June 17, 1930. R. R. STEEL 1,764,656

LIGHTHOUSE AND THE LIKE

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Fig. 1.

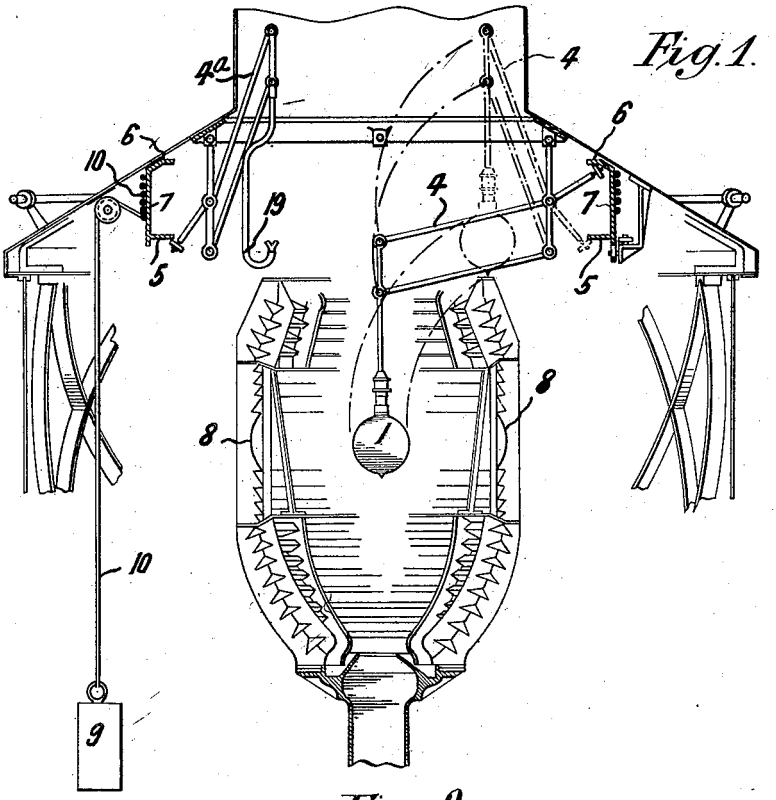

Fig. 2.

