

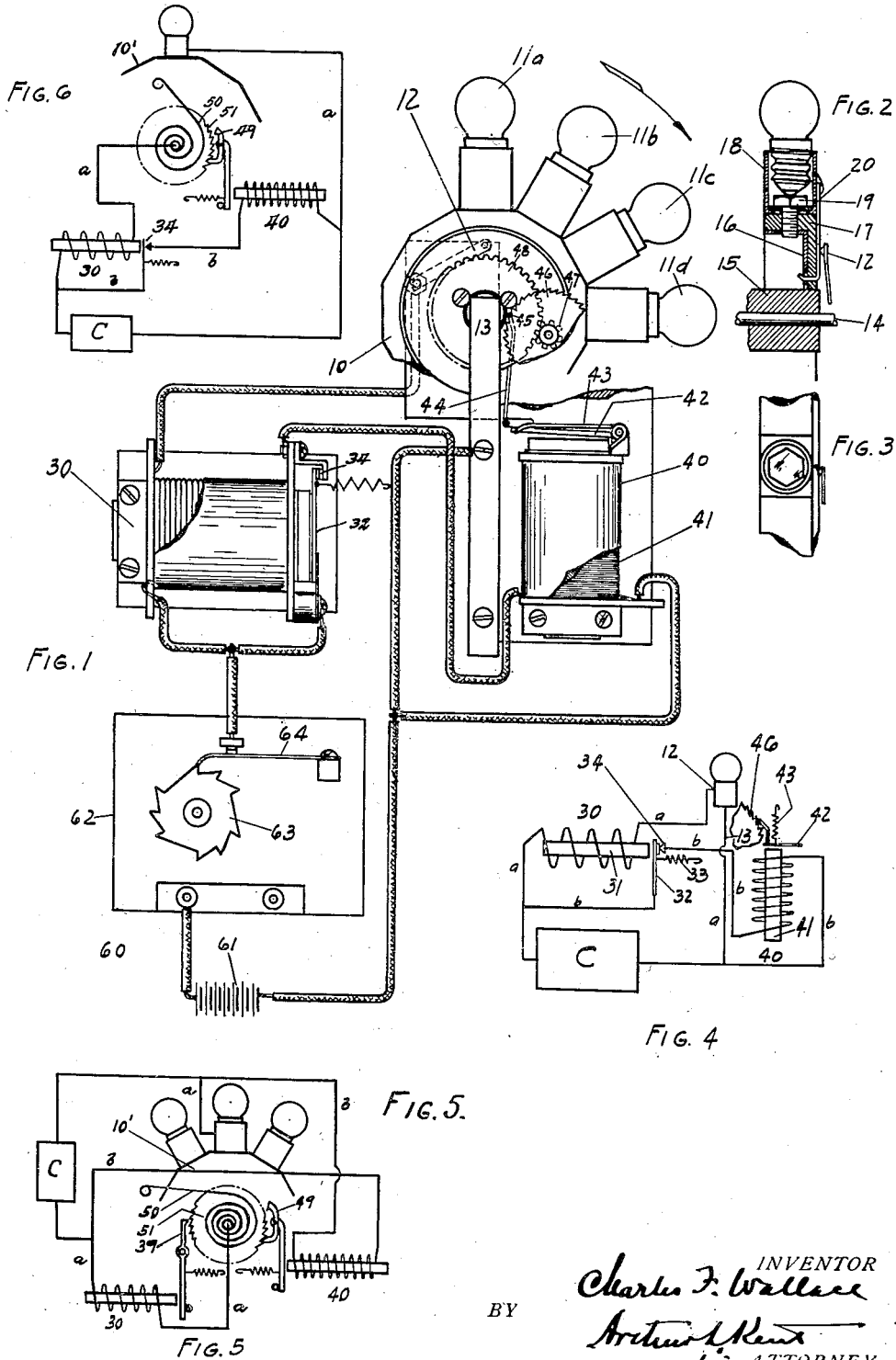
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SIGNAL DEVICE

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SIGNAL DEVICE

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

5 A particular object of the invention is to provide a simple lamp-changing mechanism for a flashing-light signal device which is reliable and efficient in operation and has the advantage of being applicable to a light which flashes irregularly.

