

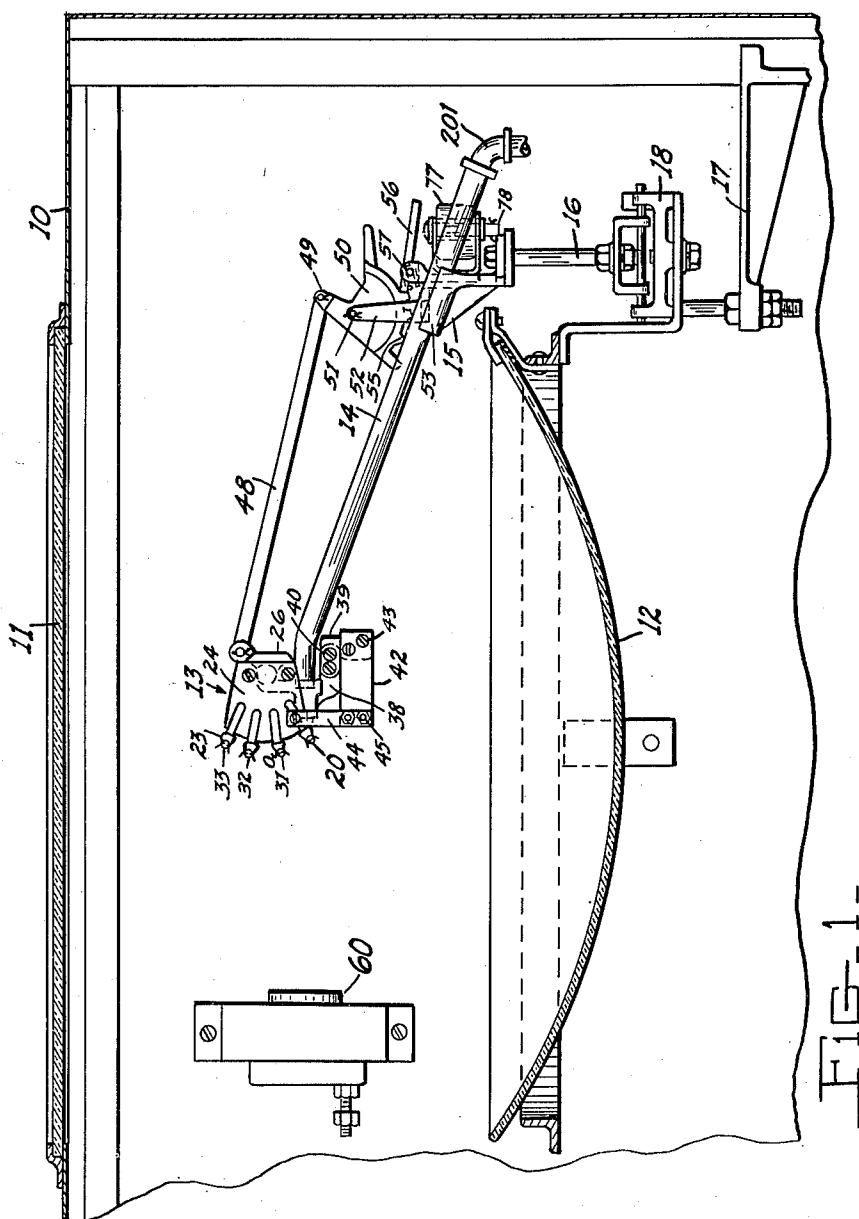
March 25, 1952

R. E. CROSSLEY ET AL
VENTILATED, LIGHT-RESPONSIVE, LAMP-CHANGING
MECHANISM FOR LIGHTING UNITS

2,590,513

Filed Feb. 19, 1947

3 Sheets-Sheet 1



