July 5, 1938. R. K. FREEMAN 2,122,416

AUTOMATIC ELECTRIC FLASHER

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Fig. 1.

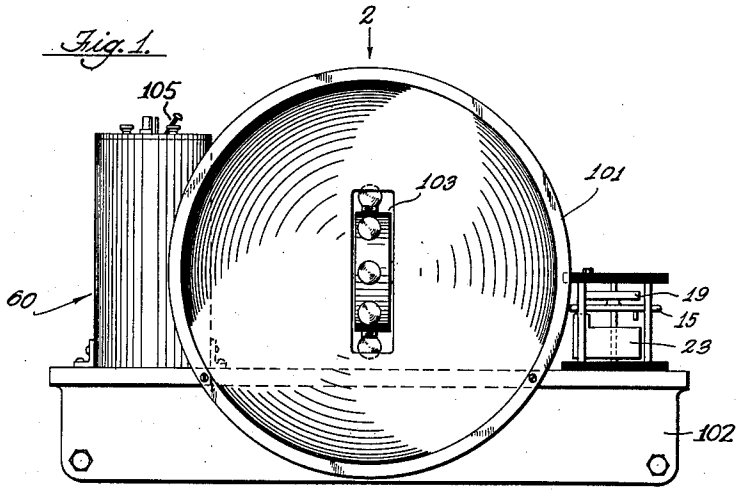


Fig. 2.

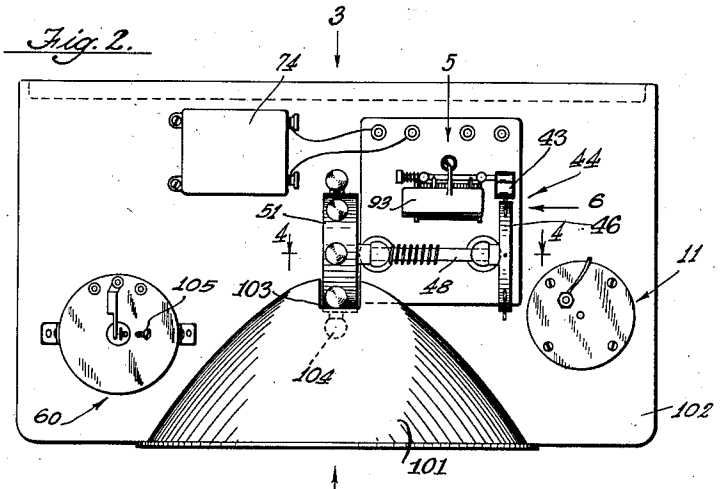
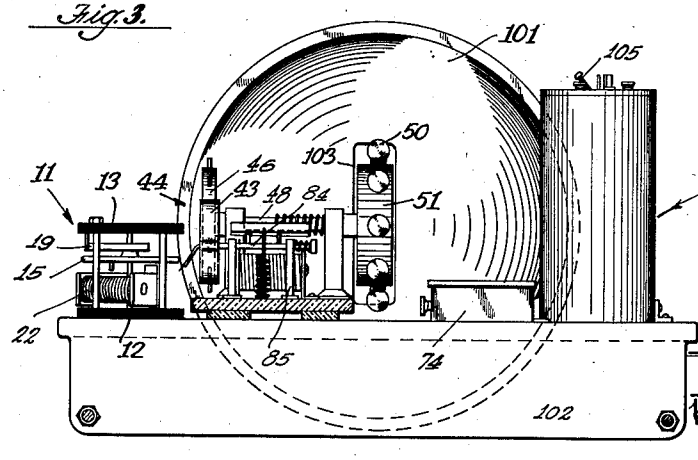


Fig. 3.



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Fig. 4.

