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**Appleton**

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## [54] EMERGENCY LIGHT CIRCUIT FOR MERCURY VAPOR LAMPS


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[51] **Int. Cl.** .....**H05b 41/46**

[58] **Field of Search** .....250/206; 307/66; 315/86, 87, 315/88, 90, 91, 92, 93, 134



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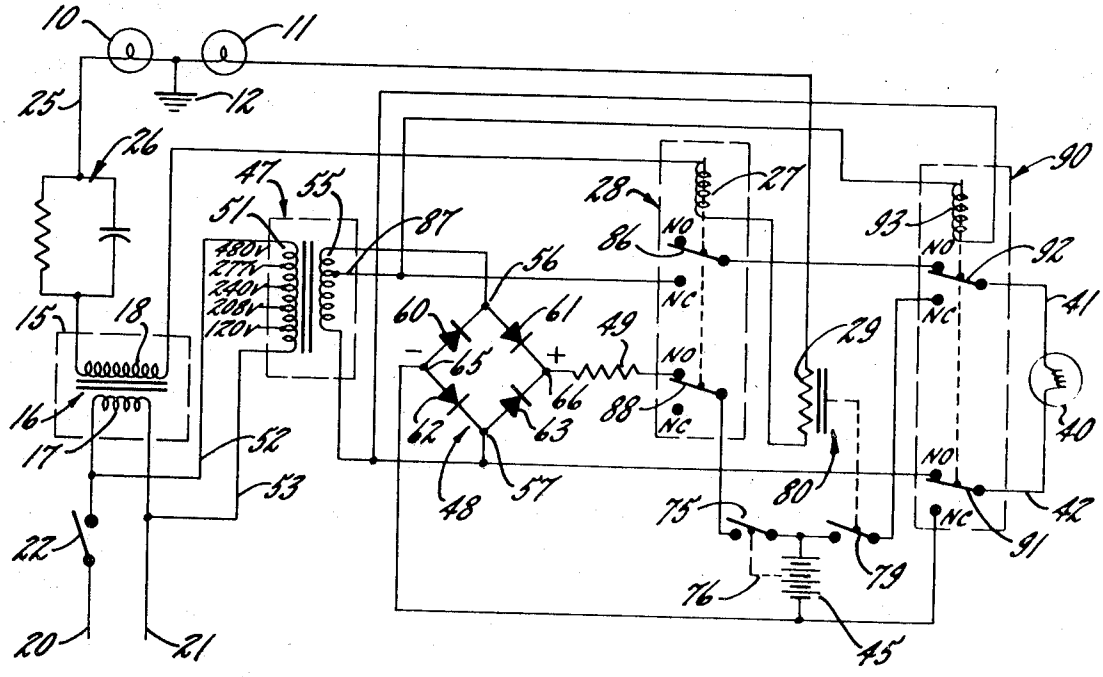
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[57] **ABSTRACT**

An auxiliary or emergency lighting system for use with electric discharge lamps, and more particularly mercury vapor lamps. Means are provided for detecting the loss of energy or illumination in the primary discharge lamps and responding thereto to turn on an emergency lamp. In one embodiment, the emergency lamp may be selectively supplied with electricity from either the primary power source or from a battery, depending upon whether the electrical discharge lamps are momentarily or permanently deprived of energy. The battery for the emergency lamp is charged by a charging circuit connected to the primary power source and operative during normal operation of the electrical discharge lamp. A second embodiment uses a light-detecting device for triggering the emergency lamp into operation and includes means for providing both a fast charge and a trickle charge to the battery, depending upon the charge state of the battery.