10 The invention is applicable to the form of signal device in which a number of lamps are mounted on a carrier which may be moved so as to position them successively between a pair of terminals of a lighting circuit. In accordance with the invention, two circuits are connected in parallel to a source of intermittent current. One circuit contains the light terminals and an electro-magnetic device of relatively low inertia operative to prevent movement of the lamp carrier. The other circuit contains an electro-magnetic device of relatively high inertia operative to cause movement of the lamp carrier except when such movement is prevented by the operation of the first-mentioned electro-magnetic device.

Specific illustrative embodiments of my invention are shown in the accompanying drawing, in which:

30 Fig. 1 is a partly diagrammatic elevation of a signal device according to the invention, omitting the casing and optical system;

Fig. 2 is a fragmentary section on the axis of the lamp carrier;

35 Fig. 3 is a fragmentary view of the periphery of the lamp carrier;

Fig. 4 is a circuit diagram including a diagrammatic representation of the mechanical features of the lamp carrier; and

40 Figs. 5 and 6 are diagrammatic illustrations of modifications.

Referring first to Figs. 1 to 4, the signal device illustrated is provided with a movable lamp carrier 10, which can be made to carry any desired number of incandescent lamps 11a, 11b, etc. A pair of electric terminals 12, 13 are so arranged that movement of the carrier 10 causes the electric lamps to be successively connected between them. As illustrated, the carrier 10 is in the form of a wheel having a shaft 14 journaled in suitable supports not shown. The shaft 14, the hub 15 and the inner portion 16 of the wheel are of conducting material, while the outer portion 17 of the wheel is made of insulating material. Lamp sockets 18 are secured about the periphery of the portion 17, and the inner terminal 19 of each

socket is formed by a screw which connects with the conducting portion 16 of the wheel, and is thus connected to the terminal 13 which bears against one end of the shaft. To the peripheral portion of each socket is connected a conductor 20, which extends radially inward along the insulated face of the wheel so as to come in contact with the spring terminal 12 when its socket is at the top point of the wheel. The lamp carrier may be enclosed in a suitable casing provided with a lens or other optical system, so positioned that the lamp which is in the socket at the top point of the wheel is at the focus of the system.

The electric circuits of the device, which are most clearly shown in Fig. 4, consist of two circuits a, b, connected in parallel to a source of intermittent current c, which may be a battery and interrupter such as shown at 60 in Fig. 1 and hereinafter described or other suitable source. The circuit a contains the lamp terminals 12, 13 and in series therewith an electro-magnetic device 30 which in the form shown consists of an electro-magnet 31 and an armature 32 normally drawn away from the magnet by a spring 33. The circuit b contains an electro-magnetic device 40 operation of which causes movement of the lamp carrier, and which in the form shown consists of an electro-magnet 41 having an armature 42 which is normally drawn away from the magnet by a spring 43 and has connected thereto a pawl rod 44 which has a bent end or pawl 45 cooperating with a ratchet wheel 46 connected by reduction gearing 47, 48 to the shaft of the lamp carrier, whereby at each movement of the armature 42 by its magnet the lamp carrier is moved one step. The circuit b also contains a normally closed circuit interrupter, or switch, 34 which is operated to open circuit b by movement of the armature 32 toward its magnet 31.

The inertia of the electro-magnetic device 30 is much less than that of the electro-magnetic device 40. The inertia of the device 40 depends upon the electro-magnetic inertia or self-inductance of its electro-magnet, and also upon the mechanical inertia or weight of its armature. In the form illustrated, the difference between the inertias of the two electro-magnetic devices consists mainly in the difference in the electro-magnetic inertias of their electro-magnets which results from providing the magnet 31 with a winding of a few turns of relatively heavy wire and the magnet 41 with a winding of a relatively large number of turns of finer wire. It will be understood that this difference in inertia of the devices might be obtained or increased by making

the weight of the armature 42 greater than that of the armature 32.

The device may be supplied with intermittent current from an outside source, or may contain within itself a source of intermittent current 60, such as a battery 61 and flashing, or current interrupting, mechanism 62, which may include an electric motor, not shown, driving a program wheel 63 operating an interrupter 64 to cause regular or irregular current impulses as predetermined by the arrangement of the teeth of the program wheel.