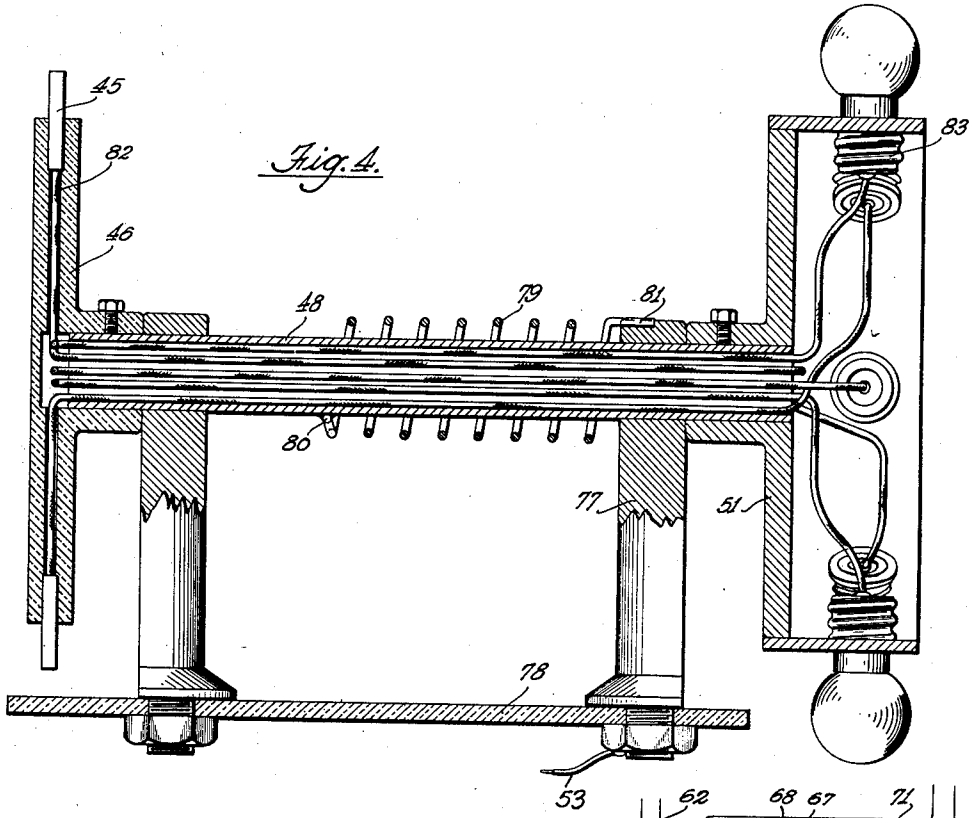
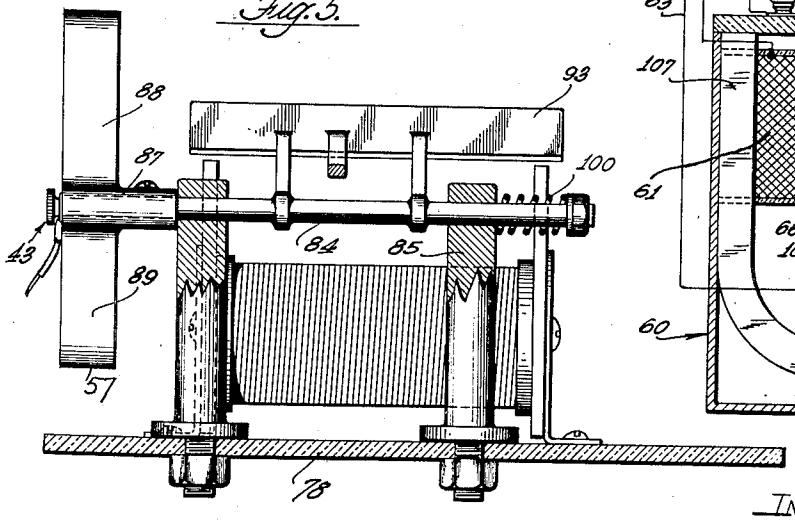


Fig. 5.



