April 17, 1934. C. F. WALLACE 1,955,616

SIGNAL DEVICE

Filed Aug. 29, 1927 3 Sheets-Sheet 1

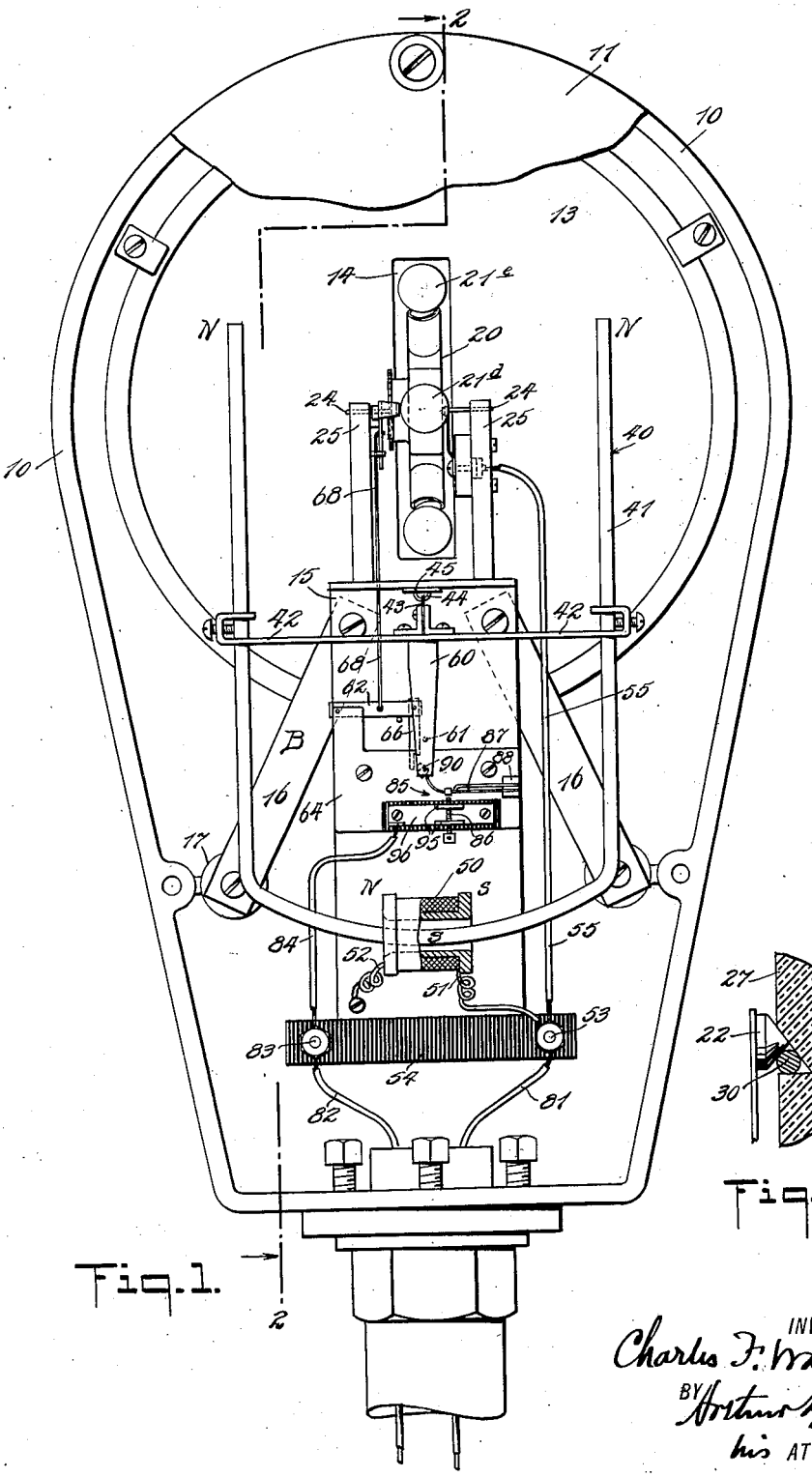

Fig. 1.

Fig. 11.