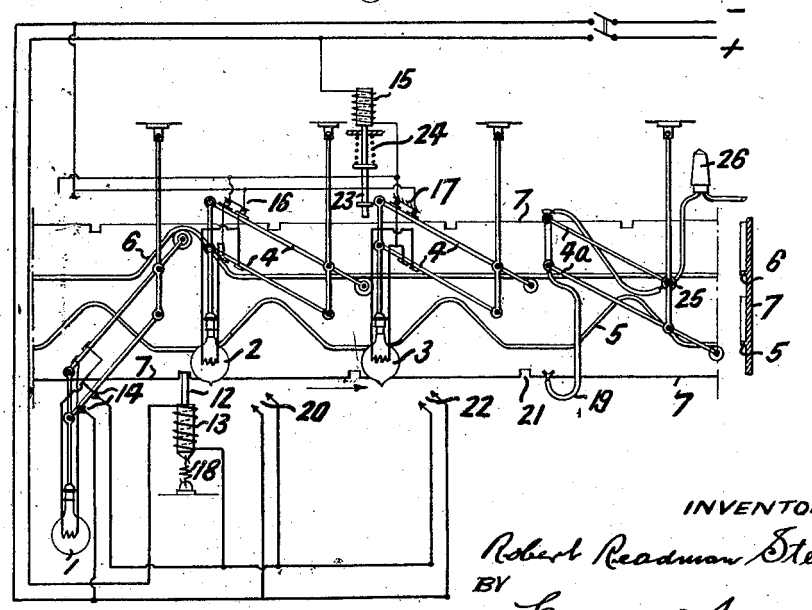

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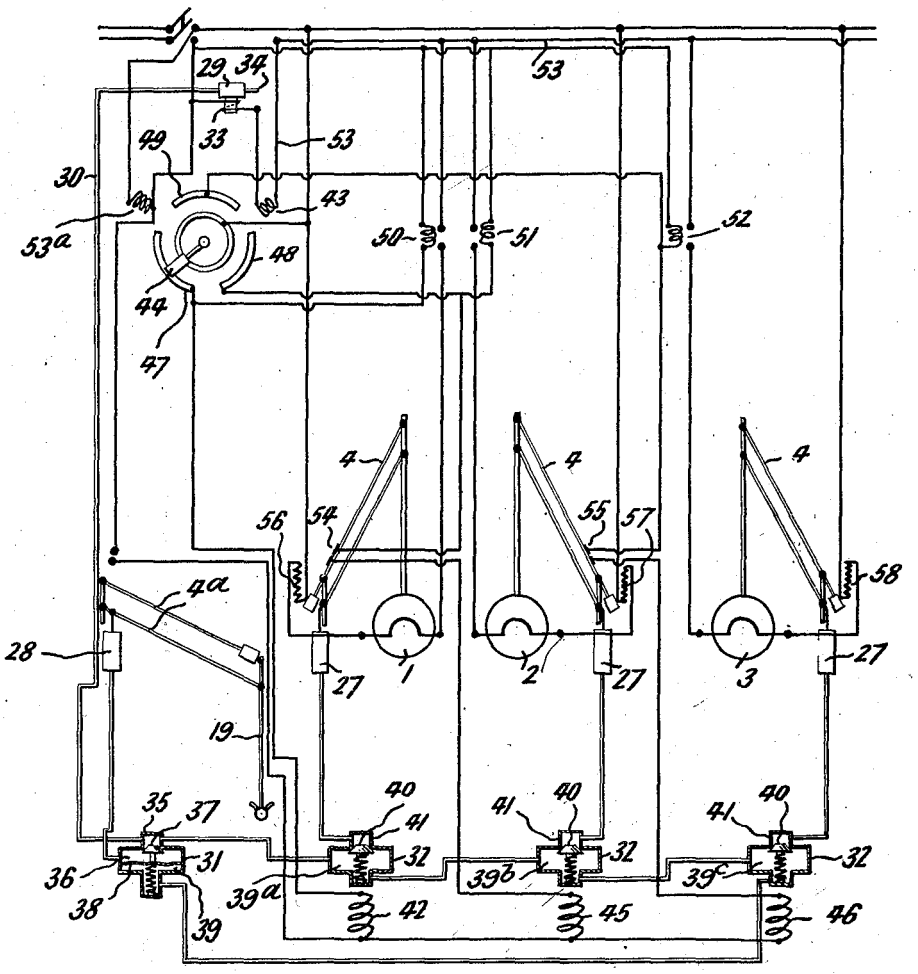
Fig. 3.



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UNITED STATES PATENT OFFICE

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LIGHTHOUSE AND THE LIKE

Application filed May 11, 1926, Serial No. 108,215, and in Great Britain May 14, 1925.

This invention relates to lighthouses and like lamps of the kind in which the illuminating means or source of light is, upon failure, automatically restored.

According to the present invention use may be made of two different illuminants as sources of light, namely electricity and gas, and one feature of the invention consists in that, as soon as the electric illumination is no longer available, it will automatically be replaced by gas illumination.

Broadly the object of the invention is to provide for the automatic replacement of a defective electric lamp in the focus of a lighthouse lens or the like by another electric lamp which may be termed a stand-by lamp, and of which there may be several, and, when gas is used, finally by a gas burner in the event of there being no perfect electric lamp available or upon failure of the source of electric current.

To this end the stand-by electric lamps are severally mounted so that they tend to occupy their out-of-use position whilst the gas burner has a tendency to move into the focus of the lens. The electric lamps and the gas burner are adapted to be brought into the focus of the lens in sequence by a motor, or by motors individual to each, under the control of electro-magnetic means.

According to one method of the invention the rotary motion of a cam-wheel or curve, driven by, for instance, a falling weight, is depended upon for effecting the exchange of the electric lamps or gas burners respectively.

The following is a description of such a device. The apparatus is intended to be employed in lighthouses and normally incandescent lamps are used, fed by an electric conduit to the lighthouse, but in addition to the incandescent lamps a gas burner is embodied in the apparatus to which gas is supplied from a gas container.

By means of this apparatus, according to the invention, it is intended to eliminate the results of such faults as may be attributed to the following causes:

Case I. During darkness a filament is broken, but unused spare incandescent lamps are at hand for use.

Case II. During darkness the filament is broken in the last spare incandescent lamp.

Case III. During darkness the electric supply fails.

Case IV. During daylight the electric circuit is broken by the lighthouse keeper or in some other way is disrupted.

The accompanying drawings illustrate two specific examples from which modifications will be readily apparent or ascertainable. Fig. 1 shows the general arrangement of one form of the apparatus, installed in a lighthouse. Fig. 2 shows schematically the same arrangement where the cam wheel or curve line is developed or straightened out in one plane. Fig. 3 is a diagram of the other form of the apparatus.

As shown in Figs. 1 and 2, electric filament lamps 1, 2, 3 are employed, the number of which may be varied if desired.