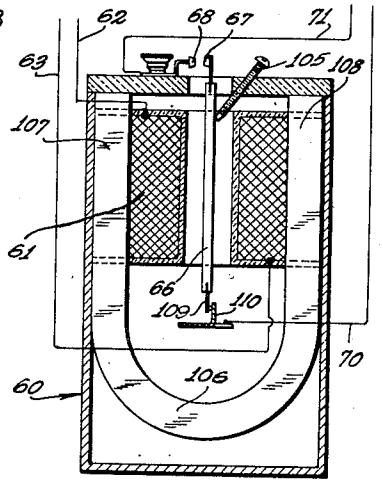


Fig 11

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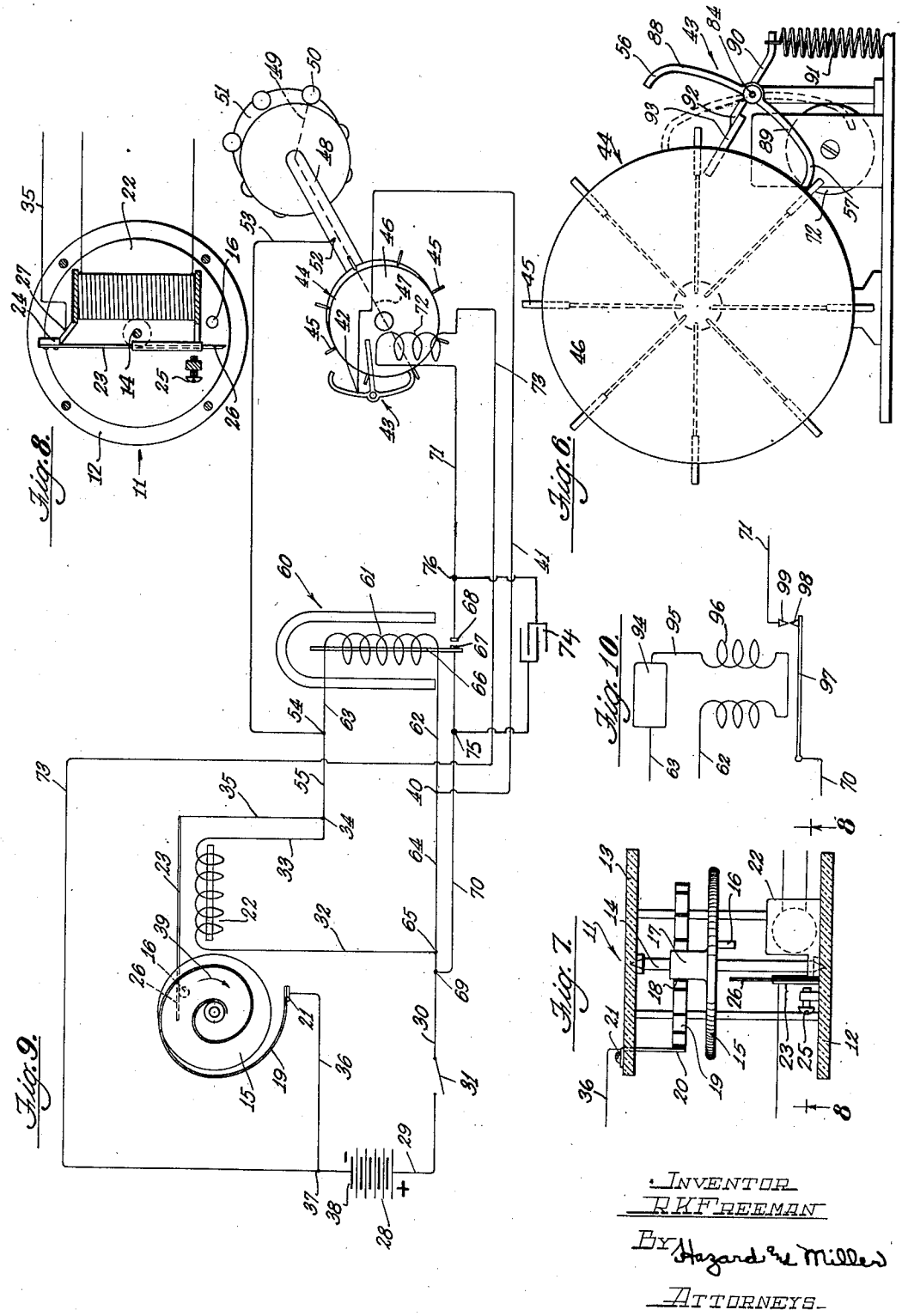


Fig. 8.

Fig. 6.

Fig. 10.

Fig. 9.

Fig. 7.

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UNITED STATES PATENT OFFICE

2,122,416

AUTOMATIC ELECTRIC FLASHER

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Application April 10, 1933, Serial No. 665,405

9 Claims. (Cl. 177—329)

An object of my invention in connection with an electric flasher, is a construction by which, should the lamp be burned out, automatically another lamp can be placed in the circuit. In more detail, an object of my invention in this regard is a bank of lights arranged, preferably, on a wheel, which wheel is urged in one direction by a spring motor and, as long as the lamp is not burned out or the socket is filled with the lamp, which is in good order, the wheel is held stationary, but, however, should a lamp be burned out or a socket empty, the wheel may be rotated step by step until a new and a good lamp is brought into circuit.

Another object and feature of my invention is utilizing the electric energy which would otherwise be short circuited through the lamp to actuate the releasing or rotating mechanism for the bank of lamps when the circuit is open through a lamp or a lamp socket. Therefore, no extraneous circuit is required to move or rotate the bank of lamps or shift the circuit from one lamp bulb to another, other than the circuit which would be employed to illuminate a lamp.