At each closing of the circuit by the interrupter 64 when a good lamp is in operative position, or at each current impulse otherwise supplied, there is at the instant of circuit closing while the lamp filament is cold a rush of current through the circuit *a*, containing the lamp and the low resistance coil of magnet 31, which causes such quick movement of the armature 32 that the circuit *b* is opened before the magnet 41 can move its armature to cause movement of the lamp carrier. As soon as the lamp filament is heated and its resistance raised, the flow of current and the amount of energy consumed by the magnet coil is reduced, and, as the heating of the lamp filament takes place almost instantly, the quick, strong pull of the armature of the magnet 31 for opening the circuit to the lamp-changing magnet before the latter can operate is secured with a very low consumption of current.

In the operation of the signal device, each current impulse passes initially through the circuits *a* and *b* in parallel and the impulse through the circuit *a* flashes the positioned lamp. The initial rush of current through the circuit *a* causes the electro-magnetic device 30 to operate to prevent movement of the lamp carrier by opening the switch 34 and cutting off the supply of current to the electro-magnetic device 40 before the latter has had time to operate to move the lamp carrier. But when the filament of the lamp between the terminals 12 and 13 has burned out, the circuit *a* is broken and the current impulses do not operate the electro-magnetic device 30 and the circuit to the electro-magnetic device 40 is not broken. The device 40 then operates to move the lamp carrier one step at each current impulse until the carrier has been moved sufficiently to position the next lamp between the terminals 12 and 13. The next current impulse then operates the electro-magnetic device 30, and thereupon and thereafter the device 30 prevents the device 40 from causing further movement of the lamp carrier until such time as the filament of the new lamp is burned out.

The electro-magnetic device or relay 30 operates to prevent movement of the lamp carrier. In the form of apparatus shown by Figs. 1, 2, 3 and 4, it accomplishes this by opening a switch in the circuit *b* and thereby preventing supply of current to the lamp-moving device 40. The electro-magnetic devices 30 and 40 may be used to prevent and cause movement of the lamp carrier in a different way. As illustrated by Fig. 5, for example, the lamp carrier 10' is urged to rotate by means of a spiral spring 50. On the lamp carrier is a toothed wheel 51 with which cooperate a stop 39 and an escapement lever 49. The stop 39 is normally out of contact with the wheel 51, but is drawn into contact with it by the electro-magnetic device 30 whenever the magnet of that device is energized. The escapement lever 49 is normally held in position to prevent rotation of the toothed wheel, but is rocked by the elec-

tro-magnetic device 40 when the armature of that device is moved by its magnet. When the filament of the positioned lamp is burned out and the circuit *a* thereby broken, the current impulses cannot operate the electro-magnetic device 30, and the stop 39 therefore remains out of engagement with the toothed wheel. The wheel and carrier 10' will then be permitted, by the rocking of the escapement lever 49 as the magnet 41 is successively energized and deenergized, to be turned step by step by the spring 50 until a new lamp is positioned, and thereupon and thereafter at each current impulse, until the new lamp burns out, the stop 39 will be moved into engagement with the toothed wheel to hold it from turning when the escapement lever is rocked.

A further modification is illustrated diagrammatically by Fig. 6. Here again, the lamp carrier is urged to rotate by means of a spiral spring 50 and the movement of the carrier is controlled by an escapement lever 49 cooperating with a toothed wheel 51 which turns with the lamp carrier, the escapement lever permitting step-by-step movement of the toothed wheel and lamp carrier when it is rocked by the electro-magnetic device 40. In this case, however, instead of the electro-magnetic device 30 operating to prevent movement of the lamp carrier through a stop device cooperating with the toothed wheel 51, as in Fig. 5, it accomplishes this result as in Figs. 1 to 4, that is, by opening the circuit to the electro-magnetic device 40 by opening a normally closed switch 34 in said circuit.