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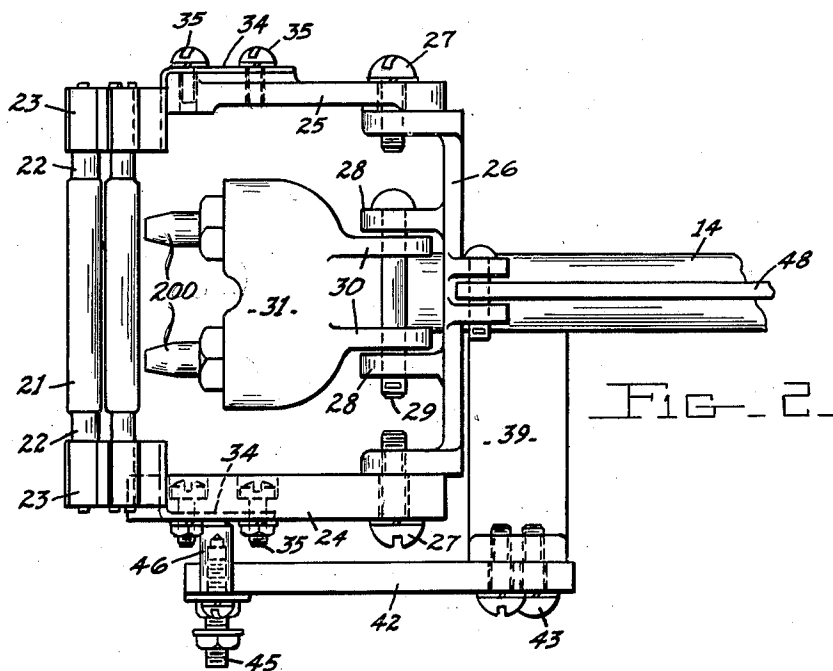


FIG. 2.

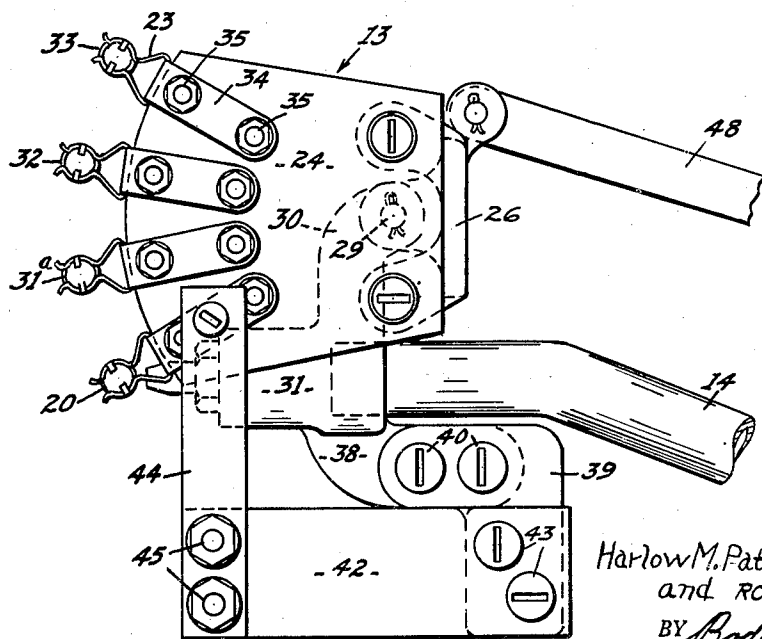


FIG. 3.

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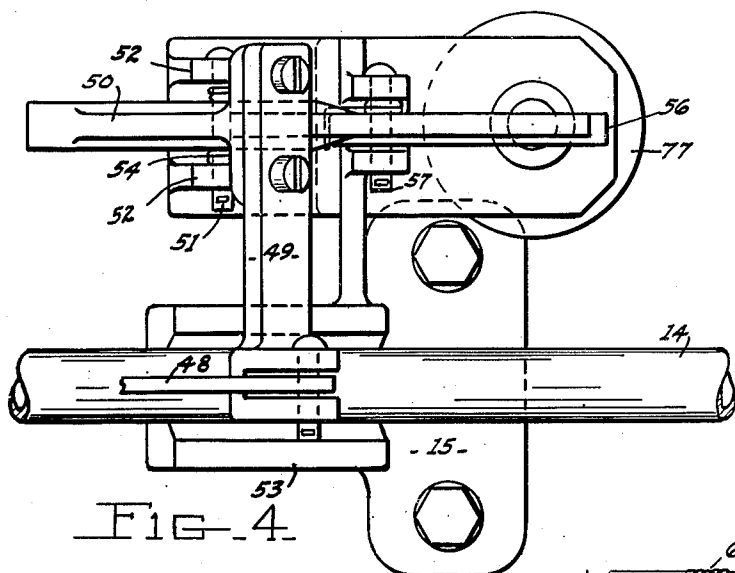