Another object and feature of my invention is the construction and operation of the electric flasher, that is, the circuit breaker which opens and closes the circuit for illuminating a lamp. In this regard a feature of my invention relates to the employment of an oscillating weighted wheel suitably journaled, the axis being, preferably, vertical. This wheel is urged by a spring in one direction to bring a contact on the spring into engagement with an electric contact on a movable armature of an electromagnet. The spring, normally, if the circuit were open, would hold the two contacts in engagement and when the circuit is closed, the quick energizing of the electromagnet moves the armature to give an impulse between the two contacts to rotate the weighted oscillating wheel, swinging this against the torsion of the spring. This action opens the circuit. The wheel will then continue to oscillate, and at each engagement of the contacts the electromagnet is energized and gives the armature an impulse, the impulse being constant for each time and thus the swing and time of the open circuit is constant. With this I employ an electric lamp in circuit with the contact on the armature so that each time there is a closure of the circuit between the contact on the wheel and that on the armature, the lamp is in circuit.

Another detailed feature in regard to the contacts is that these give a brushing movement and thus tend to maintain the contacts clean.

Another object and feature of my invention in relation to the automatic changing of the lamps is in making use of the surge of current in the windings of the electromagnet which actuates the circuit closer and timer of the flasher. At each breaking of the circuit, when the lamp is out, the reverse surge of current actuates a relay which, in its turn, closes the circuit to a second electromagnetic device used to release the rotatable bank of lamps. In this action, in order to make use of the flow of current operating only in one direction and that being the current developed on the break of the circuit, I may employ a polarized relay operating to close the circuit when the current flows only in one direction, or I may utilize a rectifier in connection with an electromagnet to close the circuit on energizing of this electromagnet.

Another detailed object and feature of my invention is the mounting and release of the wheel carrying the bank of lamps by a device utilizing a movement similar to an escapement movement of a watch, this escapement being released when there is an open circuit at any lamp or lamp socket by operating an electromagnetic device to release the escapement.

A further detail is an arrangement for releasing the pawl of the escapement movement to allow winding of the spring motor which urges and rotates the bank of lamps on the lamp wheel.

My invention is illustrated in connection with the accompanying drawings, in which:

Fig. 1 is a front elevation taken in the direction of the arrow **1** of Fig. 2, showing a manner of set-up of my invention.

Fig. 2 is a plan taken in the direction of the arrow **2** of Fig. 1.

Fig. 3 is a rear elevation taken in the direction of the arrow **3** of Fig. 2.

Fig. 4 is an enlarged longitudinal section on the line **4—4** of Fig. 2, in the direction of the arrows, through the lamp supporting wheel and the escapement wheel and connecting shaft.

Fig. 5 is an enlarged elevation taken in the direction of the arrow **5** of Fig. 2 of the escapement pawl and the electromagnetic device for operating the same.

Fig. 6 is an enlarged side elevation of the escapement wheel and pawl, taken in the direction of the arrow **6** of Fig. 2.

Fig. 7 is an enlarged vertical section through the flashing timer, showing the oscillating wheel and manner of mounting.

Fig. 8 is a transverse section on the line 8—8 of Fig. 7 in the direction of the arrows.

Fig. 9 is a diagram showing the electric circuits and the mechanical devices diagrammatically.

Fig. 10 is an electrical diagram of a modified electrical appliance to be used in the circuits of Fig. 9.

Fig. 11 is a longitudinal section through the polarized relay of low inductance.

Referring first to the flasher mechanism, designated by the assembly numeral 11, as illustrated particularly in Figs. 7 and 8. This shows lower and upper insulating panels 12 and 13. Between these panels there is journaled an oscillating shaft 14, on which is mounted a timing wheel 15. This wheel is of considerable relative weight and has a projecting electrical contact 16 thereon. The hub of the wheel 17 is connected to one end 18 of a spirally wound spring 19. The other end 20 of the spring is connected to a bracket. This bracket has an electric terminal 21. Located on the panel 12 there is an electromagnetic winding 22, which may be a solenoid, and this has a spring armature 23 illustrated as mounted on an arm 24. An adjustable stop screw 25 limits the movement of this spring armature away from the winding. The end 26 of the armature forms an electric contact, the arm being conducting and having a terminal 27 on the bracket. The spring urges the contact pin 16 into engagement with the armature when the circuit is open.

The portion of the circuit for the flasher employs a battery 28, (Fig. 9) which may have dry cells, or a storage battery. The side 29 is indicated as positive. From this there is a lead 30 having a manually controlled switch 31 therein for opening and closing the circuit. A lead 32 connects to the winding 22 and from this winding there is another lead 33 which at a point 34 has a lead 35 to the armature 23, in which the brushing contact end 26 engages the contact pin 16 on the wheel 15. The current is conducted through the spiral spring 19 to the terminal 21 and from thence by a lead 36 through the connector 37 to the negative side 38 of the battery. Thus, whenever the moving contact 16 on the wheel engages the complementary contact 26 on the armature, there is a circuit closed through the winding of the electromagnetic device 22 and this energizes the magnet to attract the armature. The quick attraction of the armature gives an impulse to the contact pin 16, rotating the wheel in the direction of the arrow 39 (Fig. 9). This action increases the twist of the spring and after the momentum has been spent the spring reverses the rotation and again engages the contact pin 16 and the contact 26 of the armature 23. The movement is then repeated.