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SIGNAL DEVICE

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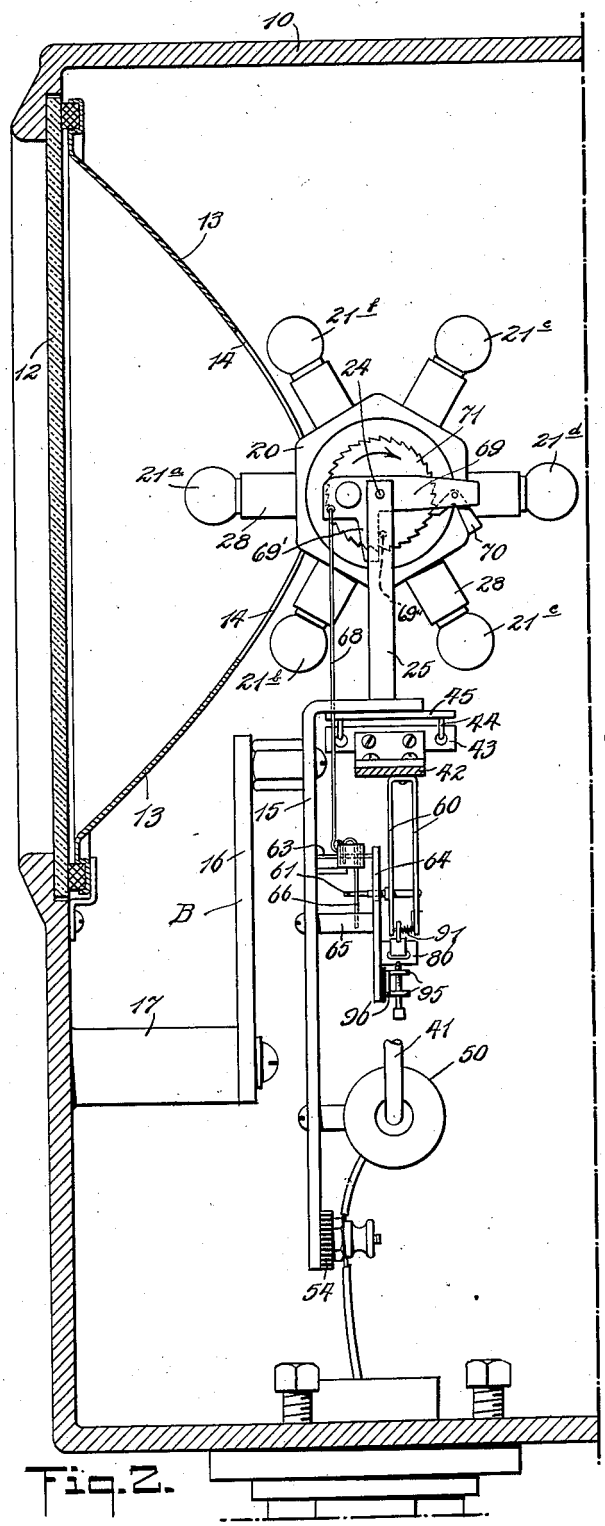

Fig. 2.

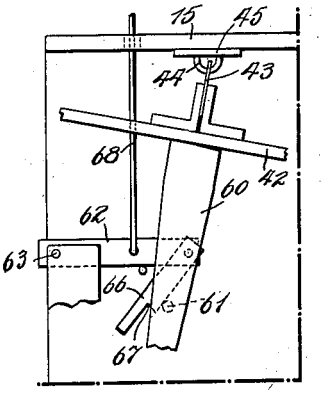

Fig. 3.

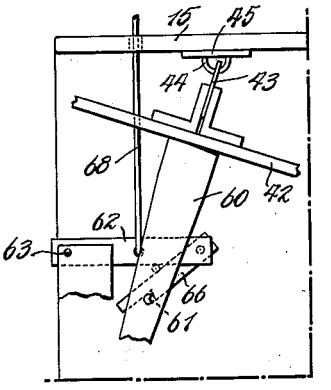

Fig. 4.