**13 Claims, 2 Drawing Figures**



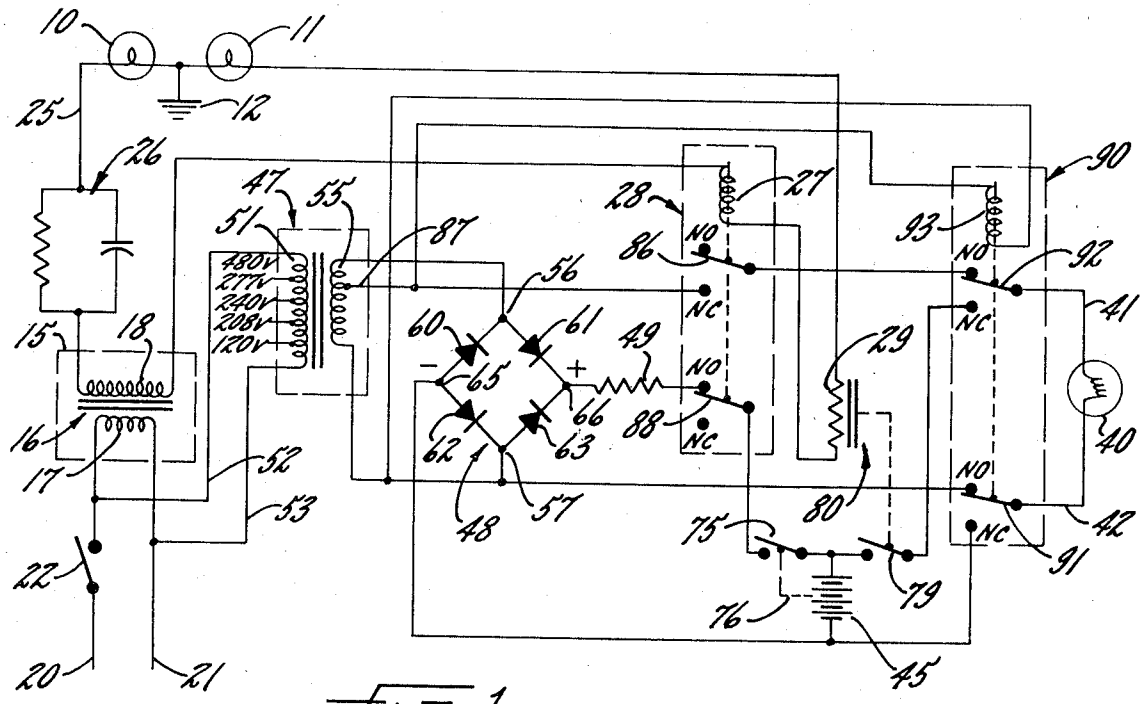



Fig. 1.

