May 28, 1935. C. F. WALLACE 2,002,804

CIRCUIT CONTROLLING DEVICE

Original Filed Aug. 29, 1927 3 Sheets-Sheet 1

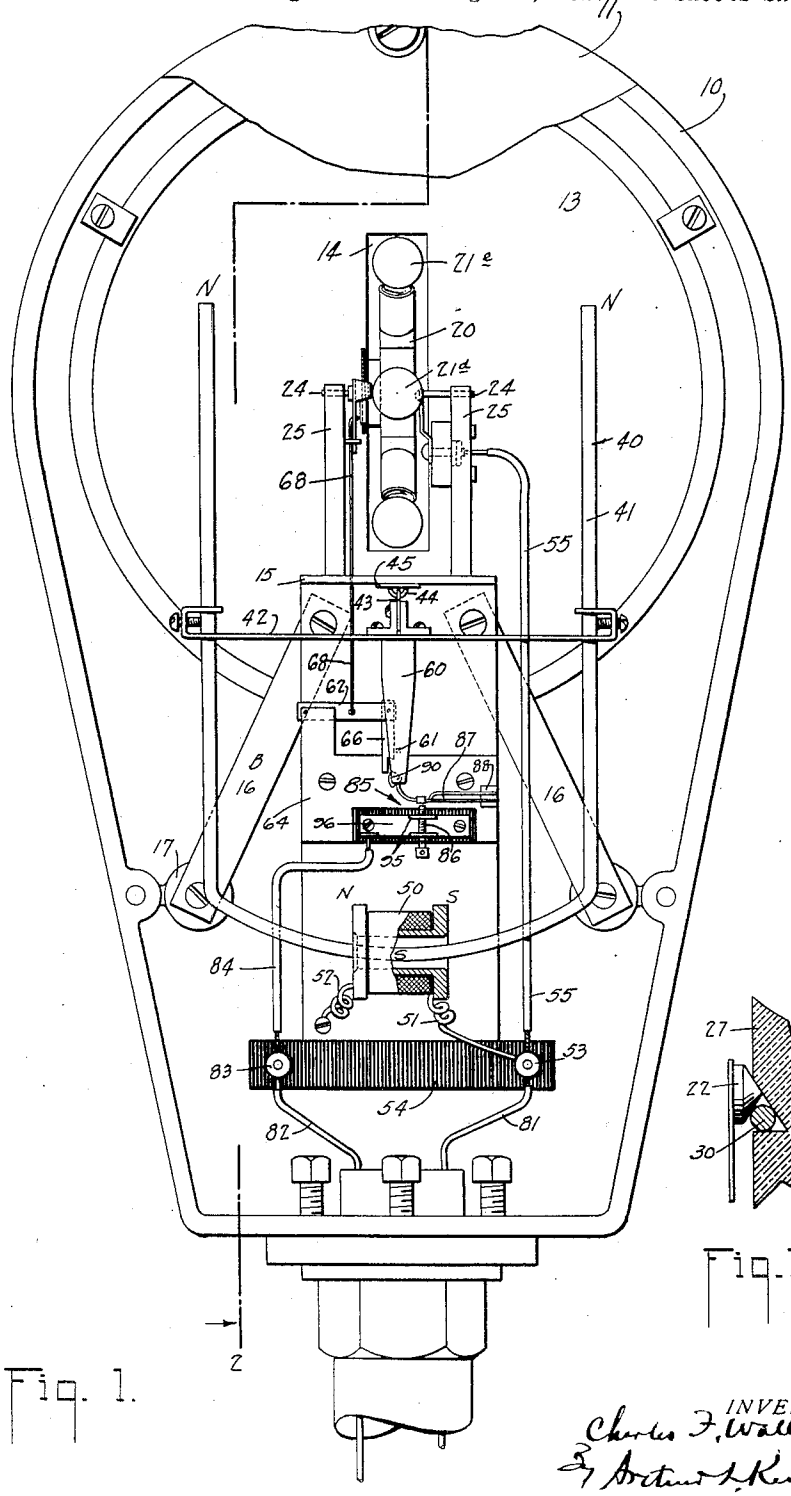


Fig. 1.