FIG. 4

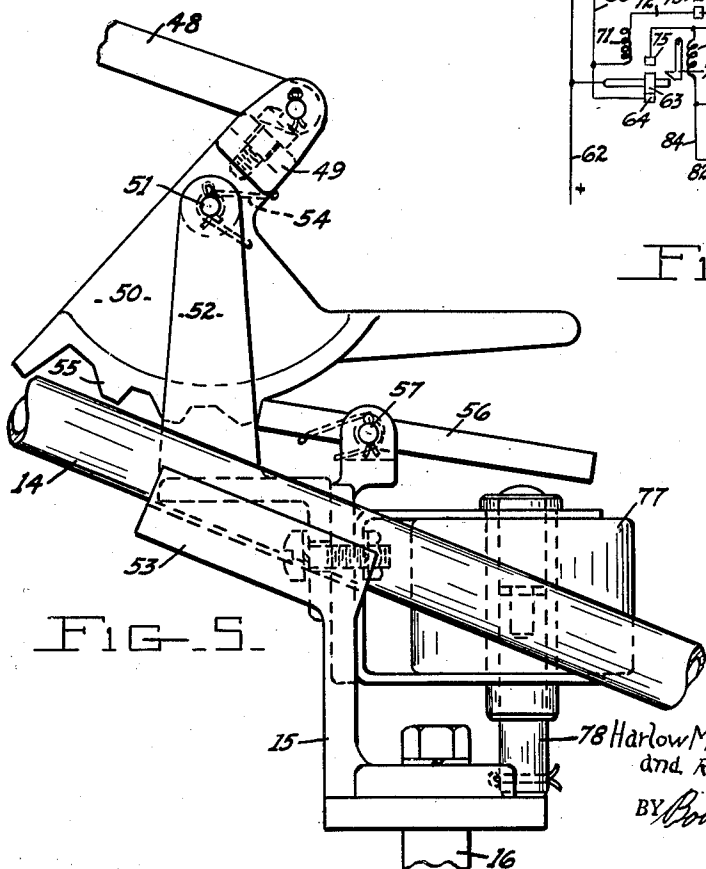


FIG. 5

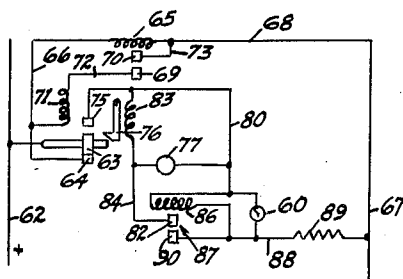


FIG. 6

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UNITED STATES PATENT OFFICE

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VENTILATED LIGHT-RESPONSIVE LAMP-
CHANGING MECHANISM FOR LIGHTING
UNITS

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6 Claims. (Cl. 240—37.1)

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This invention relates to mechanism for automatically changing lamps in an electrical lighting unit.

The invention has as an object, a mechanism of the type referred to provided with a plurality, or series, of lamps, and being operable automatically to successively move the lamps into the focal axis of the lighting unit when the light output of the lamp in the focal axis reaches a predetermined minimum, thus assuring an efficient operation of the unit at all times.

The invention has as a further object, lamp changing mechanism incorporating a structure by which high intensity lamps may be used, that is, lamps of small dimension with exceptionally high wattage, such as small high wattage mercury vapor lamps, the mechanism embodying a structure operable to effectively cool such lamps while they are being burned in operative position.

The invention has as a further object, a lamp changing mechanism embodying a structure operable to move a new lamp into operative position after the light output of the preceding lamp has reached a predetermined minimum for a period of time, and which is operable to effect the substitution of a successive lamp only after the lamp positioned in the focal axis of the unit has been so positioned for a predetermined length of time. This arrangement is effective to prevent a lamp being moved out of operative position and a new lamp substituted in the event of a momentary drop in the light output of the lamp caused by a voltage drop in the line, or a temporary power interruption. It also prevents the rapid substitution of a series of lamps, the flashing of which might be confused with a code signal customarily used on certain airway beacons.

The invention consists in the novel features and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawings in which like characters designate corresponding parts in all the views.

Figure 1 is a side elevational view of a lamp changing mechanism embodying my invention with contiguous parts of the lighting unit shown in section.

Figure 2 is a front elevational view, looking to the right, Figure 1, of the lamp carrier and contiguous parts of the associated mechanism.

Figure 3 is an enlarged side elevational view of the structure shown in Figure 2.

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Figure 4 is an enlarged front elevational view, looking to the right, Figure 1, of the mechanism for effecting movement of the lamp carrier.

Figure 5 is a side elevational view of the structure shown in Figure 4.

Figure 6 is an across the line schematic wiring diagram of the circuit employed in connection with the mechanism shown in Figures 1 to 5 inclusive.