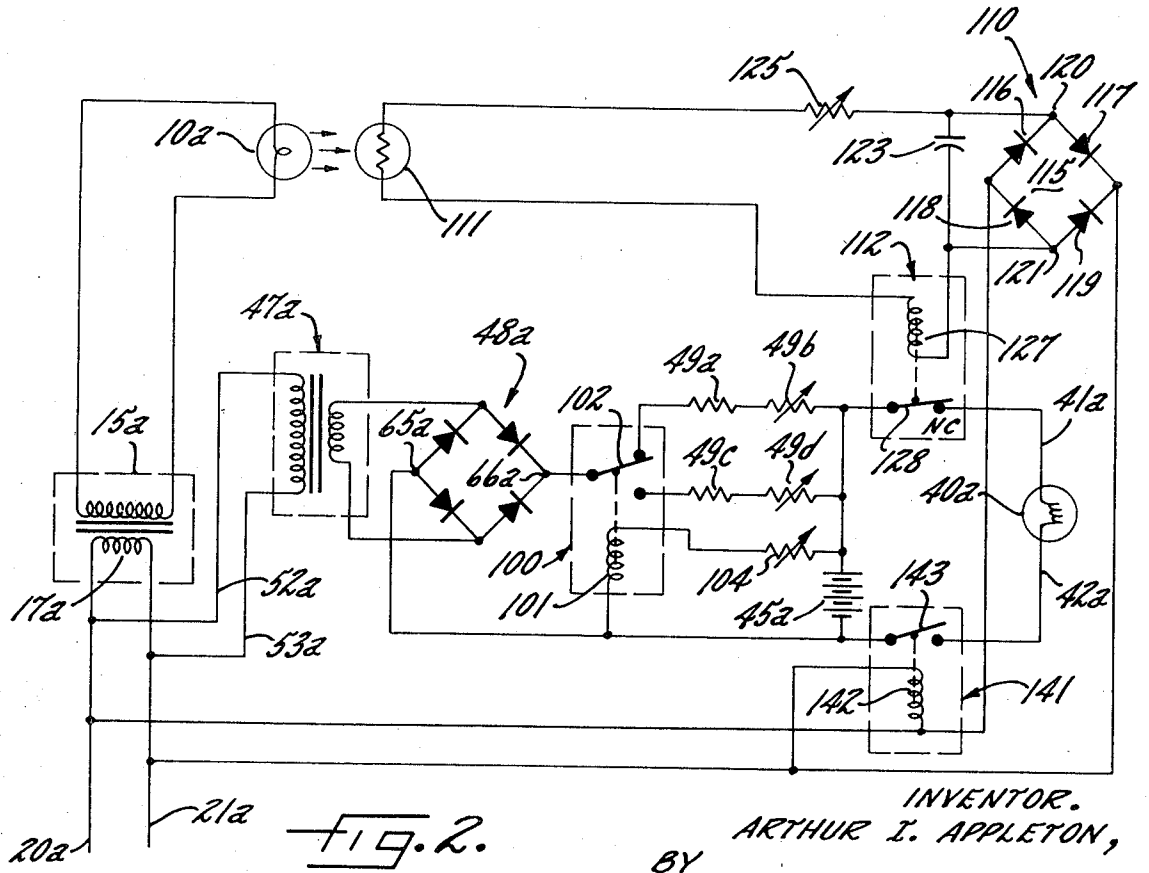



Fig. 2.

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# EMERGENCY LIGHT CIRCUIT FOR MERCURY VAPOR LAMPS

## BACKGROUND

Electrical gaseous discharge lamps emit light by sustaining an arc through a gas atmosphere in a bulb. Mercury vapor is a commonly used gas for this purpose; consequently, mercury vapor lamps will be used as an illustrative example of the primary illumination source in the subsequent discussion of the invention. The voltage required to sustain the arc in the lamp during ordinary operation is substantially less than that required to strike the arc initially. Thus the power to the mercury lamp is first channeled through a "ballast" which serves to supply the lamp with a high initial voltage to strike the arc and a lower sustaining (or operating) voltage after the arc is made. As the lamp continues in operation, it warms to a temperature considerably higher than that of the air surrounding it. Eventually it will reach a state of thermal equilibrium. Should the arc for any reason be extinguished after the lamp has reached its operating temperature, a significant problem will arise. The starting voltage required for a hot lamp is significantly higher than that required for a cold lamp, the voltage required being a function of temperature. Immediately after the arc is extinguished, the starting voltage required may be many times the cold starting voltage. It then decreases with the passage of time as the lamp cools. The "ballast" or starting circuit for electric discharge lamps is very often incapable of supplying this unusually high starting voltage. Therefore, until the lamp cools considerably the ballast will be unable to restrike the arc, this cooling process typically requiring between 10 and 15 minutes. During the cooling period the light will be completely out even though the line voltage may have been only momentarily interrupted.

Emergency lighting systems for providing illumination during a momentary drop in line voltage to a mercury vapor lamp have been proposed in the past. For instance, one prior circuit utilized an emergency lamp connected in parallel with the primary electric discharge lamp. When the primary lamp was extinguished by a momentary drop is in the line voltage, the emergency lamp provided an alternate path for the current and was illuminated. The difficulty with this arrangement lies in the fact that no emergency lighting is provided when the line current is interrupted for an appreciable period.

## DESCRIPTION OF THE INVENTION

The present invention overcomes the problems arising in prior emergency lighting systems for electrical discharge lamps in a manner heretofore untaught in the art.

It is an object of the present invention to provide an emergency lighting system for use with electric discharge lamps by means of which emergency illumination is provided whenever the power for the discharge lamps is interrupted, whether the interruption be momentary or prolonged.

It is another object of the present invention to provide an emergency lighting system which derives its power from the normal power source or line voltage when it is available, but which, when the line voltage is not available, is supplied by its own self-contained source of power.

It is a further object of the present invention to provide means for detecting an interruption in the illumination of electric discharge lamps whether that interruption be from a fluctuation in the power supply to said lamps or from an inherent difficulty arising in the lamps themselves.

A still further object of the present invention is the provision of an emergency lighting system which is adaptable to a wide variety of configurations of electric discharge lamps and power sources for the same. It is a related object of the invention that the system be simple, inexpensive and capable of operation with only a minimum amount of electrical power.

Still another object of the present invention is the provision of an emergency lighting system which is virtually maintenance-free while being capable of many consecutive operations.



Other objects and advantages of the present invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a diagram of an emergency lighting system constructed in accordance with the present invention; and

FIG. 2 is a diagram of an alternative embodiment of the present invention.

While the invention has been described in connection with a preferred embodiment, we do not intend to limit the invention to the form set forth, but, on the contrary, we intend to cover such alternatives, modifications and equivalents as may be included within the spirit and scope of the invention.