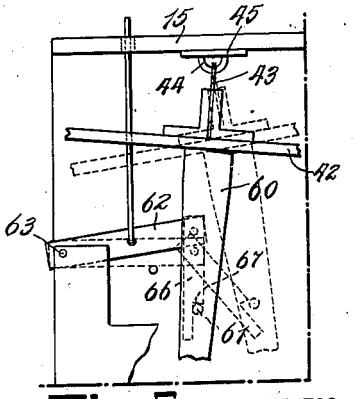

Fig. 5.

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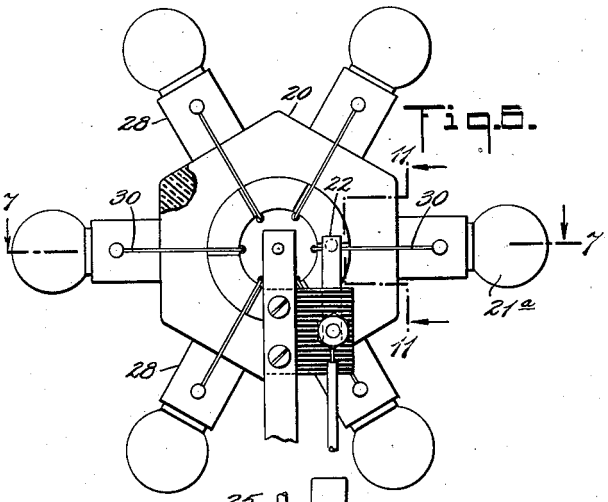

Fig. 5.

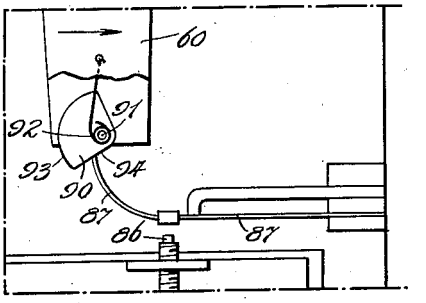

Fig. 6.

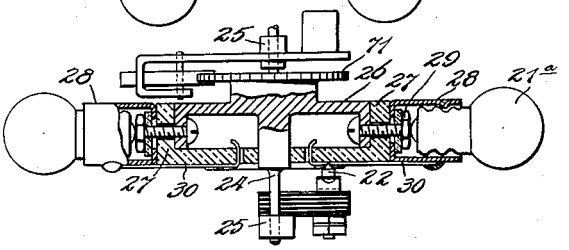

Fig. 7.

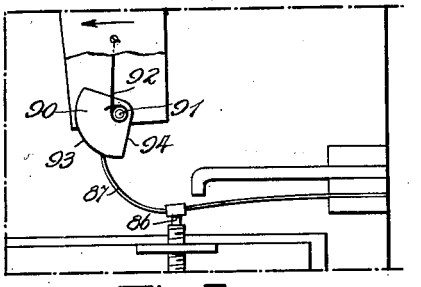

Fig. 9.

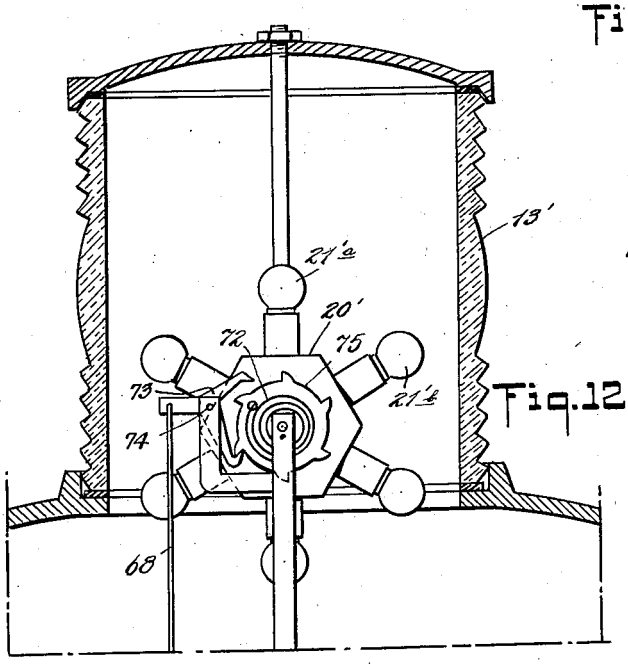

Fig. 12.