In Figure 1, the lamp changing mechanism is shown mounted in a lighting unit of the searchlight or beacon type, comprising a cylindrical casing 10 having a transparent lens 11 and a reflector 12. The lamp changing mechanism comprises a lamp carrier 13 movably mounted upon a support 14 secured to a bracket comprising a casting 15 supported on a stem 16 which, in turn, is carried by an arm 17 secured to the casing 10 of the lighting unit. The stem 16 is connected to the arm 17 by any suitable means, as 18, whereby the support 14 may be adjusted universally to accurately position one of the lamps, as 20, in the focal axis of the unit.

As here shown, the mechanism is intended particularly for using mercury vapor lamps which are of relatively small dimension, but which have an output in the neighborhood of 900 watts. These lamps consist of a small transparent tube 21 provided with a metallic ferrule 22 on each end, and the carrier 13 is provided with a plurality of pairs of clip terminals 23. The carrier is of general U formation, being formed with side plates 24, 25, secured to a back plate 26, as by screws 27. The back plate 26 is formed with a pair of spaced apart inwardly extending lugs 28 apertured to receive a pivot pin 29 also extending through a pair of lugs 30 extending from a head piece 31 carried on the end of the support 14, whereby the carrier is movable about the pivot 29. The clips 23 are mounted on the side plates 24, 25, on a radius struck from the axis of the pivot, all whereby the lamps 20, 31^a, 32 and 33 move in an arc about the pivot and, as previously stated, the lamp 20 is illustrated as being positioned in the focal axis of the unit. When the light output from this lamp reaches a predetermined minimum, the carrier is moved about the pivot 29, bringing the next succeeding lamp 31^a of the series into operative position. That is, intermittent movement of the carrier 13 about the pivot 29 successively positions the lamps of the series in the focal axis of the reflector 12. The carrier may be constructed to take any number of lamps. However, in ordinary

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use, four have been found to be entirely sufficient.

The spring clips 23 are formed with straps 34 overlying the outer sides of the plates 24, 25, and being secured thereto, as by screws 35. The plate 25 is formed of metal. The plate 24 however, is formed of insulating material and provision is made to provide current to energize the lamp in operative position. The head piece 31 is formed with a centrally arranged arm 38 to which is secured a bracket 39, as by screws 40, and which extends laterally beyond the plate 24, and to the outer end of which is secured a strip 42 of insulating material, as by screws 43. A strip of conducting material 44 is secured to the opposite end of the insulating strip 42, as by screws 45, one or both of which may serve as terminals to which one of the power wires is secured. The upper end of the strip 44 is provided with a brush 46 extending inwardly between the screws 35 and contacting the straps 34, the brush 46 being so positioned as to contact the strap of the terminal, or clip, of the lamp in operative position.

The lamp carrier is connected to a link 43 extending rearwardly and being pivotally connected to one end of a cross member 49, the opposite end of which is secured to a quadrant 50 mounted upon a pivot pin 51 carried by a pair of upstanding bosses 52 forming part of the casting 15, which is also formed with a trough shaped portion 53 extending in angular relation to the stem 16 and in which the support 14 is secured, as by being welded thereto.

The quadrant 50 is urged in a counter-clockwise direction, Figure 5, by a torsion spring 54 and tends to likewise urge the lamp carrier 13 in a counter-clockwise direction, Figures 1 and 3. The lower arcuate surface of the quadrant is formed with teeth-like projections 55 which are engaged by a restraining member 56 pivotally mounted at 57. There is one of the projecting teeth 55 for each lamp in the series carried by the lamp carrier. It will be understood that the arrangement of the teeth 55 is complementary to the arrangement of the lamps carried by the carrier 13.

Usually lamp changing mechanisms are operable after the lamp in operated position has burned out. This is brought about by mechanism operable upon current failure resulting from the burned out filament in the lamp. It is desirable, in many instances, that the lighting unit maintain a desired efficiency, or light output, and we have incorporated in our mechanism means whereby the replacement of a lamp, when it reaches the predetermined minimum efficiency, is moved out of operative position, and a new lamp substituted for it. For example, the mechanism may operate to shift a new lamp in operative position when the light output of the previous lamp has dropped to forty or fifty percent. There is arranged in the casing, and under the influence of the light output of the operative lamp, a light actuated switch 60, the contacts of which remain closed while the light output of the operative lamp is above a predetermined minimum. However, when the light output of the lamp reaches the predetermined minimum, the contacts of the switch 60 open, and the opening of this switch effects operation of mechanism to move the restraining member 56 out of engagement with the projection 55 with which it is in engagement at the time, and thus permitting the spring 54 to effect movement of the lamp carrier about its pivot 29 to