Turning then to FIG. 1, there is shown a primary or main lighting circuit including a pair of electrical discharge lamps **10, 11** connected in series, with their cases grounded via a line **12**. A ballast circuit **15** is provided for the purpose of supplying the lamps **10, 11** with their required starting and operating voltages. The ballast circuit **15** typically includes a transformer **16** consisting of primary and secondary windings **17, 18**. It is also common practice to use an autotransformer for this purpose in place of the conventional transformer **16**. The primary **17** of the transformer **16** is connected to an alternating current power source (not shown) via the lines **20, 21**, one of which has a switch **22** thereacross for controlling the application of line voltage to the circuit. One side of the winding **18** of the transformer **16** is connected to the lamp **10** via a line **25** having an R-C dropping circuit **26** disposed therein. The other side of the coil **18** is connected to the lamp **11** through the energization coil **27** of a relay **28** and through a heating resistor **29**. The lamps **10, 11**, R-C dropping circuit **26**, coil **27** and heating resistor **29** form a series loop with the secondary winding **18** of the transformer **16**.

The electrical discharge lamps **10, 11** are of the type having a metal vapor; such as mercury vapor, contained therein for sustaining an electrical arc between a pair of electrodes also contained therein. The voltage required to sustain the arc during ordinary operation is considerably less than that required to strike the arc initially. The starting voltage depends to a great extent on the temperature of the lamp. A heated lamp, such as one which has just been turned off after operating for a prolonged period, may require twice the starting potential needed for a cold lamp. The ballast circuit **15** is designed to provide a high starting voltage, but only sufficient to start a lamp at room temperature, and a lower sustaining voltage after the arc is made. Since the current flowing through the lamps **10, 11** is effectively zero before the arc is struck and increases as the operating or sustaining voltage decreases, a simple transformer such as that shown in **16** is adequate and conventionally used as a ballast.

A problem arises when the arc in the lamps **10, 11** is extinguished, the solution for which forms the basis of this invention. Until the lamps **10, 11** cool down to near room temperature, the ballast circuit **15** will be incapable of providing a sufficiently high starting voltage to restrike the arc.

Therefore, in accordance with one aspect of the present invention, a secondary lighting circuit is provided to furnish emergency illumination when, for any reason, the arc in the lamps **10, 11** is extinguished. To this end, an emergency lamp **40** is provided, which is selectively connected via lines **41, 42** to power sources hereinafter described. The emergency lamp **40** shown in FIG. **1** is intended to be an incandescent lamp capable of either AC or DC operation when supplied with a nominal voltage of 12 volts; however, other lamps may serve equally well in the circuit with only minor modifications.

For the purpose of providing an auxiliary power supply for the emergency lamp **40** in the absence of a line voltage on the lines **20, 21** a storage battery **45** is furnished as a secondary power source. A battery-charging circuit is also provided, including a transformer **47**, a bridge rectifier **48** and a dropping impedance **49**. A primary winding **51** of the transformer **47** is connected via lines **53, 52** to the power input lines **20, 21**, respectively, while the secondary winding **55** is connected across the input terminals **56, 57** of the bridge rectifier **48**.

The bridge 48 consists of four diodes 60–63 arranged to provide a full-wave rectified signal across a pair of output terminals 65, 66.

The transformer 47 has a plurality of contacts on its primary winding 51 so that it is universally adaptable to a number of conventional line voltages, such as those shown opposite the primary terminals. Since the storage battery 45 is being charged through the dropping impedance 49, it is desirable to supply the input terminals 56, 57 of the bridge 48 with a peak voltage somewhat higher than the nominal voltage of the battery 45. For instance, if the battery 45 is fully chargeable to 12 volts, the transformer 47 will typically be designed and connected to supply a peak voltage of approximately 16 volts across its secondary winding 55.

For the purpose of controlling the charging current to the battery 45 and preventing an overcharge thereof, a pressure switch 75 is connected between the battery 45 and its charging circuit. The storage battery 45 may be of the nickel cadmium variety, in which case a sensing element 76 of the pressure switch 75 will be inserted to sense the pressure created by the emission of gases in the cells of the battery during its charging process. As the battery 45 reaches its fully charged state, the pressure detected by the sensor 76 triggers the switch 75 to its open position, as shown in FIG. 1. The use of such a protective device allows a more substantial charging current to be applied to the storage battery 45 without any danger of damaging the cells. Also provided is a means for limiting the time during which the storage battery 45 may be discharged to supply a load. This function is accomplished in the present case by a thermal time delay switch 79 which is thermally coupled to the heating resistor 29 via a heat sink 80. The heating resistor 29 is chosen for low resistance and high wattage so that its temperature rises considerably, typically to 200° F. or more, when current flows in the primary lighting circuit. The thermal time switch 79 will close as the temperature of the resistor 29 passes a fixed threshold. Because of an inherent hysteresis effect in the thermal time switch 79, the temperature created by the heating resistor 29 will have to drop somewhat below this closing threshold temperature before the switch 79 will again open. Typical of thermal time switches meeting the above requirements is one designated Therm-O-Disk, type 60T22, a single-pole, single-throw switch which closes at 190° F. and opens at 150° F.