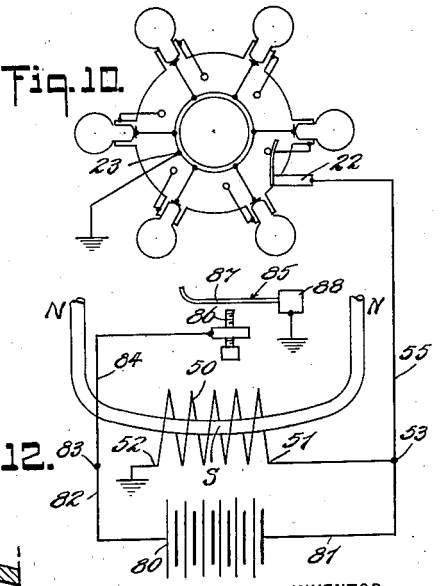

Fig. 10.

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Patented Apr. 17, 1934 1,955,616

UNITED STATES PATENT OFFICE

1,955,616

SIGNAL DEVICE

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Application August 29, 1927, Serial No. 216,080

16 Claims. (Cl. 177—329)

This invention relates to signal devices, and aims to provide a signal device which will operate automatically over long periods of time without attention.

Although the invention is adapted to numerous other uses, it is especially useful when embodied in a land or marine traffic signal. Such signals when made in accordance with the invention may be placed in remote places and will operate to show a flashing light over very long periods, if a supply of electric current is available. If not, the device may be operated by a suitable battery and will continue in operation until the battery is discharged. As only momentary flows of current are used by the device, its automatic operation is extremely long even when dry batteries are used.

The length of the automatic operation of an ordinary electric traffic signal is limited by the life of the incandescent electric lamp which it contains. An important feature of the present invention is to provide for automatic renewal of an incandescent electric lamp in a signal device, so that the life of such lamps is not a limiting factor in determining the time during which the device will operate. Other features and advantages are hereinafter pointed out in connection with a detailed description of specific embodiments of the invention shown in the accompanying drawings, in which:

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.

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; and

Fig. 12 is a view partly in section and partly in elevation of a signal device having a modified form of lamp carrier actuating mechanism mounted within a Fresnel lens.

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 particular mechanical arrangement of the lamp carrier and terminals is not an essential part of the invention, but it may be noted that in the form illustrated 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 considerably 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.

Various different means may be utilized to sustain the oscillation of the pendulum and to supply momentarily a lighting current to the terminals 22, 23 to flash the lamp in contact therewith. Particular means for accomplishing these purposes form part of the present invention; but, in its broader sense, the invention is independent of the particular pendulum-oscillating and lamp-lighting means used.

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.

Another means for utilizing the movement of the lever 62 to replace the lamp is illustrated in Fig. 12. In this case, the lamp carrier 20′ is constantly urged to rotate by means of a coil spring 72, and is normally held against rotation by engagement of an escapement lever 73, pivoted at 74, with a tooth of a spur wheel 75 fixed to the carrier 20′. The rod 68 is connected to the lever 73, so that when this rod is moved up and then down by the lever 62, the escapement lever is actuated to permit the carrier to turn through the arc which separates adjacent teeth of the spur wheel 75. This arc may be made the same as that which separates adjacent lamps on the carrier, so that a single up and down movement of the lever 62 results immediately in replacing the lamp by a new lamp. It should be noted also that in the modification shown in Fig. 12, the lamp carrier is mounted within a Fresnel lens 13′, and the active lamp is brought into the focus of the lens instead of to the focus of a reflector.

A feature of the invention consists in utilizing a part of the above described means for damping the oscillation of the pendulum as part of 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 pre-determined 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. 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.

A further feature of the invention consists in utilizing the same source of electromotive force 80 and the same switch 85 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 29 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.

Still another feature of the invention consists in using a battery or other source of electromotive force of higher voltage than that for which the filament of the lamp is intended and in cutting off the application of this voltage to the lamp 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.