The filament lamps and gas burner are suspended from and supported by parallel motion link systems 4 and 4ª respectively which are movably connected to the lantern ceiling, wall or other fixed point inside the lantern. These link systems are guided and moved by the cam rings or curves 5 and 6, mounted upon a rotatable ring 7, or an element of a ring. When the ring is revolved the cam rings or curves will act upon the link systems in such a way that the respective lamps will be lowered into or lifted up from the focal point of the lens 8, through the upper dark sector of the lens structure and out of the paths of the rays of light which emanate from the lamp which is in use or illuminating position whereby the said rays are unobstructed. The lens 8 may be of any known construction but preferably is of general drum type, as shown.

In order to obtain the revolving motion of the ring 7 a weight 9 is employed which weight is connected to the lower end of a depending portion of a cord or rope 10 which is wound upon the ring 7.

To arrest the ring 7, at the moment when a serviceable light source is installed in the focal point of the lens, two electric control stops 23 and 12 are employed which are adapted to engage respectively the notches

provided on the upper and lower edges of the said ring.

The path of the current and the motions of the mechanism and its positions in the four cases mentioned above are as follows:—

Case I. Current flows from the positive line designated by the plus sign through the coil 13, contacts 14 and the lamp 1 to the negative line designated by the minus sign. In addition the shunt coil 15 receives current in series with the unused lamps 2 and 3 through the contacts 16 and 17. If the filament of the lamp 1 is broken the mechanism will be moved in the following way:—

The stop 12 is released by the deenergizing of the coil 13 which no longer receives current and is moved, by spring 18, out of engagement with a notch in the ring 7. The ring is consequently moved by the action of the weight 9, whereby the cam or curve 6 (see Fig. 2) so acts upon the link system 4 for the lamp 1, that said lamp is lifted and removed from the lens system.

The cam or curve 5 then acts on the link system 4^a for the gas burner 19 so that this will take its place in the focal point of the lens 8 where, however, it cannot remain because the ring 7 continues to rotate. The ring 7 continues its rotation so that the gas burner 19, in its turn, is replaced by the electric lamp 2, whereby the electric circuit is reestablished and completed through contacts 20 whereupon the stop 12 will again enter into engagement with one of the notches of the ring 7 in this case at 21 so that the system is brought to rest.

Case II. Before the breaking of the filament in lamp 3 the path of the current is as follows:—

From the positive line through the series coil 13, the contacts 22 and the lamp 3 to the negative line. The shunt coil 15 is de-energized because its circuit was broken at the contacts 17 when the lamp 3 was put into use after the breakage of the filament of the lamp 2. When the circuit of the shunt coil 15 was broken, the stop 23 was moved by the spring 24 against the ring 7, at a position however, where it could not engage any one of the notches in the upper edge of the ring 7. If the filament of the lamp 3 is broken, the mechanism will be moved in the following way:

The series coil 13 will be de-energized and the stop 12 will liberate the ring 7, which is moved by the weight 9 so that the cam curve 6 will lift the link system of the lamp 3.

Thereafter, the cam or curve 5 will act upon the link system 4^a which supports the gas burner 19, so that it will take its place and be retained in the focal point of the lens when the stop 23 locks the ring 7 and brings the system to rest.

The gas burner during the functioning or operation of the incandescent electric lamps burns with a considerably reduced flame (pilot flame) but when it is lowered so that it occupies a position in the focal point of the lens the cock or valve 25, which controls the gas conduit, is opened. In the gas conduit there is, in addition to the cock 25, also the sun valve of known construction, indicated at 26. During darkness the gas flow to the burner is not stopped by the sun valve.

The apparatus will remain in this position until new electric lamps are substituted and exchanged for those which have become inoperative and the weight is hoisted. In the lighthouse the gas burner burns or is operative during darkness. During daylight the flame is extinguished automatically by the sun valve.

Case III. In this case the lamp (for instance the lamp 1) as well as the series coil 13 and the shunt coil 15, are devoid of current.

The stopping arrangement 12 is then moved from its engagement with the ring 7. The stop 23 is moved against the ring 7 but is not adapted to effect stopping until the ring 7 has revolved to an extent sufficient to cause movement of the gas burner down into the focal point of the lens, in which position the gas burner is lit.

When the electric circuit is again established, the stop 23 is disengaged from the ring 7. The said ring then is turned by the weight 9 until a serviceable incandescent lamp has taken its position in the focal point of the lens. The series coil 13 then receives current through the contacts 14, 20 or 22 as the case may be and thus the stopping arrangement 12 will engage with the ring 7, and bring the system to rest.