The lamp circuit for the flashing lamp is in parallel with the magnet winding 22 and includes the connector 40 in the lead 30, the line 41, which connects at 42 to the pawl 43 of the escapement mechanism 44. This pawl engages conducting radial pins 45 on the escapement wheel 46 and a lead 47 is connected through the hollow shaft 48 to the lead 49 to a lamp 50 on a lamp mounting wheel 51 at the opposite end of the shaft 48. The lamps on the periphery of the wheel are all grounded to such wheel and a ground connection is by the brush 52 engaging the shaft, a lead 53 to the connector 54 which has a lead connection 55 to the connector 34 and thence to the negative side of the battery by the leads 35, the armature 23, contacts 26 and 16, the spring 19, terminal 21, lead 36, connector 37, and negative side 38 of the battery. Thus, when either the upper end 56 or the lower end 57 of the escapement pawl 43 engages one of the pins 45, the current is conducted to one of the lamps on the lamp wheel and causes this to flash. The flash is at the moment in which the contacts 16 and 26 are in contact, and is immediately broken on separation of these by the movement of the armature 23. The movement of this armature gives a wiping contact between 16 and 26, thus tending to maintain good conducting surfaces.

The swing-back of the wheel 15, due to the impulse of the spring motor, causes a bending of the spring armature 23. On account of having a variable adjustment for this swing through the medium of the stop screw 25, the length of movement of the armature 23 may be adjusted and, hence, the striking impact on the contact pin 16. This arrangement may, therefore, be used to regulate the arc through which the wheel 15 rotates.

The automatic movements of the lamp supporting wheel or lamp magazine for replacing a good lamp for a defective lamp or an empty socket is as follows, having reference, particularly to Fig. 9.

A polarized relay 60 has a winding 61 with a lead 62 connected to the positive lead 30 from the battery. An outlet lead 63 connects to the connector 54 with the lead 55 and at the connector 34 with the lead 35, the armature 23, contacts 26 and 16, the spring 19, terminal 21, lead 36, connector 37, to the negative side of the battery. This is the normal manner of energizing the relay when a lamp is illuminated, and in this direction of current there is no action of the relay. However, should a lamp form an open circuit by breakage of the filament or other damage, or the socket, which is in a position to have the lamp lit, be minus a lamp, the flashing circuit cannot function. There is, therefore, a reverse surge of current from the inductive winding 22 through the leads 33, connector 34, lead 55, connector 54, lead 63, winding 61, lead 62, connector 40, lead 64, connector 65, and the lead 32. This causes an energizing of the relay to move the armature 66 to bring the contact 67 on the armature into engagement with a fixed contact 68. This will establish a circuit from the positive lead 30 from the battery, branching at the connector 69, through lead 70, the contacts 67 and 68, lead 71, to the solenoid or electromagnetic winding 72, return being by the lead 73 to the negative side of the battery through the connector 37. A condenser 74 is illustrated as being bridged in the leads 70 and 71 between the connector points 75 and 76. This is to diminish the sparking at the contacts 67 and 68. The energizing of the winding 72 actuates the escapement pawl of the escapement wheel to permit rotation of the wheel 51 carrying the lamps, as hereinunder detailed.

The mounting of the lamp-carrying wheel is on journal posts 77 mounted on an insulating base 78. The hollow shaft 48 is journaled in these posts. At one end there is the escapement wheel 46 and at the opposite end the lamp-carrying wheel 51. A coiled spring 79 has one end 80 attached to the shaft and the opposite end 81 attached to one of the posts. This spring, therefore, when wound, urges the rotation of the shaft in

one direction. In radial sockets 82 in the escapement wheel 46 are mounted the pins 45. The leads 47 are from each pin through a radial socket 82 and the hollow shaft 48 to the sockets 83 of the lamps on the lamp wheel 51, there being a connection from each pin to each lamp, and thus there are an equal number of pins and lamps.

The escapement pawl 43 is mounted on a shaft 84 journaled in posts 85 mounted on the insulating base 78. The pawl 43 has a hub 87 secured to the shaft 84 and has arcuate upper and lower arms 88 and 89 terminating respectively at the upper end 56 and the lower end 57. These are associated and positioned so as to engage alternatively one of the pins on the periphery of the escapement wheel to form an electric contact therethrough, as above described.