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bring the next succeeding lamp of the series into operative position. The light actuated switch referred to may be of the type sold by the Mercoid Corporation, Chicago, Illinois, under the trade name "Visaflame." Switches of this type are referred to in Patents No. 2,159,392 and No. 2,171,861, issued to I. E. McCabe, May 23, 1939 and September 5, 1939, respectively. These switch units are adjustable to operate at various light intensities and accordingly the lamp shifting mechanism can be set to operate at any desired efficiency of light output.

Referring to Figure 6, power is supplied from the conductor 62 to a movable contact 63 of a latch relay, the contact 63 of which is in engagement with contact 64 connected to the heater 65 of a time delay relay by conductor 66. The opposite side of the heater 65 is connected to the common return leg 67 of the circuit through conductor 68. The heater 65 is constructed, or adjusted, to require approximately one minute to close its contacts 69, 70. The conductor 66 also furnishes current to the operating coil 71 of the latch relay, the opposite end of the coil being connected to contact 69 through conductor 72. Thus, when the contacts 69, 70, close, the circuit to the common conductor 67 is completed by conductors 73, 68.

When the coil 71 is energized, the movable contact 63 is moved upwardly into engagement with the contact 75 and is held in this position by a latch 76. Contact 75 is connected to a solenoid 77 mounted on the bracket 15 and having a plunger 78 adapted, when the coil 77 is energized, to engage the restraining member 56 and move it counter-clockwise about the pivot 57, thereby releasing it from engagement with the teeth 55 of the quadrant 50. This connection is effected through a conductor 80, the opposite side of the solenoid coil 77 being connected to a contact 82. Power is also furnished from contact 75 to a coil 83 which, when energized, moves the latch 76 out of latching engagement with the contact 63, permitting it to drop into engagement with contact 64. The opposite side of the coil 83 is also connected to the contact 82 through wire 84. The conductor 80 also furnishes a feed to the heater 86 of a time delay relay 87, the opposite side of the heater being connected to the common side of the line 67 through a conductor 88 and if high voltage is used on the circuit, a resistor 89 may be employed. The movable contact 90 of this time delay relay is normally out of engagement with the contact 82 and accordingly, there is no return provided for the solenoid 77 and latch coil 83. The conductor 80, from contact 75, is also connected to the switch 60, the other side of the switch being connected to line 67, or to the resistor 89, if used.

With this arrangement, it will be observed that the switch 60 is connected in shunt with the heater coil 86 and thereby short-circuits the same while the contacts of the switch 60 are closed, and that situation prevails, as previously stated, while the output of the operative lamp is above the predetermined minimum. When the light output of the operative lamp falls to the predetermined minimum, the contacts of the switch 60 open and current accordingly flows through the heater coil 86, causing the contacts 82, 90, to close. When this takes place, the circuit through the solenoid 77 is completed, effecting release of the restraining member 56 resulting in the movement of the carrier 13 to bring the next succeeding lamp in the series

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into operative position and simultaneously, the circuit is completed through the latch coil 83, causing contact 63 to move out of engagement with contact 75 and into engagement with contact 64. The time delay relay 87 is likewise adjusted for approximately one minute operation. In other words, the light output of the effective lamp has to drop to the predetermined minimum and remain there for the period required for the relay 87 to close its contacts 92, 90. This prevents the substitution of a new lamp in case of a momentary voltage drop, or power interruption. Likewise, the time delay relay 65 is effective to prevent a succeeding substitution to take place immediately in view of the fact that the control circuit for the solenoid 77 does not become energized until the contacts 69, 70, of relay 65 close. This arrangement prevents the possibility of the new lamp flashing on and failing immediately followed by the substitution of the next lamp within a short space of time. Such a situation might indicate an erroneous code signal to an airplane pilot and lead to a disastrous result.

As illustrated in the drawings, the support 14 consists of a tubular member, and the head 31 connected thereto is provided with discharge nozzles 200 arranged in proximity to the lamp positioned in the focal axis of the unit. The nozzles directing streams of a gaseous cooling medium, such as compressed air, on the lamp to maintain the same at operating temperature. The rear end of the member 14 is connected to a pipe 201 supplied with a gas under pressure as by a conventional air compressor.