Fig. 11.

INVENTOR
Charles F. Wallace
By Arthur L. Kent
his ATTORNEY

May 28, 1935. C. F. WALLACE 2,002,804

CIRCUIT CONTROLLING DEVICE

Original Filed Aug. 29, 1927 3 Sheets-Sheet 2

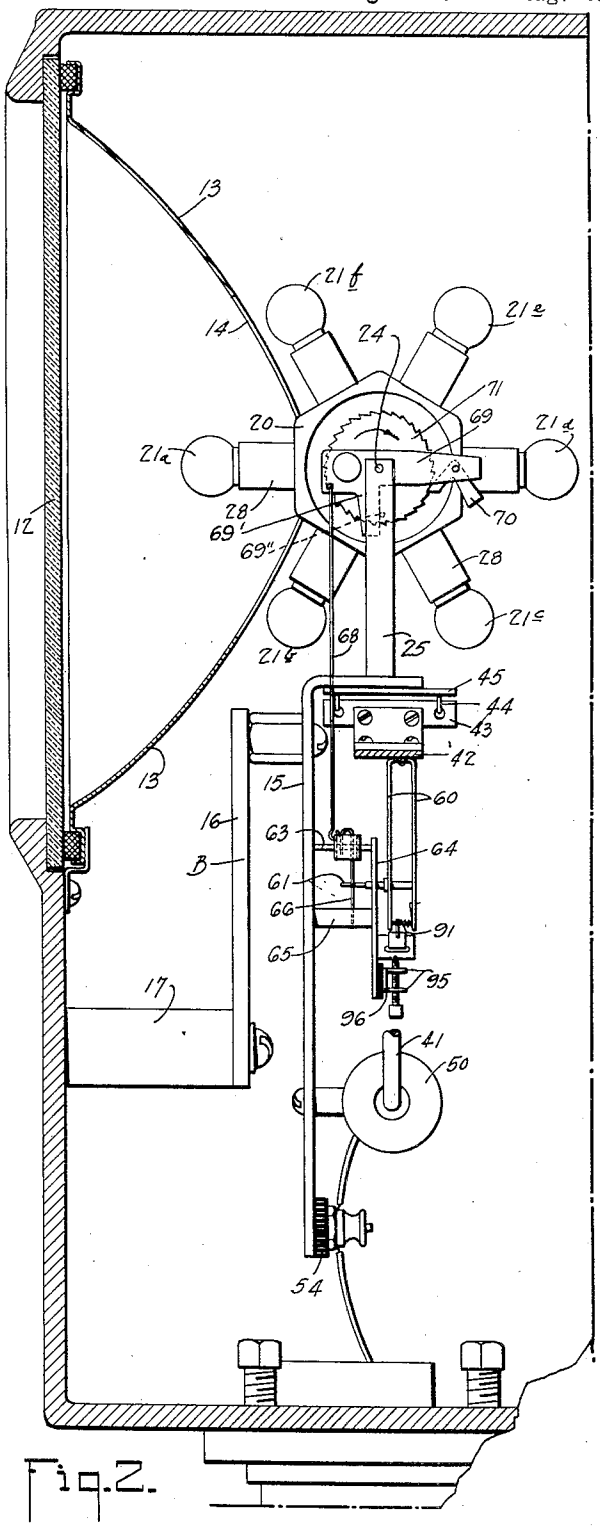


Fig. 2.

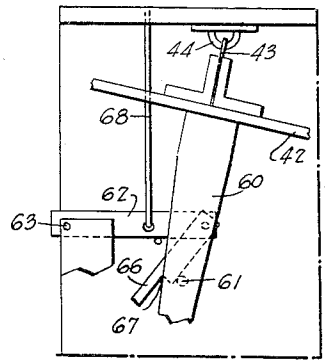


Fig. 3.