It should be noted, that if the voltage of the battery drops due to use, the pendulum will swing at a smaller amplitude and lower speed so that 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 a signal device which may be made to operate over very long periods of time without attention and at very low cost of lamps and batteries or other source of electric current. It is to be understood that the invention is not to be limited to the exact constructions shown and to which the foregoing description has been largely directed, but that it includes changes and modifications thereof within the claims, and that features of the inventio may be embodied in a device having only a single lamp.

What I claim is:

1. In a flashing light system having a lighting circuit with a periodically operative circuit interrupter, the combination with a plurality of lamps mounted for movement one after another into said lighting circuit, of means controlled by the breaking of the filament of the lamp in the lighting circuit adapted to move another of said lamps into the circuit, said means being ineffective to perform the lamp moving operation during the circuit interruptions of the lighting circuit when a lamp having an unbroken filament is includeded therein.

2. A signal device, comprising a carrier, a plurality of lamps thereon, an electrical circuit including a source of electrical energy, contacts in said circuit to electrically connect said lamps as said carrier moves them one after another into said circuit, interrupter contacts in said circuit, and means energized from said source of electrical energy for periodically operating said interrupter contacts to cause successive flashes of the connected lamp while its filament is unbroken and upon breaking of said filament to cause movement of the lamp carrier until a succeeding lamp with unbroken filament is positioned in said circuit.

3. In a flashing light system, in combination, electric circuit means including a source of electrical energy and a coil, a plurality of filament lamps arranged for successive inclusion in said circuit means, a device for intermittently varying the condition of said circuit means to effect continued flashing of one of said plurality of lamps included therein, and a device, responsive to a condition of the coil in said circuit means established when the filament of said included lamp is broken and maintained ineffective during the flashing operation of the system when said filament is unbroken, adapted to include in said circuit means another of said plurality of lamps.

4. In a flashing light system, in combination, a rotatable carrier having a plurality of filament lamps thereon, electric circuit means including a source of electric energy and one of said lamps,

a circuit controlling device continuously operative to make and break the electric circuit, and means for rotating said carrier to position another lamp in the circuit, the last said means being normally ineffective during the normal flashing operation of its system and said means comprising an intermittently acting pawl and ratchet device adapted to respond to continued makes and breaks in the circuit after the lamp positioned in the circuit fails to convey current and thereupon rotate the said carrier until the positioning in the circuit of another lamp renders the pawl and ratchet device ineffective.

5. A signalling device including a plurality of electric lamps, means mounting said lamps for movement successively into operative position and for connecting the operatively positioned lamp in an electric circuit, an oscillatory member, means for causing said oscillatory member to oscillate at a certain amplitude when the filament of the operatively positioned lamp is intact, and for causing said oscillatory member to oscillate at a larger amplitude when said lamp filament is broken, said means including means for flashing said operatively positioned lamp at each oscillation, and means operated by said oscillatory member, inoperative at said smaller amplitude of oscillation and operative at said larger amplitude of oscillation for operating said lamp mounting means to substitute a lamp with an unbroken filament for a lamp with the broken filament.

6. A signal device, comprising an electric lamp having a filament, a battery of a voltage higher than that for which said filament is intended, a switch, a circuit including the lamp and the battery and the switch in series, means for intermittently lighting the lamp comprising a switch closing and opening member driven by electric current from said battery so that its rate of movement depends upon the voltage of said battery, whereby as the voltage of the battery decreases the speed of movement of said member will decrease and the switch will be closed for a longer period.

7. A signal device comprising an optical system, a plurality of electric lamps, means for mounting the lamps for movement one after another into position in said system, a lighting circuit including means whereby the positioned lamp is connected in the circuit, an oscillating member, means for damping the oscillation of said member while the filament of the positioned lamp is intact, and means controlled by undamped oscillation of said member for moving the next lamp into position, said device including means for oscillating said oscillating means.

8. The combination of a plurality of electric lamps, means mounting the lamps for movement one after another into a lighting circuit, an oscillating member, means for damping the oscillation of said member while the filament of the lamp positioned in the lighting circuit is intact, and means controlled by undamped oscillation of said member for moving the next lamp into the lighting circuit, whereby the positioned lamp, when burnt out, is automatically replaced by another lamp, said device including means for oscillating said oscillating member.

