of the views:

Fig. 1 is a front view of the improved time switch with the parts in one position of adjustment;

Fig. 2 is a side view of the switch with the parts in the position of adjustment of Fig. 1;

Fig. 3 is a vertical sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is a fragmentary transverse vertical sectional view of the upper portion of the switch mechanism;

Fig. 5 is a plan view of the switch;

Fig. 6 is a fragmentary front view of the switch in a position of adjustment different from that shown in Fig. 1;

Fig. 7 is a fragmentary side view of the showing in Fig. 6;

Fig. 8 is a fragmentary front view of the switch in still another position of adjustment; and

Fig. 9 is a fragmentary side view of the showing in Fig. 8.

Referring to the drawings it will appear that the numerals 12 and 13 indicate respectively front and rear plates, formed of insulating material, on and between which the switch mechanism is mounted. Said plates are held together in spaced, parallel relation by transverse posts or studs 14. In practice the entire frame and mechanism carried thereby may be enclosed by a suitable casing (not shown) and the device is mounted vertically wherever convenient.

Mounted on the outer face of the rear plate 13 is an electric clock mechanism 15 which receives electricity from any convenient electrical outlet (not shown) through circuit wires 16. A driven shaft in the clock mechanism 15 extends through the rear plate 13 and by means of a series of reduction gears, designated generally by the numeral 17, a clock dial shaft 18 is revolved in a clockwise direction. Said clock dial shaft 18 is journalled in a suitable bearing 19 and extends through the front plate 12.

Apertured inner ends of a series of arms or operating hands are adjustably mounted on the outer extended portion of the shaft 18 in axially spaced relationship and between spacing and clamping collars or discs 20.

Said actuating arms or hands include first circut closing and opening members 21 and 22, respectively, and second circuit closing and opening members 23 and 24, respectively. The shaft 18 also adjustably revolvably carries a clock dial 25 and the same is graduated in a counterclockwise direction from 12 noon to 12 midnight on 180 degrees of the same, and on the other 180 degrees the graduations extend from 12 midnight to 12 noon. There are also suitable quadrant markings to represent "noon," "evening," "night" and "morning." The first circuit operating arms 21 and 22 are mounted adjacent the inner face of the dial 25, whereas the second circuit operating arms 23 and 24 are mounted over the outer

face of the dial 25. The outer extremity of the shaft 18 is threaded and carries a winged nut 26. When this winged nut is released the dial and the various hands 21, 22, 23 and 24 may be adjusted on the shaft 18 to properly position the same. When the nut 26 is tightened the dial and hands are clamped between the collars 20, and all of the members on the shaft 18 will then turn therewith. The ends of all of the arms 21, 22, 23 and 24 extend beyond the periphery of the dial 25. The extremities of the arms 21 and 23 are beveled as at 21' and 23', and the outer extremities of the arms 22 and 24 are turned right-angularly inwardly, all for the purpose hereinafter to be disclosed.

The first circuit includes contact arms 27 and 28 secured to separated inner upper wall portions of the front plate 12. Circuit wires 29 and 30 have their extremities engaged by binding posts on the upper portions of the members 27 and 28, respectively. A spring metal switch element 31 is secured at its inner end to the lower angled portion of the member 27 while its outer end is adapted to make and break contact with the angled end of the element 28, whereby the first circuit is opened and closed automatically.

The second circuit includes contact arms 32 and 33 carried by spaced-apart portions of the inner upper wall of the rear plate 13. Circuit wires 34 and 35, respectively, are connected to the binding posts on the upper ends of the elements 32 and 33. A spring metal switch element 36, similar to the element 31, is fixed at its rear end to the flanged portion of the contact element 32 and its free end is adapted to make and break contact with the flanged lower extremity of the element 33.

Extending through the front plate 12, somewhat above the dial 25 and in vertical alinement with the shaft 18, is a squared shaft 37. The inner end portion of the squared shaft 37 is reduced and rounded as at 37' (see Fig. 4), and extends revolvably through a circular opening therefor in the rear plate 13. A screw 37'' is threaded into said end portion of the shaft 37 to retain the same relative to the plate 13.