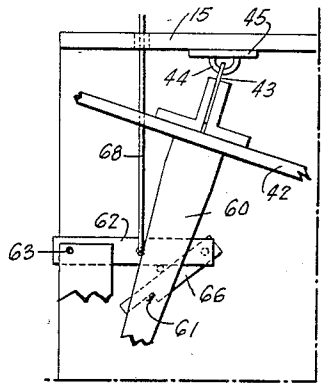


Fig. 4.

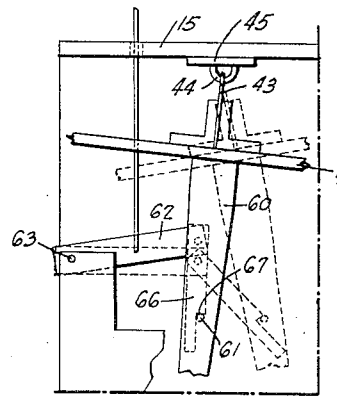


Fig. 5.

INVENTOR
Charles F. Wallace
By Arthur A. Kent
ATTORNEY

May 28, 1935. C. F. WALLACE 2,002,804

CIRCUIT CONTROLLING DEVICE

Original Filed Aug. 29, 1927 3 Sheets-Sheet 3

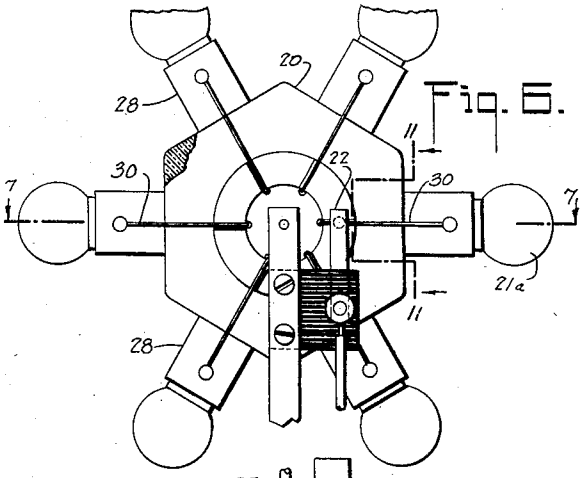


Fig. 6.

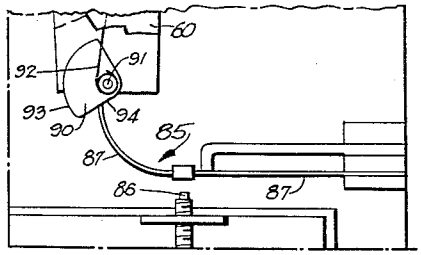


Fig. 8.

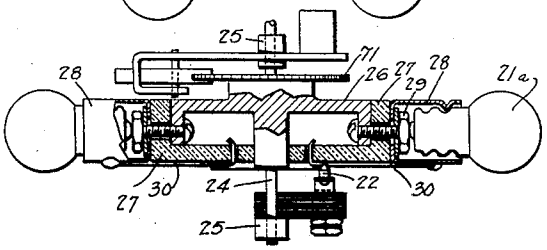


Fig. 7.

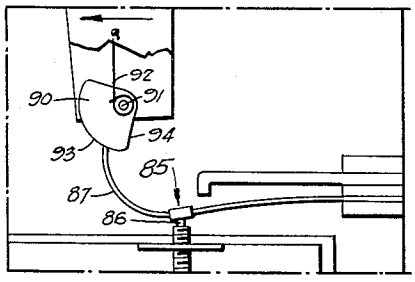
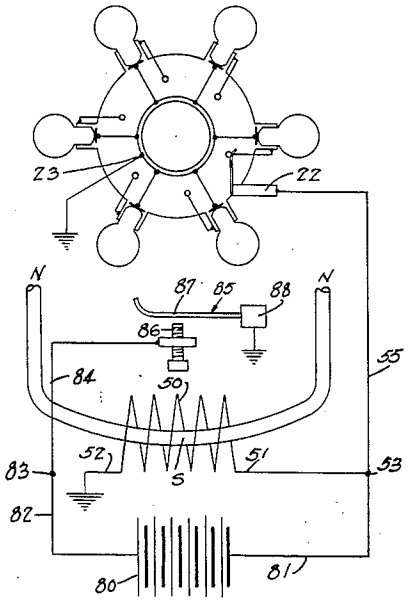


Fig. 9.