In accordance with another aspect of the present invention, the secondary lighting circuit is selectively connected to be supplied by the primary power source in the instance where power to the lamps 10, 11 is only momentarily interrupted; while, alternatively, this same circuit is connected to be supplied by the storage battery 45 in the instance where the primary power is interrupted for an extended period. To this end, the relay 28 has a contact arm 86 which, when in its normally closed condition, completes a circuit with a tap 87 on the secondary winding 55 of the transformer 47. A second contact arm 88 of the relay 28 couples the dropping impedance 49 of the battery charging circuit to the storage battery 45 when the relay is energized. A second relay 90 has a pair of contact arms 91, 92 and an energization coil 93 connected between one side of the secondary winding 55 of the transformer 47 and the takeoff tap 87 of the same winding 55. The contact arms 91, 92 have normally open and normally closed positions for respectively connecting the emergency lamp to the primary power source (via the relay 28 and the transformer 47) or to the storage battery 45 (via the thermal time switch 79). The takeoff tap 87 of the secondary winding 55 provides the necessary AC voltage for driving the emergency lamp 40 and the relay coil 93. In the present instance, both the lamp 40 and coil 93 are operative at 12 volts AC, and the storage battery 45 has a fully charged voltage of 12 volts DC.

To facilitate an understanding of the operation, assume first that the switch 22 becomes closed to supply the ballast circuit 15 with power via the power lines 20, 21. If the electrical discharge lamps 10, 11 have cooled to room temperature from any previous operation, the ballast circuit 15 will provide a starting voltage sufficiently high to strike the arc and illuminate the lamps 10, 11. Current begins to flow through the primary lighting circuit, energizing the coil 27 of the relay 28 and heating up the resistor 29. The contact arms 86, 88 of the relay 28 move to their normally open positions, as shown in FIG. 1. If the battery 45 is not already charged to its fully charged state, the pressure switch 75 will be closed, and the charging circuit will charge the battery via the transformer 47, the bridge rectifier 48 and dropping impedance 49. When the battery 45 becomes fully charged, the pressure switch 75 opens. Meanwhile, the heating resistor 29 has reached a temperature sufficient to close the thermal time switch 79. The energization coil 93 of the relay 90 has been energized by virtue of its connection to the secondary of the transformer 47, and the contact arms 91, 92 have moved to their normally open positions.

If a momentary fluctuation now occurs in the primary source voltage, the lamps 10, 11 will be extinguished. If the lamps have reached their operating temperature, the ballast circuit 15 will be unable to provide a high enough voltage to restrike the arc. Even though the primary power source is immediately reactivated, the current through the lamp circuit is effectively zero. The relay 28 becomes deenergized, with the contact arms 86, 88 assuming their normally closed positions. Since primary power was immediately reestablished, the relay 90 remains energized to connect the emergency lamp 40 to the primary power source via the transformer 47 and the contact arm 86 of the relay 28. Although the emergency lamp 40 is providing illumination, there is no load put on the battery 45. When the electrical discharge lamps 10, 11 cool sufficiently, their arcs will be again struck by the ballast circuit 15, and current will flow in the primary lighting circuit. The relay 28 will become energized, disconnecting the emergency lamp 40 from the primary power source.

If, instead of a momentary power interruption, there had been a permanent power stoppage, such as when the main switch 22 is opened, a different sequence of events would take place. The lamps 10, 11 would again be extinguished and the relay 28 would be deenergized. Since primary voltage is no longer supplied to the transformer 47, the relay 90 would also be deenergized, connecting the emergency lamp 40 across the storage battery 45 via the thermal time switch 79. The emergency lamp 40 would glow to illuminate the area until the heating resistor 29, which is now deprived of current, cools sufficiently to open the thermal time switch 79. After 10 to 15 minutes, the switch 79 opens and the emergency lamp 40 goes off. If the switch 22 is closed at any time during the time delay period of the switch 79, the relay 90 will be energized to disconnect the lamp 40 from the battery 45. Depending upon whether the discharge lamps 10, 11 have cooled sufficiently to allow ignition by the ballast circuit 15, the illumination for the area will then be supplied by the discharge lamps 10, 11 or the emergency lamp 40 (via the primary power source instead of the battery 45).