For the purpose of actuating the switch element 36 of the second circuit, a cam 38 is mounted on an inner portion of the squared shaft 37, a central portion of said cam having a squared opening to receive said shaft portion. On said shaft 37, between the cam 38 and the inner face of the plate 13, is a spacing collar 39. On the other side of said cam 38 the shaft 37 carries a longer spacing collar 40. Revolvably mounted on the shaft 37 at the outer extremity of the collar 40 is a sleeve 41 which has a squared external portion to extend into a squared aperture in the central portion of a first circuit operating cam 42. A spacing collar 43 surrounds the sleeve 41 between the cam 42 and the inner face of the front plate 12. The forward end portion of the sleeve 41 extends revolvably through an enlarged opening therefor in the plate 12, and on a forwardly projecting portion of said sleeve, which is slightly squared, a first circuit operating disc 44 is mounted, the central portion of said disc having a squared opening to receive the extended squared portion of the sleeve 41. A coiled spring 45 surrounds the shaft 37 forwardly of the disc 44 and said spring has one end thereof turned inwardly and secured to a face portion of the disc 44. The other end portion of the spring 45 extends freely outwardly as at 45'. The central squared portion of a second circuit operating disc 46 is mounted on an outer end portion of the squared shaft 37 so as to turn directly therewith. Forwardly of the disc 46 said shaft portion carries a coiled spring 47 which has one extremity bent inwardly and secured to a face portion of the disc 46. The other extremity of said spring 47 extends freely outwardly as at 47'. A washer 48 and a screw 49 retain the assembled parts on the outer end of the shaft 37.

Extending transversely through the front plate 12 adjacent the operating discs 44 and 46, and above the dial 25, is a stud shaft 50 on the outer end of which are mounted in spaced relation intermediate portions of a pair of bell-crank levers 51 and 52 respectively. Said bell-crank levers are revolvable relative to the stud shaft 50. The lever 51 is connected with the disc 44 by means of a spring 53, while the lever 52 is connected with the disc 46 by means of a spring 54. The lever 51 has its inner extremity flanged outwardly so as to lie in the path of movement of the first circuit operating arms 21 and 22. The inner extremity of the lever 52 is likewise angled and flanged outwardly so as to lie in the path of movement of the second circuit operating arms 23 and 24.

When the improved time switch is to be utilized for the making and breaking of two independent electrical circuits, as for instance those which include the electric lights in a pair of independent store windows, the circuit wires 29 and 30 extend from one circuit and are connected to the terminals 27 and 28 as previously described. Likewise the circuit wires 34 and 35 include the lights of the other circuit and are connected to the terminals 32 and 33. Although the switch is susceptible of being operated in a great number of conditions, let it first be assumed that it is desired to have the lights of one window (the first circuit) turned on at 3 o'clock in the afternoon and turned off at 3 o'clock a. m.; and the lights of the other store window (the second circuit) turned on at 5 o'clock in the afternoon and turned off at midnight. Let it also be assumed that the time of day is 10:30 a. m. All of these conditions are represented by the adjustment of the dial and hands depicted in Fig. 1. It should also be observed that the operating discs 44 and 46 are provided with peripheral shoulders 55 and said shoulders are releasably engaged by lugs 56 on the inner sides of the inner legs of the bell-crank levers 51 and 52. As thus secured the discs 44 and 46 are partially turned in a counterclockwise direction and the springs 45 and 47 are under partial compression. The bell-crank levers 51 and 52 are held in said shoulder engaging positions by means of the springs 53 and 54.

With the operating discs thus positioned the squared shaft 37 and the sleeve 41 are turned so as to engage the eccentric projecting portions of the cams 38 and 42 with the forward under portions of the contact elements 36 and 31, whereby said elements are separated from the fixed contacts 33 and 28 respectively, and the circuits to the lights of the two store windows will be broken.

At this point it may be stated that notwithstanding the operation of the clock mechanism to drive the dial, the separate switches may be manually independently operated if it becomes necessary to open or close either of the circuits before the times for which the mechanism is set have automatically operated. To this end, the outer arms of the bell-crank levers 51 and 52 may be manually manipulated so as to swing said levers to release the lugs 56 from the shoulders

55 of the discs. Likewise extensions 46' and 44' on said discs provide means whereby the discs may be manually turned in either direction.