9. The combination of a plurality of electric lamps, means mounting the lamps for movement one after another into operative position, a lighting circuit, means connecting the positioned lamp in the lighting circuit, a pendulum, means for damping the oscillation of the pendulum while the filament of the positioned lamp is intact, and means controlled by undamped oscillation of the pendulum for moving the next lamp into the lighting circuit, said device including means for oscillating said pendulum.

10. A signal device, comprising a plurality of electric lamps, means mounting the lamps for movement one after another into operative position, a lighting circuit, means for connecting the positioned lamp in the lighting circuit, a magnetic pendulum, means controlled by the pendulum for controlling the lighting circuit to cause intermittent lighting of the positioned lamp, a damping coil associated with said pendulum and connected across the terminals of the positioned lamp, and means controlled by undamped oscillation of said pendulum for moving the next lamp into the lighting circuit, said device including means for oscillating said pendulum.

11. A signal device, comprising a plurality of electric lamps, a carrier for said lamps movable to bring the lamps successively into operative position, a lighting circuit, means for connecting the positioned lamp in the lighting circuit, a magnetic pendulum, means actuated on each oscillation of the pendulum to momentarily close the lighting circuit to cause intermittent lighting of the positioned lamp, a damping coil associated with the pendulum and connected across the terminals of the positioned lamp, and means controlled by undamped oscillation of the pendulum for moving the lamp carrier to position the next lamp.

12. A signal device, comprising a plurality of electric lamps, a carrier for said lamps movable to bring the lamps successively into operative position, a lighting circuit, means for connecting the positioned lamp in the lighting circuit, a magnetic pendulum, a damping coil associated with said pendulum and connected across the terminals of the positioned lamp, means controlled by undamped oscillation of said pendulum for moving the lamp carrier to position the next lamp, and means actuated on each oscillation of the pendulum to cause a momentary flow of electric current through said coil to sustain the oscillation of the pendulum.

13. A signal device, comprising a lamp carrier for carrying a plurality of electric lamps and movable to bring the lamps successively into operative position, a magnetic pendulum, a damping coil associated with the pendulum and connected in a closed circuit in series with the positioned lamp, means controlled by undamped oscillation of the pendulum for moving the lamp carrier to position the next lamp, and circuit connections and means actuated on each oscillation of the pendulum to connect a source of electric energy across the terminals of the positioned lamp and the coil to cause momentary flow of current in parallel through the coil and the lamp terminals to light the lamp intermittently and to sustain the oscillation of the pendulum.

14. A signal device, comprising a plurality of electric clamps, means for moving the lamps successively into operative position, a closed electric circuit containing a damping coil and the positioned lamp connected in series, a battery connected in said circuit, a switch connected in said circuit on one side of said battery, a magnetic pendulum extending through said coil, means carried by the pendulum for closing said switch momentarily on each oscillation of the

pendulum causing a flow of current through the coil to sustain the oscillation of the pendulum and a flow of current through the lamp to flash the lamp, and means controlled by the undamped oscillation of the pendulum which occurs when said damping coil is open circuited by the breaking of the filament of the lamp for operating the lamp positioning means to remove the positioned lamp and to replace it by another.

15. In a signal device, the combination with a plurality of electric lamps, means for moving the lamps successively into operative position, a lighting circuit, and means for connecting the positioned lamp in the lighting circuit, of a magnetic pendulum, means for oscillating the pendulum and for damping the oscillation of the pendulum while the filament of the positioned lamp is intact comprising a coil associated with the pendulum and connected in a closed circuit in series with the positioned lamp, a projection on the pendulum, a swinging trip bar mounted in position to be engaged by said projection and movable bodily upward and having a shoulder positioned so that on damped oscillations of the pendulum said projection does not enter under the shoulder but on undamped oscillations said projection enters under the shoulder and on its return movement raises the trip bar, and means controlled by the bodily movement of the trip bar for moving the next lamp into position.

16. The combination of a plurality of electric lamps, means mounting the lamps for movement one after another into a lighting circuit, an oscillatable magnet element, means for oscillating said magnet element including a coil having a damping characteristic, said coil being arranged in a closed circuit in series with the positioned lamp, and means controlled by said magnetic element in its undamped oscillation for moving the next lamp into the lighting circuit.

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