An arm 90 is secured to the shaft 84 and is under the tension of a retraction spring 91 secured to the end of the arm and to the insulating base 78. This tends to always move the pawl in one direction. This is shown as bringing the lower end 57 into engagement with the escapement wheel. An armature arm 92 has an armature 93 secured thereto, which armature operates in conjunction with the coil 72. Therefore, on each energizing of this coil 72 the armature 93 is operated, thus rocking the shaft 84 and actuating the escapement pawl 43 which, on releasing one pin by an end of the pawl 43, causes a rotation of the escapement wheel. Thus, as the lamps are evenly spaced around the lamp wheel in the same manner as the escapement pins 45, the lamp wheel is only rotated through the arc between one lamp and the next at each time that the flashing circuit is opened by there being a broken lamp in a socket or no lamp in such socket. However, the connection for illuminating a lamp is only through the lower end 57 and lower arm 89 of the escapement pawl 43. Therefore, this assures that a lamp is properly positioned to give the desired illumination on the operation of the escapement pawl and escapement wheel.

As an alternative construction to the polarized relay 60, I may employ the biased construction of Fig. 10. In this, the lead 63 is illustrated as being connected to a rectifier 94, which is connected by a lead 95 to the electromagnet winding 96. The opposite terminal of this winding connects to the lead 62. In this construction, the positive lead 70 is connected to an armature 97 having a moving contact 98, and this engages a fixed contact 99 connected to the lead 71. In this case, as the rectifier only passes current in one direction, the electromagnet 96 can only be actuated by the current flowing in the desired direction to close the positive circuit through the contacts 98 and 99 and thus through the lead 71 to the electromagnetic winding 72 for actuating the pawl of the escapement mechanism.

In order that the spring motor 79 may be wound or tensioned without the necessity of oscillating the pawl 43, the shaft 84 carrying this pawl may be shifted longitudinally in the bearing supports or posts 85, and there is a retraction spring 100 to urge this shaft and the pawl into position for engaging the pins on the escapement wheel, but when the pawl and the shaft are pulled to one side, the escapement wheel may be freely rotated by hand and thus wind up the spring motor 79. This motor, when fully wound, is sufficient to rotate the lamp wheel 51 a full rotation and may thus be used to bring all of the lamps into operative position. Instead of having a brush 52 engage the hollow shaft 48, one of the bearing posts 77 may have this function by connecting the lead 53 to one of such posts.

In Figs. 1, 2, and 3, I have illustrated a mounting for the flasher mechanism and the lamp wheel. This is shown as having a reflector 101 attached to a supporting structure 102. The back of the reflector has a slot 103, through which the lamp wheel partly extends a sufficient distance so that at the focus 104 of the reflector may be positioned the lamp to be illuminated at each operation of the flasher. Hence, on operation and rotation of the lamp wheel, the lamps are always brought into proper focus in connection with the reflector before they can become illuminated.

In these Figures 1, 2, and 3, the relay 60 is indicated as having an adjusting screw 105, which limits the movement of the armature 66 away from the contact 68 and may thus be utilized to regulate the rapidity of action of closing the contacts 67 and 68.

An important feature of my invention in regard to the flasher is that under the urge of the spring 19, the contact pin 16 on the wheel 15 is brought into engagement with the contact end 26 of the spring armature 23 with considerable force. Thus, although the area of contact is comparatively small, there is a high pressure developed. The first action of impact is to force the spring back further from the winding coil, the adjusting stop screw 25 being a limit to this motion, and then the spring reacts, reversing the direction of rotation of the wheel. This action is before current has built up sufficient magnetic force in the winding 22 to operate the armature 23 to again give a rotative impulse to the wheel 15 in the direction of the arrow 39 (Fig. 9). Thus, during substantially the full period of time in which the contacts 16 and 26 are in engagement, there is a relatively high pressure between these contacts, thus making a good electrical connection.

A characteristic feature of the lamp-changing mechanism is in the use of a differential electromotive force in opposite directions in the first electromagnet 22 and that in the relay 60 or in the electromagnet 96. During the time the circuit is closed by engagement of the contacts 16 and 26, the current passes through these parallel windings toward the common connector 34 to the negative side of the battery. The electromagnet 22 has an iron core and is of much higher inductance than the winding 60, which may have an air core or a small iron core. As above mentioned, the current through 61 cannot operate the polarized relay. When the circuit is opened by separation of the contacts 16 and 26, the collapse of the magnetic fields in both of the windings, 22 and 61, develops an opposed E. M. F. in these coils. However, the E. M. F. developed by the coil 22 is much greater than that developed by the coil 61 and as both of these tend to cause a flow of current in the same direction as before the opening of the circuit, a current of sufficient strength is forced through the coil 61 to operate the relay. This is only when there is no lamp burning in the parallel lamp circuit. When there is a lamp illuminated in the lamp circuit, this lamp and lamp circuit absorb the current developed by the coil 22 on the opening of the circuit between the contacts 16 and 26.