Fig. 10.



INVENTOR
Charles F. Wallace
By Arthur J. Kent
his ATTORNEY

Patented May 28, 1935

2,002,804

UNITED STATES PATENT OFFICE

2,002,804

CIRCUIT CONTROLLING DEVICE

Charles F. Wallace, Westfield, N. J., assignor to Wallace & Tierman Products, Inc., Belleville, N. J., a corporation of New Jersey

Original application August 29, 1927, Serial No. 216,080. Divided and this application August 11, 1933, Serial No. 684,631

4 Claims. (Cl. 200—30)

This invention relates to circuit controlling devices, and more particularly to devices for intermittently closing and opening an electric circuit, such, for example, as the feed circuit of a lamp used in a signal device of flash-beacon type.

It is an object of the present invention to provide simple but reliably operative means for causing periodic circuit closure with a minimum of surface friction and with a minimum net loss of energy in the actuating means.

As many flash-beacon signals are located in remote places where they are dependent on battery operation, and frequently on dry batteries, it is important that the apparatus be constructed to operate with a low consumption of current. In the flash-beacon of my application Serial No. 216,080, filed August 29, 1927, of which this is a division, the duration of each flash is very short, and as the actuating devices or circuit controls operate with small demand on the source of electrical energy, the apparatus may stand in operation for long periods of time without attention. The present invention is, therefore, particularly suited to meet the requirements of flash-beacon signals, although, obviously, it may serve other purposes.

To demonstrate the relation of the general principle of the invention to a specific condition, the invention is shown in the drawings and is hereinafter described in connection with the electromagnetic pendulum control of the flashing-light signal system of my said application Serial No. 216,080.

In the drawings:

Fig. 1 is a back elevation of a signal device embodying the invention, with the back cover broken away;

Fig. 2 is a side elevation with the casing sectioned on the line 2—2 of Fig. 1 and its rear portion cut away;

Figs. 3, 4 and 5 are enlarged detail views showing the positions of the pendulum and trip bar shown in Fig. 1 at various different times during the operation of the device;

Fig. 6 is a side elevation of the light carrier which is shown from the other side in Fig. 2;

Fig. 7 is a plan view of the light carrier partly sectioned on the line 7—7 of Fig. 6;

Figs. 8 and 9 are enlarged fragmentary back elevations showing different positions of the switch operating mechanism shown in Fig. 1;

Fig. 10 is a diagram of the electric connections of the device; and

Fig. 11 (on Sheet 1) is an enlarged fragmentary vertical section taken on the line 11—11 of Fig. 6 showing the lamp contact mechanism.

The signal device illustrated in Figs. 1 to 11 has a casing 10 provided with a removable back cover 11. In the upper part of the front wall of the casing is a window 12 behind which is a parabolic reflector 13 having a vertical slot 14 in its central portion. The working parts of the device are supported from a main bracket 15 which is rigidly held in the central portion of the casing by bars 16 secured to posts 17 projecting inwardly from the front wall of the casing.