Case IV. In this case the lamp, the series coil 13 and the shunt coil 15 are devoid of current. The gas burner 19 is then in the focal point but the gas to the burner is stopped by the sun valve 26. Should the lighthouse keeper forget to complete the electric circuit or should the electric circuit fail through any other cause at sunset, the gas flame will be automatically lit by the sun valve 26.

According to the method shown in Fig. 3, the presence of the gas is utilized to assist also in the replacement of the electric lamps and the gas burner. To move the electric lamps 1, 2, 3 each of the link systems 4 is adapted to be displaced by the upward thrust of a piston in a cylinder 27 when gas is admitted thereto, which piston is connected to an extension of the link system 4. A cylinder and a piston are provided for each system. The gas burner is suspended in an equivalent manner by another parallel motion link system 4^a counterweighted in the opposite sense and normally held in elevated position by the upward thrust of a piston in another cylinder 28 in which gas is normally imprisoned. The respective cylinders and

pistons will be referred to hereinafter as motors.

The gas employed in the motor cylinders 27, 28 is supplied through a valve 29 which is normally open to a pipe system 30 leading to valve casings 31, 32, the casing 31 being connected to the cylinder 28 and the casings 32 to the respective cylinders 27. The valve 29 is held in open position by electro-magnetic means such as a solenoid 33, de-energizing of which produces movement of said valve to connect the pipe system to the atmosphere at 34.

The gas is first led to a chamber 35 of the valve casing 31 associated with the motor 28 that controls the gas burner 19, which chamber is adapted to be separated from a central chamber 36 in communication with the motor cylinder 28, by a single seated valve 37, a flexible diaphragm 38 serving as one wall of the second named or central chamber 36 and of a third chamber 39. Gas is conducted from the first chamber 35 to the third chamber 39 by way of the chambers 39^a, 39^b, 39^c of the other valve casings 32 associated with the motors 27 controlling the electric lamps. Each casing 32 contains a double seating valve 40 normally forced by a spring into position to isolate from the system the chamber 41, which is connected to the cylinder of the motor 27. The arrangement is such that initially the single seated valve 37, controlling the gas burner motor 28, is opened by a spring to enable gas to flow into the motor cylinder 28 to elevate the gas burner suspension means 4^a. As soon as the gas, traversing the other valve casings 32, as referred to, fills the third chamber 39 of the valve casing 31 associated with the gas burner motor 28 it acts, through the diaphragm 38, to close the valve 37 and imprison the gas in the motor cylinder 28. Since the first lamp to be used is an electric one, for instance lamp 1, the double valve 40 associated with the motor 27 thereof is moved in opposition to the pressure of a spring, by a solenoid 42, so that the motor cylinder 27 is supplied with gas whilst the portion of the pipe system therebeyond is isolated imprisoning gas in the diaphragm chamber 39 of the valve casing 31 associated with the motor 28 for the gas burner which is thus not affected. If the lamp 1 or current supply fails and the solenoid 33 controlling the gas supply valve 29 is de-energized, the chamber of said valve 29 and companion motor cylinder 27 are temporarily exhausted whereby the electric lamp 1 is automatically raised out of the lens. The de-energizing of the solenoid 33 controlling the gas supply valve 29 is accompanied by the de-energizing of say the solenoid 43 of a stop, not shown, normally adapted to arrest movement of a rotary switch 44 through which the solenoid 42 of the motor valve 40 of lamp 1 is completed. The resultant switch movement interrupts this circuit and shortly after closes that of the solenoid 45 associated with the valve 39^b of the motor 27 of lamp 2 next in order. The release of the first valve 40 then isolates the associated motor 27 and prevents that lamp 1 coming into use again out of turn, but establishes the pipe circuit so that gas can be supplied to the next motor cylinder 27. This cycle of operation is repeated for each of the remaining electric lamps, except that, after removal of the last lamp, in this case lamp 3, from the lens, the diaphragm chamber 39 of the valve 31, associated with the gas burner motor 28, is vented to allow said valve 37 to open and vent the motor cylinder 28, whereupon the gas burner 19 descends into the lens. The circuit for each motor control solenoid 42, 45, 46 is completed across the mains through the appropriate switch contacts 47, 48, 49 which at the same time connect in parallel therewith solenoids 50, 51, 52 controlling switches in the actual lamp circuits, which latter include a common return 53 containing the solenoids 43 and 33 of the switch stop and gas supply valve. If therefore the lamp in any circuit thus closed by its individual switch associated with the respective solenoids 50, 51, 52, fails, the rotary control switch 44 is started and continues to rotate until the circuit of the next lamp is completed when it is again arrested. To prevent continued rotation of the control switch if the stop mechanism should be rendered inoperative due to a fault in supply, the solenoid 53^a of a brake, normally energized to render the latter ineffective, responds to the fault and applies the brake.