Substantially the same action takes place in regard to the circuit of Fig. 10, having the rectifier 94 and the electromagnet 96. This rectifier is so designed that it cannot pass the current from the positive side 62 to the negative side 63 but can

pass the current in a reverse direction, which is the flow from the coil 22 on opening of the circuit between the contacts 16 and 26.

Another important feature of my invention, if there is no lamp in position to be illuminated, or such lamp is defective, is that at each operation of the oscillating circuit breaker there is a forcible make and break at these contacts and this will tend to keep such contacts clean. Moreover, there will be an operation of the polarized relay 60 or the magnet 96 in accordance with which type is used, thus tending to keep the contacts 67 and 68 or 98 and 99 clean. Thus, although the escapement mechanism may not operate on the first time of actuation of the relay where operating an electromagnet for closing the circuit through the winding 72, nevertheless, this flasher mechanism making and breaking the main current will continue until it eventually causes the rotation of the lamp-carrying wheel.

Although I have illustrated my invention as employed in connection with a lamp flasher mechanism, the lamp may be considered as in a work circuit subject to a current of short duration, which current, on being opened, causes the development of opposed E. M. F.'s in two electromagnetic devices, one of which is a secondary circuit closer, and on closing of this secondary circuit, a second work circuit is brought into action, and all of these circuits are operated from the same source of power, the first work circuit being closed a comparatively short time, and the second work circuit being also closed for a momentary period. Therefore, both of these work circuits may be actuated by a source of power of comparatively low voltage, which voltage may have a considerable range.

In Fig. 11, I illustrate the polarized relay 60, which is of low inductance. This employs a U-shaped permanent magnet 106 having pole pieces 107 and 108. The winding 61 may be considered as having an air core, as the armature 66 is quite small. The adjusting screw 105 is to adjust the position of the armature in reference to the fixed contact 68. The armature is illustrated as being secured by a spring 109 to a supporting base 110, this latter being connected to the lead 70. When the current passes through this relay, on the making of the circuit between the contact pin 16 and the spring armature 23, the polarization is in such a direction that the armature is not moved to bring the contacts 67 and 68 together. However, when there is a surge of current on the opening of the primary circuit developed by the greater E. M. F. in the coil 22, the current developed in the relay closes the contacts 67 and 68 and, as above mentioned, on account of this relay 60 having a low inductance, the E. M. F. counter to that developed in coil 22 is comparatively small. Also, as above mentioned, when there is a lamp in circuit for illumination, the current developed by the E. M. F. of the coil 22 is absorbed in the light circuit and is insufficient to actuate the relay 60.

The polarized relay 60 is so biased that the direct current when the contacts 16 and 26 are closed and the lamp circuit is closed by having a good lamp in the energized socket, cannot close what may be termed a secondary circuit closer having the contacts 67 and 68, but when an induced current is forced through the winding 61 by the induced current in 22 on the opening of the contacts 16 and 26 and when the lamp circuit is opened due to a defective lamp, the E. M. F. developed in 61 is in the proper direction and of sufficient force to close the secondary contacts 67 and 68. Therefore the relay 60 may be considered as a biased relay.

The construction of Fig. 10 may also be considered a biased relay in that the rectifier 94 will not pass the direct current from the positive side 62 to the negative side 63 through the winding 96, but when an induced current is developed by the coil 22 due to the opening of the energizing circuit for this latter coil, the direction of the current is reversed and the rectifier 94 passes a current from 63 through the winding 96 to the lead 62, thereby energizing this second electromagnet relay to close the secondary circuit closer having the contacts 98 and 99.

For convenience, the devices 60 and 96 may be designated as circuit closers, as their main function is to close a circuit. The electromagnet 22 with its armature 23 with the contacts 26, 16 and the oscillating wheel may be for convenience designated as a circuit breaker, as the main function of this is to break a circuit through the flasher lamp.

Various changes may be made in the details of construction without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. In a device as described, a first electromagnetic circuit closer connected to a source of power and forming a first circuit, a second circuit in parallel therewith forming a first work circuit, the first work circuit being energized only on closing of the first circuit closer and de-energized on opening of said first circuit closer, a second polarized electromagnet operating a normally open second circuit closer and being in a third and parallel circuit to that of the first electromagnet and first work circuit, said second electromagnet and its circuit being inoperative to close the second circuit closer on energizing of the first work circuit due to E. M. F. in a wrong direction but operative due to the greater E. M. F. developed in the first electromagnet over that of the second electromagnet on opening of the first circuit closer and the first work circuit to close the second circuit closer, and a second work circuit through the second circuit closer when closed.