The signal device is provided with a movable lamp carrier 20, which can be made to carry any desired number of incandescent electric lamps 21*a*, 21*b*, etc. A pair of electric terminals 22, 23 are so arranged that the movement of the carrier 20 causes the electric lamps to be successively connected in a lighting circuit. The carrier 20 is in the form of a wheel having a shaft 24 journaled in two posts 25 rising from the top of the main bracket 15. The shaft 24 and the inner portion 26 of the wheel are of conducting material, while one side and the periphery of the wheel are made of insulating material 27. Lamp sockets 28 are secured about the periphery of the portion 27, and the inner terminal 29 of each socket is insulated from the side wall of the socket and is connected by a screw with the conducting portion 26 of the wheel and is thus grounded through the shaft to the bracket, so that in this instance the terminal 23 is the grounded metallic portion of the wheel 20. To the peripheral portion of each socket is connected a wire 30 which extends radially inward along the insulated face of the wheel. The wire 30 of each lamp comes in contact with the spring terminal 22 when the lamp is positioned at the focus of the reflector 13. Thus, when the lamp carrier 20 is rotated, the lamps are successively brought into the focus of the reflector and into circuit between the terminals 22 and 23.

The device has an oscillating member, which most desirably and as shown is a magnetic pendulum 40 formed by a U-shaped bar 41 magnetized in its lower central portion as indicated on Fig. 1 and supported by a transverse bar 42, which has secured at its center a thin upwardly projecting plate 43 by which the pendulum is suspended from staples 44 projecting downwardly from a plate 45 secured to the top of the main bracket 15, the staples passing through openings in the plate 43. The bearing provided by the staples 44 in the plate 43 is located above the center of gravity of the pendulum but consider-

ably below its upper end, the pendulum being a compound pendulum and being proportioned according to the period of oscillation desired.

A fixed coil 50 surrounds the lower magnetized part of the bar 41 of the pendulum, and the ends 51, 52 of this coil are connected respectively with the terminals 22 and 23 (see Fig. 10). The end 51 of the coil is secured to a binding post 53 mounted on an insulating bar 54 carried by the main bracket, and this post is connected by a conductor 55 to the terminal 22. The end 52 of the coil is grounded to the main bracket, and is thus connected to the grounded lamp terminal 23. Consequently, when the filament of the electric lamp 21*a* is intact, the coil 50 is in a closed circuit. Under these circumstances, the oscillation of the pendulum 40 moving the magnet bar 41 to and fro through the coil generates a flow of electric current through the coil and its closed circuit, and the energy thus dissipated is, of course, drawn from the kinetic energy of the pendulum. Consequently, when a small properly timed force is applied to the pendulum to sustain its oscillation, the amplitude of its oscillation is less when the circuit containing the coil 50 is closed than when the coil is open-circuited.

With the magnetic pendulum 40 and the damping coil 50 in series with the active lamp are combined means for utilizing the large amplitude oscillation of the pendulum, which occurs when the damping coil 50 is open-circuited by the burning out of the filament in the lamp for the purpose of removing the burned out lamp and replacing it with a new one whose filament is intact. Such means include, in the form shown, a rigid double bar 60 depending from the cross-piece 42 of the pendulum, and carrying a projecting pin 61, and a lever 62 pivoted on a pin 63 extending between the main bracket 15 and a vertical plate 64 fixed on posts 65 secured to the main bracket. The lever 62 has at its free end a hanging trip bar 66 provided with a shoulder 67 which is at a lower level than the pin 61 when the bar hangs vertically. A rod 68 limits downward turning of the lever 62. The trip bar 66 hangs close to the pin 61 projecting from the depending bar 60, as shown in Fig. 1, and the shoulder 67 is so positioned that with only a normal amplitude oscillation of the pendulum, such as occurs when the coil 50 is in closed circuit, the pin 61 does not move under the shoulder 67 but merely strikes the side of the trip bar 66 as shown in Fig. 3. When, however, the filament of the lamp burns out, open-circuiting the coil 50, and the amplitude of the oscillation of the pendulum becomes greater, the pin 61 in its left-hand swing moves far enough to enter under the shoulder 67 as shown in Fig. 4, so that as the pendulum and pin start back towards the right, the pin raises the shoulder 67, thereby lifting the trip bar 66, and tipping up the free end of the lever 62 as shown in Fig. 5.