If the above-described circuit is part of a lighting system which is used every evening, it is seen that the emergency lamp 40 will be operative for a period of time after the primary lighting circuit is turned off in the morning; the storage battery 45 will partially discharge every morning and will be recharged every evening when the primary power is turned on. Such a discharge-charge cycle extends the life of the battery.

An alternative embodiment of the present invention is shown in FIG. 2. This embodiment is similar in several ways to that shown in FIG. 1; consequently, the reference numbers for the elements of FIG. 1 are carried over to those elements of FIG. 2 which provide an identical function, with the addition of subscripts. All of the alternative features shown in FIG. 2 are applicable to the preferred embodiment shown in FIG. 1; therefore, all modifications to either circuit incorporating features of the other are within the scope of the present invention.

Turning then to FIG. 2, there is shown an electrical discharge lamp 10*a* connected for energization by a ballast

circuit 15a. The ballast circuit primary winding 17a is coupled to a primary source of power on the lines 20a and 21a. It will be noted that the lamp 10a is connected directly across the secondary winding 18a of the ballast circuit 15a, forming an integrated unit for connection to the AC power lines.

A secondary or emergency power source is provided by a battery 45a, the charge of which is maintained by a battery-charging circuit in a manner similar but not identical to that described for the preferred embodiment. In this case, the battery-charging circuit is selectively controlled to provide a fast charge or a trickle charge to the battery 45a, the rate of charge depending upon the voltage existing across the battery. To this end, the battery-charging circuit includes a transformer. 47a connected to the primary power source via lines 52a, 53a. The transformer output is fed to a bridge rectifier 48a, which provides full-wave rectification at the terminals 65a and 66a. A charging current is selectively applied to the battery 45a through a low-impedance path consisting of a fixed resistor 49a and a variable resistance 49b or through a high-impedance path consisting of a fixed resistor 49c and a variable resistor 49d. For sensing the voltage across the battery 45a there is provided a relay 100 having an energization coil 101 and a contact arm 102, the coil 101 being in series with a variable resistor 104 connected across the battery 45a. The resistance 104 is preset so that the coil 101 is energized as the storage battery 45a reaches its full operating voltage. Energization of the coil 101 trips the contact arm 102, switching the output terminal 66a of the bridge 48 from the low-impedance path (resistors 49a, 49b) to the high-impedance path (resistors 49c, 49d). In this way a switch from a fast charge rate to a slow charge rate is accomplished, protecting the storage battery 45a from overcharging.

A secondary lighting circuit including a lamp 40a is disposed for connection across the storage battery 45a in a manner hereinafter described.

For responding to the interruption of illumination of the primary lighting source there is provided a light-sensing circuit having its own DC power supply 110, a photosensitive device 111 and a relay 112. The photosensitive device 111 in this case is a photoresistor of the type having a very high resistance value in darkness and a very low resistance value in the presence of light. The DC power supply for the sensing circuit includes a bridge rectifier 115 consisting of four diodes 116–119 connected across the primary source of power on the lines 20a and 21a. A pair of output terminals 120, 121 of the bridge 115 supply a full-wave rectified AC signal across a capacitor 123, the capacitor 123 serving to reduce the ripple component of the signal. In a series loop with the power supply 110 is a variable control resistance 125, the photosensitive device 111 and the energization coil 127 of the relay 112. The relay 112 has a normally closed contact arm 128 connecting one terminal 41a of the lamp 40a to one side of the storage battery 45a.

In operation, the relay 112 will not become energized until the current flowing through the coil 127 becomes sufficiently high. This current is determined by the variable resistance 125 and the photoresistor 111. While the arc is ignited in the lamp 10a, the resistance of the photo device 111 is sufficiently low to allow a high current to flow through the sensing circuit, causing the relay 112 to be energized, disconnecting the lamp 40a from the storage battery 45a. As described previously, a momentary interruption in the primary power source will cause the lamp 10a to be extinguished until it cools sufficiently to be restarted by the ballast circuit 15a. During this period of darkness the resistance of the photo device 111 becomes extremely high, decreasing the current through and deenergizing the relay 112. The contact arm 128 assumes its normally closed position, connecting the terminal 41a of the lamp 40a to the storage battery 45a, enabling the secondary lighting circuit to provide emergency illumination. The relay 112 will remain deenergized until the arc is again struck in the discharge lamp 10a.