What is claimed is:

1. In a flashing light signal device, in combination, a lamp circuit containing a pair of terminals, a plurality of lamps, a rotary carrier for said lamps rotatable to bring said lamps successively between said terminals, a ratchet connected to said carrier, a pawl for operating said ratchet, an oscillation armature adapted to actuate said pawl, means comprising an electro-magnet adapted to oscillate said armature to turn said carrier by means of said pawl and said ratchet, a source of intermittent current supplying both the lamp circuit and said electro-magnet, and means actuated by flow of current in the lamp circuit to cut off the supply of current to said magnet, the last said means comprising an electro-magnetic relay the coil of which is in series with the lamp and which relay is quicker acting than the means for turning said carrier.

2. In a flashing light signal device, in combination, a lamp circuit containing a pair of terminals, a plurality of lamps, a rotary carrier for said lamps rotatable to bring said lamps successively between said terminals, a ratchet connected to said carrier, a pawl for operating said ratchet, an oscillation armature adapted to actuate said pawl, means comprising an electro-magnet adapted to oscillate said armature to turn said carrier by means of said pawl and said ratchet, a source of intermittent current supplying both the lamp circuit and said electro-magnet, and means actuated by a flow of current in the lamp circuit to prevent the carrier from being turned, the last said means comprising an electro-magnetic relay the coil of which is in series with the lamp and which relay is quicker acting than the means for turning the carrier.

3. In a flashing light signal device, in combination, a lamp circuit containing a pair of terminals, a plurality of lamps, a rotary carrier for said lamps rotatable to bring said lamps successively between said terminals, a ratchet con-

connected to said carrier, a pawl for operating said ratchet, an oscillation armature adapted to actuate said pawl, means comprising an electro-magnet adapted to oscillate said armature to turn said carrier by means of said pawl and said ratchet, a source of intermittent current supplying both the lamp circuit and said electro-magnet, and means actuated by flow of current in the lamp circuit to cut off the supply of current to said magnet, said last mentioned means being quicker acting than the means for turning the carrier.

4. In a flashing light signal device, in combination, a lamp circuit containing a pair of terminals, a plurality of lamps, a rotary carrier for said lamps rotatable to bring said lamps successively between said terminals, a ratchet connected to said carrier, a pawl for operating said ratchet, an oscillation armature adapted to actuate said pawl, means comprising an electro-magnetic device adapted to oscillate said armature to turn said carrier by means of said pawl and said ratchet, a source of intermittent current supplying both the lamp circuit and said electro-magnetic device, and means actuated by a flow of current in the lamp circuit to prevent the carrier from being turned, said last mentioned means being quicker acting than the means for turning the carrier.

5. In a flashing light signal device, in combination, a plurality of lamps, a lamp circuit having terminals for including one of said lamps in the circuit, a source of intermittent current for supplying the lamp circuit, mounting means for said lamps, means for causing relative step by step movement between said lamp mounting means and a terminal in the lamp circuit when a lamp fails, to include another of the lamps in the lamp circuit, said last mentioned means including an electro-magnet having an oscillatory armature in a shunt circuit across said source of current and a member controlled by said armature for controlling said relative step by step movement to produce one step of such movement at each oscillation of the armature, and a quick-acting relay in the lamp circuit in series with the lamp for opening the shunt circuit at each flashing flow of current, whereby said means for causing relative step by step movement is prevented from operating when the lamp circuit is completed through the lamp.

6. In a flashing light signal device, in combination, a plurality of lamps, a lamp circuit having terminals for including one of said lamps in the circuit, a source of intermittent current for supplying the lamp circuit, mounting means for said lamps, means for causing relative step by step movement between said lamp mounting means and a terminal in the lamp circuit when a lamp fails, to include another of the lamps in the lamp circuit, said last mentioned means including an electro-magnet having an oscillatory armature in a shunt circuit across said source of current and a member controlled by said armature for controlling said relative step by step movement to produce one step of such movement at each oscillation of the armature, a quick-acting electro-magnetic device in the lamp circuit, and means controlled by said electro-magnetic device to prevent operation of said means for causing relative step by step movement when the lamp circuit is completed through the lamp.

7. In a flashing light signal device, in combination, a lamp carrier for a plurality of lamps movable for positioning the lamps successively, a

lamp circuit having terminals for including a positioned lamp in the circuit, a source of intermittent current for supplying the lamp circuit, a shunt circuit across said source of intermittent current, a quick-acting relay in the lamp circuit in series with the lamp for opening the shunt circuit when current flows in the lamp circuit, and means for moving the carrier step by step to move a lamp out of position and to bring another lamp into position, said means including an electro-magnetic device having an oscillatory armature in the shunt circuit and a member connected to the carrier and a part cooperating with said member and operated by the armature of said electro-magnetic device to cause the carrier to move one step at each oscillation of the armature.