The tipping up of the lever 62 may be used in various different ways to actuate the lamp carrier 20 so as to move the burnt out lamp away from the terminal 22, and to bring the next lamp into contact with it. In the form shown in Fig. 1, the lever 62 is connected by the rod 68 with a lever 69 pivoted on the shaft 24 and having a downwardly extending arm 69′ abutting a pin 69″ projecting from the post 25. The lever 69 carries a pawl 70 which engages a ratchet wheel 71 fixed on the lamp carrier 20. The movements of the lever 62, which occur on the large amplitude swings of the pendulum after the filament of a lamp is burnt out, thus serve to ratchet the lamp carrier 20 around until the next lamp is brought into the focus of the reflector 13 and its contact-wire into contact with the terminal 22. As soon as this occurs, the filament of the new lamp closes the circuit of the coil 50, thus damping the oscillation of the pendulum, so that the pin 61 ceases to enter under the shoulder 67 and the movement of the carrier 20 stops. The carrier then remains stationary until the filament of the active lamp is burnt out or broken.

A part of the above described means for damping the oscillation of the pendulum may be utilized as a means for sustaining the oscillation of the pendulum 40. This is accomplished by causing a momentary flow of electric current through the coil 50 on each oscillation of the pendulum in such a direction that the action of the coil as a solenoid tends to accelerate the movement which the pendulum has at the time. A source of electromotive force, such as the battery 80 shown diagrammatically in Fig. 10, has one of its terminals connected by a wire 81 to the binding post 53 and thus to the end 51 of the coil 50. The other terminal of the battery is grounded to the main bracket 15 through a wire 82, binding post 83, wire 84 and switch 85, so that when the switch is closed this terminal of the battery is connected through ground to the end 52 of the coil 50. The switch 85 has a fixed insulated contact 86, and a movable contact 87 formed by a leaf spring fixed at its outer end in a block 88 mounted on the plate 64 and thus grounded to the main bracket. The binding post 83 is mounted on the insulating bar 54.

The switch 85 is closed at a predetermined point of each oscillation of the pendulum through the engagement of the spring contact 87 by a quadrant-shaped member 90 carried on the lower end of the double bar 60 of the pendulum. The quadrant-shaped engaging member 90 is pivotally mounted to turn freely on an axis 91 extending across the lower end of the double bar 60, and is normally held in the position shown in Fig. 1 by a light coiled spring 92. On each swing of the pendulum toward the left in Fig. 1, the concentrically curved edge 93 of the member 90 engages the upwardly turned end of the leaf spring 87 and then, as the movement of the pendulum continues, the member 90 turns on its pivot without changing its point of contact with the end of the spring and depresses the spring into contact with the fixed contact member 86, as shown in Fig. 9. There is thus no rubbing friction between the pendulum and the movable contact member of the switch, and the retardation of the pendulum which would result from such rubbing contact is avoided. The energy expended by the pendulum in depressing the spring through the rolling contact of the member 90 with the end of the spring is, at least largely, returned to the pendulum by the pressure of the end of the spring against the member 90 after the axis of the member 90 has passed beyond the line extending from the end of the spring at right angles to the direction of movement of said axis. When the continued movement of the pendulum has carried the member 90 out of engagement with the contact spring, the member is returned by its light coil spring to its normal position, and on the succeeding swing of the pendulum to the right as viewed in Fig. 1 the radial edge 94 of the member 90 strikes the end of the contact spring as shown in Fig. 8 and the member 90 tips up and passes over the end of the contact

spring without depressing it, and, because of the very light force exerted by the coil spring 91, this engagement of the member 90 with the end of the contact spring offers very little resistance to the movement of the pendulum.