In accordance with another feature of the present invention, means are provided for disabling the secondary lighting circuit when the primary power source has been interrupted or disconnected for a prolonged period of time. This is desirable to prevent the lamp 40a from completely discharging the storage battery 45a when the primary power is not available to recharge the battery. In the previous embodiment the thermal switch 79 provided this feature, whereas in the present embodiment a time delay relay 141 is provided, having its coil 142 connected across the primary power lines 20a, 21a. The device 141 has a normally open contact arm 143 in series with the lamp 40a of the secondary lighting circuit. While the primary power source is operative, the relay 141 is energized, so that the illumination sensing circuit operates in the manner described above, causing the lamp 40a to be illuminated when the discharge lamp 10a is extinguished. A time delay relay may be chosen which has a delay time of 10 minutes. Assuming this delay, it is seen that the secondary lighting circuit will be disabled from the battery 45a in 10 minutes after the primary power becomes inoperative. If the interruption of primary power is only momentary, or less than 10 minutes, the coil 142 of the relay 141 will be reenergized before the contact arm 143 opens, and the lamp 40a will provide continuous illumination until the discharge lamp 10a is reactivated. It will be noted, therefore, that the lamp 40a will provide illumination for 10 minutes after the lighting system is turned off in the morning in similar fashion to the operation of the preferred embodiment of FIG. 1. The battery 45a will experience the same advantageous charge-discharge daily cycling described above for the previous embodiment.

From the above description it will be evident that there has been brought to the art a novel emergency lighting system for use with mercury vapor lamps or the like which is efficient and virtually maintenance-free and which may be used with a variety of different lighting systems with only minor modifications.

I claim as my invention:

1. A lighting circuit, comprising,
   a. input lines providing a primary source of power;
   b. a primary lighting circuit including electrical discharge lamp means having different energy demands during hot starting, cold starting and normal operating periods;
   c. a storage battery;
   d. charging means coupled to said input lines and adapted to be selectively coupled to charge said battery;
   e. charge control means responsive to the substantially charged condition of said battery to prevent overcharge thereof by said charging means;
   f. sensing means responsive to an interruption in the operation of said primary lighting circuit;
   g. a secondary lighting circuit;
   h. switching means actuated by said sensing means to connect said battery for energizing said secondary lighting circuit;
   i. and a time delay device for disconnecting said battery from said secondary lighting circuit a predetermined time interval subsequent to its connection thereto, thereby preventing the complete discharge of said battery.

2. A lighting system comprising, in combination,
   a. input lines providing a primary source of power;
   b. a primary lighting circuit including electrical discharge lamp means having different energy demands during hot starting, cold starting and normal operating periods and ballast means for supplying energy for said lamp means during cold starting and normal operating periods;
   c. a secondary power source;
   d. a secondary lighting circuit;
   e. switching means coupled to said secondary lighting circuit and responsive:
      e1. to a momentary interruption of current in said primary lighting circuit to energize said secondary lighting circuit from said primary power source, and

e2. to an extended period of current interruption in said primary lighting circuit to energize said secondary lighting circuit from said secondary power source.

3. A lighting system according to claim 2 wherein said secondary power source is a battery and wherein said combination further

f. battery-charging means supplied by said primary power source and adapted to charge said battery during normal operation of said primary lighting circuit.

4. A lighting system according to claim 3 further including

g. charge control means responsive to the substantially charged condition of said battery to prevent overcharging thereof,

h. and discharge control means operative to disconnect said battery from said secondary lighting circuit a predetermined time interval after energization of said secondary lighting circuit from said battery, whereby complete discharge of said battery is prevented.

5. A lighting circuit according to claim 4 wherein said discharge control means comprises a heating resistor in circuit with said primary lighting circuit and a thermal switch connected in series with said battery, said switch being operative to close when current flows through said primary lighting circuit to heat said resistor and to open after the heating resistor has cooled due to a loss of current in said primary lighting circuit, the cooling time defining a discharge interval for said battery.