8. In a flashing light signal device, in combination, a lamp carrier for a plurality of lamps movable for positioning the lamps successively, a lamp circuit having terminals for including a positioned lamp in the circuit, a source of intermittent current for supplying the lamp circuit, a shunt circuit across said source of intermittent current, a quick-acting relay in the lamp circuit in series with the lamp for opening the shunt circuit when current flows in the lamp circuit, and means for moving the carrier step by step to move a lamp out of position and to bring another lamp into position, said means including an electro-magnetic device in the shunt circuit having an oscillatory armature which makes one oscillation for each current impulse when the shunt circuit is closed and a member connected to the carrier and a part cooperating with said member and operated by the armature of the electro-magnetic device to cause the carrier to move one step at each oscillation of the armature.

9. In a flashing light signal device, in combination, a lamp carrier for a plurality of lamps movable for positioning the lamps successively, a lamp circuit having terminals for including a positioned lamp in the circuit, a source of intermittent current for supplying the lamp circuit, a shunt circuit across said source of intermittent current, a quick-acting relay in the lamp circuit in series with the lamp for opening the shunt circuit when current flows in the lamp circuit, and means for moving the carrier step by step to move a lamp out of position and to bring another lamp into position, said means including an electro-magnetic device in the shunt circuit and means operated thereby for controlling the movement of the carrier step by step.

10. In a flashing light signal device, in combination, a lamp carrier for a plurality of lamps movable for positioning the lamps successively, a lamp circuit having terminals for including a positioned lamp in the circuit, a source of intermittent current for supplying the lamp circuit, a shunt circuit across said source of intermittent current, a quick-acting relay in the lamp circuit in series with the lamp for opening the shunt circuit when current flows in the lamp circuit, and means for moving the carrier step by step to move a lamp out of position and to bring another lamp into position, said means including an electro-magnetic device in the shunt circuit and means operated thereby for moving the carrier one step for each current impulse when the shunt circuit is closed.

11. In a flashing light signal device, in combination, a lamp carrier for a plurality of lamps movable for positioning the lamps successively, a lamp circuit having terminals for including a positioned lamp in the circuit, a source of inter-

mittent current for supplying the lamp circuit, a shunt circuit across said source of intermittent current, a quick-acting relay in the lamp circuit in series with the lamp for opening the shunt circuit when current flows in the lamp circuit, and means for moving the carrier step by step to move a lamp out of position and to bring another lamp into position, said means including a magnet in the shunt circuit having an oscillatory armature and a driving connection between the armature and the carrier for moving the carrier one step at each oscillation of the armature.

12. In a flashing light signal device, in combination, a lamp carrier for a plurality of lamps movable for positioning the lamps successively, a lamp circuit having terminals for including a positioned lamp in the circuit, a source of intermittent current for supplying the lamp circuit, a shunt circuit across said source of intermittent current, means for moving the carrier to position said lamps successively, said means including driving means tending to move the carrier and an electro-magnetic device in the shunt circuit and an escapement device operated by the electro-magnetic device for permitting step by step

movement of the carrier, and a quick-acting relay in the lamp circuit in series with the lamp for opening the shunt circuit when current flows in the lamp circuit, whereby said means for moving the carrier is prevented from operating when the lamp circuit is completed through a lamp.

13. In a flashing light signal device, in combination, a lamp carrier for a plurality of lamps movable for positioning the lamps successively, a lamp circuit having terminals for including a positioned lamp in the circuit, a source of intermittent current for supplying the lamp circuit, a shunt circuit across said source of intermittent current, means for moving the carrier to position said lamps successively, said means including driving means tending to move the carrier and an electro-magnetic device in the shunt circuit and an escapement device operated by the electro-magnetic device for permitting step by step movement of the carrier, a stop device, and a quick-acting electro-magnetic device in the lamp circuit for operating said stop device to prevent movement of the carrier when current flows in the lamp circuit.

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