2. In a device as described, a first and a second inductive winding arranged in parallel, a first circuit breaker, a first work circuit parallel to the inductive windings through said circuit breaker, means actuated by the second inductive winding to operate a second circuit breaker, the first work circuit being normally closed and the first inductive winding being energized during the period of closure of the first circuit breaker, the inductive windings being de-energized on opening of the first circuit breaker, said inductive windings on opening of the first circuit breaker developing differential and opposite E. M. F. but the E. M. F. of the first winding being sufficiently greater than that of the second winding to force current through the second winding when the first work circuit is open and thereby close the second circuit breaker, and a second work circuit operating through the second circuit breaker.

3. In a device as described, comprising a first work circuit, a primary inductive winding in parallel therewith, a series connected electromagnet and a rectifier in parallel with the inductive winding and first work circuit, a direct current source of energy connected to the first work circuit, the inductive winding, and the electromagnet, the direction of flow through the electromagnet being

blocked by the rectifier, means to simultaneously open the first work circuit and the circuit of the inductive winding and the electromagnet, the E. M. F. developed in the inductive winding being operative through the rectifier when the first work circuit is open to energize the electromagnet, a second work circuit, and means operated by the electromagnet to close said second work circuit on energizing of the electromagnet.

4. In a device as described in claim 3, the first work circuit having a sequence of connections for completing said circuit should one of said connections be defective and thereby cause an open circuit, and an electromechanical means included in the second work circuit to change a defective to a complete connection.

5. In a device as described, a primary inductive winding, a polarized relay having a secondary inductive winding arranged in parallel, a parallel primary work circuit, a circuit breaker operating in common with the circuits of the windings and first work circuit, a direct current source of power connected to the primary inductive winding and the relay, means to operate the circuit breaker simultaneously open and close the primary work circuit and the circuits of the windings, a secondary work circuit with a secondary circuit closer forming part of the relay, said relay being biased to be inoperative to close the second circuit closer on energizing of the primary winding and the relay due to direction of current, said primary winding on opening of the circuit breaker developing a greater E. M. F. than that of the winding of the relay, forcing a current through such relay to operate the latter to thereby close the secondary circuit closer of the secondary work circuit when the primary work circuit is open.

6. In a device as claimed in claim 5, the primary work circuit including a plurality of parallel connections and means to pass the current through only one connection at a time, the secondary work circuit having an electromechanical means operative to act on said connections to replace a defective, that is, an open circuit of said connections by a complete closed circuit connection when said secondary work circuit is energized.

7. In an electric flasher, a first electromagnet having a spring arm forming an armature and with an electric contact thereon, an oscillating wheel having a second contact, a spring engaging the wheel and urging said contacts together, a source of power having one side connected to the electromagnet and the opposite side through the contacts, a flasher lamp in a circuit in parallel with the electromagnet, the energizing of the electromagnet causing a movement of the wheel by the action of the spring arm in one direction to open the circuit and the spring causing a rotation of the wheel in the opposite direction to close the circuit, said spring arm and moving wheel being adapted to exert a considerable pressure between the two contacts, said lamp being illuminated during the period of engagement of said contacts, a second electromagnet in a parallel circuit to the first electromagnet, a second circuit closer operated by the second electromagnet, said second electromagnet being energized on closing of the circuit by engagement of the contacts insufficiently to close the second circuit closer, the first and second electromagnets having the characteristic that on opening of the circuit by disengagement of the contacts a current is forced through the second electromagnet of such a strength as to actuate the second circuit closer to close a further circuit from said source of power through said second circuit closer and having an electromagnetic device, and means actuated thereby to operate a lamp-moving device having a bank of lamps, said lamps being electrically connected each to form in succession part of the lamp circuit.

8. An electric lamp flasher having a lamp circuit including a plurality of sockets for lamps, each socket having its individual connection to the circuit, electromagnetic means for changing said connections should one socket have an open circuit caused by a defective lamp in such socket, means to intermittently energize the lamp circuit to cause flashing of a lamp in such circuit, a polarized relay characterized when its circuit is in one direction to be normally inactive when the flasher lamp circuit is operative to energize a lamp, but actuated by a flow of current in a reverse direction when the lamp circuit is open due to a defective lamp to energize a work circuit to operate said electromagnetic means.

9. An electric lamp flasher as claimed in claim 8, the lamp sockets being mounted on a wheel and the work circuit having the electromagnetic means to rotate said wheel step by step.

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