What we claim is:

1. A lamp changing mechanism for lighting units comprising a tubular support arranged in the unit and being connected at one end to a supply of cooling medium and terminating at its inner end in juxtaposition to the focal axis of the unit, a lamp carrier movably mounted on the inner end of said support and being adapted to carry a series of at least three lamps and being movable to successively position the lamps of said series in the focal axis of the unit, a nozzle secured to the inner end of said tubular support and arranged to discharge the cooling medium on the lamp positioned in said focal axis, and means operable when the light output of the lamp positioned in said focal axis drops to a predetermined intermediate percentage to effect movement of said carrier to position the next succeeding lamp in said focal axis.

2. A lamp changing mechanism for lighting units comprising a support arranged in the unit, a lamp carrier mounted on the support and being adapted to carry a series of at least three lamps and being movable on the support to successive positions for successively positioning the lamps of said series in the focal axis of the unit, means urging said carrier to said successive positions, a restraining member operable to hold said carrier against such movement, an electro-responsive device operable when energized to release said restraining member, a power circuit, a relay, said electro-responsive device being connected in the power circuit through normally open contacts of said relay, a branch circuit including the coil of said relay, a light actuated switch connected in shunt with said coil and being arranged under the influence of the light output of the lamp in the focal axis of the unit, said switch being operable to maintain its contacts closed and thereby short circuit said coil

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while the light output of said lamp is above a predetermined minimum, and to cause said contacts to open when said light output reaches said predetermined minimum, and means operable to energize said circuits a predetermined time after said lamp has been positioned in the focal axis of the unit.

3. A lamp changing mechanism for lighting units comprising a support arranged in the unit, a lamp carrier mounted on the support, a series of at least three lamps mounted on said carrier and said carrier being movable on the support to successively position said lamps in the focal axis of the unit, carrier restraining means operable to hold said carrier in any selected one of such successive positions, a releasing member operable when energized to release said restraining means, and means operable to effect movement of said carrier upon such release to the next successive position, a light actuated switch mounted in the unit under the influence of the light output of the lamp positioned in said focal axis and being cooperable when the light output of said lamp drops to a predetermined minimum percentage to effect energization of said restraining means, and time delay means operable to render said light actuated switch ineffective until the elapse of a predetermined time after the positioning of each lamp.

4. A lamp changing mechanism for lighting units comprising a support arranged in the unit, a lamp carrier mounted on the support, said carrier being adapted to carry a series of at least three lamps and being movable on the support to successively position said lamps in the focal axis of the unit, electro-responsive means operable when energized to effect movement of said carrier to position the next succeeding lamp in said series in the focal axis of the unit, a light actuated switch mounted in the unit under the influence of the light output of the lamp positioned in said focal axis and being cooperable when the light output of said lamp drops to a predetermined minimum percentage short of complete extinguishment to effect energization of said electro-responsive means, and time delay means operable to prevent such energization until the elapse of a predetermined time after the light output of said lamp drops to said predetermined minimum percentage.

5. A lamp changing mechanism for lighting units comprising a nozzle fixedly mounted in the unit in juxtaposition to the focal axis thereof, a carrier movably mounted in the unit and being adapted to carry a series of at least three lamps and being movable successively to position said lamps of said series in the focal axis of the unit and in registration with said nozzle, said nozzle being operable to discharge a cooling medium on the lamp positioned in said focal axis, electro-responsive means operable when energized to effect movement of said lamp carrier through said successive positions, a light actuated switch mounted in the unit under the influence of the light output of the lamp positioned in said focal axis and being cooperable when the light output of said lamp drops to a predetermined minimum percentage short of complete extinguishment to effect energization of said electro-responsive means.

6. A lamp changing mechanism for lighting units comprising a support extending transversely of the focal axis of the unit, a nozzle secured to the inner end of said support in juxtaposition to the focal axis of the unit and arranged to

discharge a cooling gas on a lamp positioned in said focal axis, a lamp carrier movably mounted on the inner end of said support and being adapted to carry a series of at least three lamps and being movable to successively position the lamps of said series in the focal axis of the unit, electro-responsive means operable when energized to effect movement of said carrier to position the next succeeding lamp in said focal axis, a light actuated switch mounted in the unit and arranged under the influence of the light output of the lamp positioned in said focal axis and being cooperable when the light output of said lamp drops to a predetermined minimum percentage short of complete extinguishment to effect energization of said electro-responsive means.

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