The source of electromotive force 80 and the switch 85 are used to cause flashing of the lamp which is in operating position. This is accomplished by means of the connections already described, since when the switch 85 is closed, one terminal of the battery is connected with the terminals 20 of the lamp sockets through wires 82 and 84, the switch 85, the main bracket and the metallic portion of the lamp carrier which forms the grounded lamp terminal 23, while the other terminal of the battery is permanently connected with the lamp terminal 22 through the wire 81 and conductor 55. Therefore, when the switch 85 is closed, current from the battery flows through both the coil 50 and the lamp filament in parallel. The coil is of relatively high resistance compared to the lamp, so that only a small part of the current flows through the coil.

The battery or other source of electromotive force may be of higher voltage than that for which the filament of the lamp is intended and the application of this voltage to the lamp may be cut off so quickly that the filament is not heated beyond its normal operative temperature. The use of the higher voltage reduces the time required to heat the lamp filament to the desired brilliancy, and the total period of time during which the current flows through the lamp is extremely short. I have ascertained that by this expedient the normal length of life of both the lamp and the battery may be increased, while at the same time the flashes although very brief may be of strong intensity so as to serve as an effective signal. A very high efficiency is thus secured, a desired signal light being secured at a very low lamp and battery cost. Regulation of the length of time during which the switch 85 is closed on each oscillation of the pendulum is accomplished in the construction shown by adjustment of the position of the fixed contact 86 of the switch. To provide for such adjustment, the contact 86 is made in the form of a screw set in threaded openings in two tabs 95 extending from an insulated plate 96. In order that the contact screw shall be held in its position of adjustment, the tabs 96 after their openings are tapped are slightly relatively upset before the contact screw is inserted.

If the voltage of the battery drops due to use, the pendulum will swing at a smaller amplitude and lower speed and the switch member 87 will be held closed for a longer period, thus compensating for the lower voltage applied to the lamp and preventing the drop in brilliancy of flash which would otherwise result from the drop in voltage of the battery.

It will be seen that the invention provides an electric circuit control which is particularly suited to use with battery-operated flash beacons and especially those employing a dampened pendulum action. On the other hand, it will be obvious that the controlling device may be of general application serving to make and interrupt a circuit with slight demand on the power source and in a manner which regulates itself favorably to the decrease in energy at said source.

What is claimed is:

1. A circuit controlling device, comprising a normally open switch having a movable member, an oscillating member, and an engaging member pivotally mounted on the oscillating member and shaped and normally positioned to engage the movable switch member and to turn while in engagement therewith to maintain a fixed point of engagement with the switch member and to move the switch member to close the switch on the movement of the oscillating member in one direction and on engagement with the switch member on the movement of the oscillating member in the other direction to turn and pass over the switch member without moving it to close the switch.

2. A circuit controlling device, comprising a normally open switch having a movable member, an oscillating member, a quadrant-shaped engaging member pivotally mounted on the oscillating member, and a light coiled spring tending to hold the engaging member in position such that its concentric surface comes into engagement with the movable switch member on the movement of the oscillating member in one direction and one of its radial surfaces comes into engagement with the movable switch member on the movement of the oscillating member in the other direction, the engaging member being free to turn in either direction against the light resistance of its spring from its normal position in which the spring tends to hold it.

3. In a circuit controlling device, the combination with an oscillating member and a movable switch member to be operated thereby, of an engaging element pivotally mounted on one of said members, and a spring normally positioning said engaging element to engage the other member when the oscillating member is swinging in one direction, the engaging parts being shaped and relatively positioned to cause pivotal movement of the engaging element and bodily movement of the movable member while maintaining a fixed point of engagement between them during continued swing of the oscillating member in said direction, and said engaging element being freely pivotally movable to turn and pass said other member without moving it when the oscillating member swings in the opposite direction.

4. In a circuit controlling device, the combination with a moving member and a movable switch member, of an engaging element pivotally mounted on one of said members and shaped and yieldingly held on its pivot normally in position to engage the other member and being free to turn in engagement with said other member to maintain a fixed point of engagement therewith, thereby to move the movable member during continued movement of the moving member.

CHARLES F. WALLACE.