With the condition shown in Figs. 1, 2, 3, 4 and 5, and with the setting of the mechanism as described, the several circuits are open and the lights in the windows are off. With the electric clock mechanism driving the dial 25 through the medium of the gears and shafts, said dial will turn slowly in a clockwise direction. When 3 o'clock in the afternoon is reached the angled end of the arm 23 will engage the angled end of the inner bell-crank lever 51, and as the movement of the dial continues said bell-crank lever will be moved so as to disengage its lug 56 from the shoulder 55 of the inner disc 44. This will be against the tension of the coiled spring 53 and as the other spring 45 for the disc 44 was under compression, said disc 44 will move in a clockwise direction, upon being released, to the position of Fig. 6. This movement of the disc 44 will cause an oscillation of the sleeve 41 in a clockwise direction and the cam 42, carried by said sleeve, will have its high point moved away from the switch element 31 so that said movable switch element will snap into contact with the fixed contact 28 whereby the first circuit will be closed and the lights in the window will light.

As the clock dial 25 moves toward 5 p. m. the extremity of the arm 23 will engage the lower angled end of the outer bell-crank lever 52 and it will similarly kick and move said bell-crank lever so as to disengage its lug 56 from the shoulder 55 of the disc 46. Hence, upon movement of the dial 25 beyond the position depicted in Fig. 6, the outer disc 46 will be released and will swing back to a position coinciding with the position of the inner disc. As the outer disc 46 is mounted on the squared shaft 37 so as to turn the same, this movement of the disc will cause the cam 38 to move away from the spring contact element 36 of the second circuit, whereby said contact element will snap into engagement with its fixed element 33 and complete the circuit to the lights of the second show window.

The clock dial 25 will continue rotating until midnight is approached which is the time set for opening the circuit to the second show window. As the dial 25 with the superimposed arm 24 moves toward the midnight position, the end of the arm 24 will engage the extended portion 47' of the spring 47 and move it toward the right as in Fig. 8, so as to put said spring under compression. The disc 46 was being retained in the position of Fig. 8 by virtue of the lug 56 of the bell-crank lever engaging another shoulder on the disc slightly spaced from the shoulder 55. As the spring 47 is moved and compressed and as the arm 24 engages and moves the bell-crank lever 52, the lug 56 will move out of the shoulder against which it is then seated and it will ultimately, when it is passed by the arm 24 after midnight, snap back and engage the shoulder 55 so as to hold the disc 46 in the position of Fig. 6. Further movement of the dial operates to remove the angled extremity of the arm 24 from the free end 47' of the spring 47 whereby said portion of the spring, being no longer required to be under tension, snaps back to its original position, or that of Fig. 1. At this stage of the operations, therefore, we have the second circuit open due to the fact that the last mentioned movement of the disc 46 on the shaft 37 has turned the shaft so as to engage the high portion of the cam 38 with the switch element 36 to hold said element in the raised position of Fig. 7.

As the clock dial 25 continues to turn, its second operating arm 22 will ultimately engage and compress the spring 45 of the inner disc 44. Also, when 3 o'clock is reached, the end of said arm 22 will kick the lower end of the inner bell-crank lever 51 so as to release its lug 56 from the advanced peripheral shoulder of the inner disc and the contracting force exerted by the spring 45 will turn the disc 44 so as to coincide with the disc 46 and its other shoulder 55 will then be engaged by the lug 56 of the bell-crank lever 51, after the arm 22 has cleared the extremity of said bell-crank lever and it has been permitted to snap to the left by virtue of the spring 53. Also, the extended end of the spring 45 will ultimately be released by the arm 22 and all of the parts will reassume the position shown in Fig. 1. Under these conditions both of the circuits will be broken and this condition will continue throughout all of the morning hours and until 3 p. m. when the first circuit will be closed and the sequence of operations previously described will continue.

The foregoing explanation of the operation of the improved automatic time switch has relation to a certain proposed setting of the controlling hands. Many more combinations or schedules of operation are possible including the following operation of circuits:

First circuit on—second circuit on—both circuits off simultaneously.

Both circuits on simultaneously—first circuit off—second circuit off.

First circuit on—second circuit on—first circuit off—second circuit off.

First circuit on—first circuit off and simultaneously second circuit on—second circuit off.

First circuit on—first circuit off—second circuit on—second circuit off.

First circuit on—second circuit on—second circuit off—first circuit off (this operation was described in detail above).