6. A lighting system comprising, in combination,

a. input lines providing a primary source of power;

b. a primary electric gaseous discharge device of a type whose starting potential at normal operating temperature is far in excess of its starting potential at room temperature;

c. a ballast circuit capable of generating a potential sufficient for starting said device at room temperature and for sustaining normal operation thereof;

d. a secondary power source;

e. a secondary lighting circuit;

f. a light-sensing circuit supplied by said input lines and optically coupled to said discharge device for providing an electrical response to the inoperative condition thereof; and

g. switching means controlled by said light-sensing circuit to energize said secondary lighting circuit from said secondary power source upon occurrence of said electrical response.

7. A lighting system according to claim 6 wherein said secondary power source is a battery and wherein said combination further comprises,

h. a battery-charging circuit supplied by said primary power source and selectively operable to provide both a fast charge and a trickle charge, depending upon the charge condition of said battery.

8. A lighting system according to claim 7 further including

i. discharge control means operative to disconnect said secondary lighting circuit from said battery an interval of time subsequent to an interruption of said primary power source, thereby preventing excessive discharge of said battery.

9. A lighting system comprising,

a. a primary lighting circuit including electrical discharge lamp means having different energy demands during hot starting, cold starting, and normal operating periods and ballast means for supplying said different energy demands during cold starting and normal operating periods;

b. a secondary power source;

c. a secondary lighting circuit;

d. sensing means responsive to an interruption in the operation of said primary lighting circuit;

e. switching means selectively interposed in series with said secondary lighting circuit and adopted for actuation by said sensing means to couple said secondary power source to said secondary lighting circuit, energizing said secondary lighting circuit to provide an auxiliary source of illumination;

f. charge control means associated with said secondary power source; and

g. discharge control means including a time delay device automatically operable in response to the inoperative condition of said primary lighting circuit, said charge and discharge control means being operative to allow cyclical charging and discharging of said secondary power source in controlled amounts in accordance with the normal daily ON-OFF cycle of said primary lighting circuit.

10. In an auxiliary lighting system for use with a primary night-lighting system an auxiliary power supply including,

a. a storage battery,

b. a charging circuit for selectively charging said battery,

c. means controlling the charge rate to said battery in accordance with the charge state of said battery, and

d. time delay means automatically rendered operative during inoperativeness of said primary night-lighting system for controlling the discharge period of said battery, said charge and discharge control means being cyclically operable in conjunction with the normal daily ON-OFF cycle of said primary night-lighting system and said charge and discharge of said battery being controlled in predetermined amounts so as to prolong the operating life of said battery.

11. A lighting system comprising,

a. input lines providing a primary source of power,

b. a primary electric gaseous discharge device whose starting potential at its normal operating temperature is far in excess of the starting potential required at room temperature,

c. a ballast circuit capable of supplying a sufficient starting potential when said device is at room temperature,

d. a storage battery,

e. a battery-charging circuit supplied by said primary power source and operable to provide a fast charging current and a trickle charging current,

f. switching means selectively coupling said fast charge current or said trickle charge current to said battery in accordance with the charge state of said battery,

g. a light-sensing circuit including a direct current power supply and a photosensitive device optically coupled to said discharge device to provide an electrical response to an interruption of illumination thereof;

h. a secondary lighting circuit;

i. switching means associated with said sensing circuit for energizing said secondary lighting circuit from said battery upon the occurrence of said electrical response; and

j. a time delay relay having a pair of contacts in circuit with said secondary lighting circuit and an energization coil adapted for energization by said primary power source, said contacts being operative to open a predetermined interval after an interruption in said primary source of power so that complete discharge of said battery does not occur.

12. In an emergency lighting circuit for use with electrical gaseous discharge lighting systems having a ballast circuit capable of providing a potential sufficient to start gaseous discharge lamps at room temperature but insufficient to start the lamps at their normal operating temperature, the combination comprising,

a. input lines providing a primary source of power for said ballast circuit;

b. a secondary power source;

c. a secondary lighting circuit, and

d. switching means coupled to said secondary lighting circuit and responsive:

d1. to a momentary interruption of current through said gaseous discharge lamps to energize said secondary lighting circuit from said primary power source, and

d2. to an extended period of current interruption in said lamps to energize said secondary lighting circuit from said secondary power source.

13. The combination in an emergency lighting system according to claim 12 wherein said secondary power source is a battery and wherein said combination further includes;

e. a battery-charging circuit,

f. charge control means responsive to the substantially charged condition of said battery to prevent overcharging thereof, and

g. discharge control means operative to disconnect said battery from said secondary lighting circuit a predetermined time interval after energization of said secondary lighting circuit from said battery, whereby complete discharge of said battery is prevented.

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