Although it is not considered necessary, it may be arranged that the circuit of any one solenoid 42, 45 or 46 of the lamp motors 27 shall not be completed to bring another lamp into use until the previous lamp has been removed from the lens. When this is desired it may be effected by an auxiliary switch 54, 55 closed by the lamp suspension means. If lamps are employed in which it is necessary or advantageous to complete the circuit through a resistance, such resistance 56, 57 or 58 may be arranged to be gradually cut out as the lamp is being lowered, as by a short circuiting member, not shown, movable with the lamp suspension means 4.

Any other suitable means within the scope of the invention, as defined by the claims, may be employed for effecting the movements of the electric lamps and gas burner as hereinbefore described.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. In signal lighting means, the combination of an electric lamp, means for supplying electric current thereto, means for movably supporting said lamp, a gas burner,

means operating independently of the support for said electric lamp to movably support the said burner, means acting automatically upon the failure of said electric lamp to remove the same from illuminating position, and separate means operating to move the said gas burner into illuminating position.

2. In signal lighting means, the combination of an electric lamp, a pivoted support therefor, said support being adapted to move in a vertical plane to raise and lower the said lamp, a revoluble cam member adapted to effect pivotal movements of the said support, a gas burner, a pivoted support therefor, means for causing movement of the said pivoted support to raise and lower the said gas burner, and means operative upon the failure of the said electric lamp to substitute the gas burner therefor.

3. In a signal lighting means, the combination of a plurality of electric lamps each of which is adapted to be moved into and out of operative position, pivoted supports for each of said lamps, the pivots of said supports being stationary, means for supplying electric current to said lamps, a gas burner which is adapted to be moved into and out of the said operative position adapted to be occupied by the said electric lamps, a pivoted support for the said gas burner, the pivot for said support being stationary, a revoluble curved member having cam members mounted thereon, means for causing rotative movement of the said curved member and the cam members mounted thereon, and means whereby rotative movement of the said curved member and the cam members carried thereby is adapted to cause movement of the said pivoted supports, and means rendered operative upon the failure of the last of the said electric lamps to effect substitution of the said gas burner therefor.

4. In signal lighting means, the combination of an incandescent electric lamp pivotally supported, parallel links for supporting said lamp, a gas burner, parallel links for pivotally supporting said gas burner, means for supplying electric current to the said lamp, means for supplying illuminating gas to the said burner, and means cooperating with the supporting links of said lamp and burner whereby the said burner will be substituted for the said lamp upon failure of the said lamp.

5. In signal lighting means, the combination of a plurality of means for providing sources of light, said means comprising an electric lamp and a gas burner, pivoted link devices for supporting said lamp and gas burner respectively, the pivots of said supporting link devices being stationary, each of the said pivoted link devices being adapted to carry the said means into and out of operative position, and means operating to actuate the pivoted link device for supporting said lamp to move the same from the position occupied thereby upon failure thereof and the said means operating also to actuate the pivoted link device for supporting the said gas burner to move the latter into the position occupied by the said lamp at the time of its failure.

6. In signal lighting means, the combination of a lens of general drum type, a plurality of electric lamps one of which normally is positioned at the focal point of the said lens and the others of which normally are positioned out of the paths of the rays of light which pass through the said lens, a gas burner which also normally is located out of the paths of the said rays, pivoted levers for supporting the respective lamps, a pivoted lever for supporting the said gas burner, means for actuating the lever supporting a lamp to remove the same from its position at the focal point of the said lens upon failure thereof, the said means also operating to actuate the lever of the next succeeding lamp to move it into the place occupied by the failed lamp, and means for moving the gas burner into position at the focal point of said lens upon failure of all of the said lamps.

7. In signal lighting means, the combination of a plurality of movable electric lamps and a movable gas burner, movable means for supporting the respective lamps and burner, a rotatable member having contact with portions of the respective movable means and adapted when rotated to cause movement of said means to successively move the said lamps and burner, means operating upon failure of one of said lamps to cause rotation of said member to cause movement of said lamp out of operative position with relation to a lens system, and the rotation of said member also operating to cause movement of the next succeeding lamp into the position vacated by the failed lamp, and the said rotatable member operating upon failure of the last of said lamps to actuate the movable means supporting the said gas burner to move the latter into operative position with relation to the said lens system.

Signed at London, England, this twenty-sixth day of April, 1926.

ROBERT READMAN STEEL.