Several more schedules are mathematically possible and in addition, by setting the two "on" hands together and the two "off" hands together both circuits will operate simultaneously and act as a common single throw time switch, and in this arrangement there may be either a single or double pole wiring.

The improved time switch is a unitary structure of simplified and efficient mechanism which in effect will accomplish all of the functions of two separate switches. The present unitary switch controls two circuits selectively, independently, or simultaneously.

It is obvious that the improved time switch is automatic in its operation, but is also susceptible of manual manipulation when it becomes desirable. The device is furthermore positive and quick in its actions, is of unique and simple construction, and is well adapted for the purposes described.

What I claim as my invention is:

1. An automatic time switch, comprising a time mechanism having a movable time indicating dial, two pairs of adjustable arms moving with said dial, a movable switch element for controlling one electric circuit, a second movable switch element for controlling a second electric circuit, means between one pair of arms and the first switch element whereby movement of said arms with the dial will close and open said switch ele-

ment, and means between the other pair of arms and the second switch element whereby movement of the latter pair of arms with the dial will close and open the second switch element, the means for actuating each switch element including a spring urged oscillatory member, an eccentric connected thereto and operated thereby, and a spring urged pivotal latch for temporarily holding the oscillatory member in either of several positions, the latch extending into the path of movement of one of the pairs of arms and being moved by engagement with the arms.

2. An automatic time switch, comprising a time mechanism having a movable time indicating dial, two pairs of adjustable arms moving with said dial, a movable switch element for controlling one electric circuit, a second movable switch element for controlling a second electric circuit, means between one pair of arms and the first switch element whereby movement of said arms with the dial will close and open said switch element, means between the other pair of arms and the second switch element whereby movement of the latter pair of arms with the dial will close and open the second switch element, the means for actuating each switch element including a spring urged oscillatory member, an eccentric connected thereto and operated thereby, and a spring urged pivotal latch for temporarily holding the oscillatory member in either of several positions, the latch extending into the path of movement of one of the pairs of arms and being moved by engagement with the arms, the latch being manually manipulatable to permit oscillation of its oscillatory member and actuation of a switch independently of automatic operation of the members through normal movement of the time dial.

3. An automatic time switch, comprising a time mechanism having a movable time indicating dial, two pairs of adjustable arms moving with said dial, a movable switch element for controlling one electric circuit, a second movable switch element for controlling a second electric circuit, means between one pair of arms and the first switch element whereby movement of said arms with the dial will close and open said switch element, means between the other pair of arms and the second switch element whereby movement of the latter pair of arms with the dial will close and open the second switch element, the means for actuating each switch element including an oscillatory member, a cam moved thereby, a pivotal latch for temporarily holding the oscillatory member under tension in either of several positions, the latch extending into the path of movement of one of the pairs of arms and being moved by engagement with the arms, and means for putting the oscillatory members under compression during portions of the range of travel of the time dial.

4. A time switch for controlling a pair of independent circuits, comprising two switches having yielding contact members, an oscillatory tubular shaft having a cam thereon cooperable with the contact member of one of said switches to move the same into and out of circuit closing position, a second shaft oscillatable within said tubular shaft and carrying an outwardly extending cam cooperable with the contact member of the other switch to move the latter into and out of circuit closing position, an oscillatory disc on each of said shafts, movable clock mechanism, spring urged pivotal latch members independently engageable with separated portions of the disc members for temporarily holding the same in either of several positions, and means controlled by said clock mechanism for selectively operating said latch members whereby movement of said disc members and consequent movement of the shafts, cams, and contact members for selective control of the switches is accomplished.

5. A time switch for controlling a pair of independent circuits, comprising two switches having yielding contact members, an oscillatory tubular shaft having a cam thereon cooperable with the contact member of one of said switches to move the same into and out of circuit closing position, a second shaft oscillatable within said tubular shaft and carrying an outwardly extending cam cooperable with the contact member of the other switch to move the latter into and out of circuit closing position, an oscillatory disc on each of said shafts, movable clock mechanism, spring urged pivotal latch members independently engageable with separated portions of the disc members for temporarily holding the same in either of several positions, and means controlled by said clock mechanism for selectively operating said latch members whereby movement of said disc members and consequent movement of the shafts, cams, and contact members for selective control of the switches is accomplished, said latch members also being manually operable independently of clock controlled means.

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