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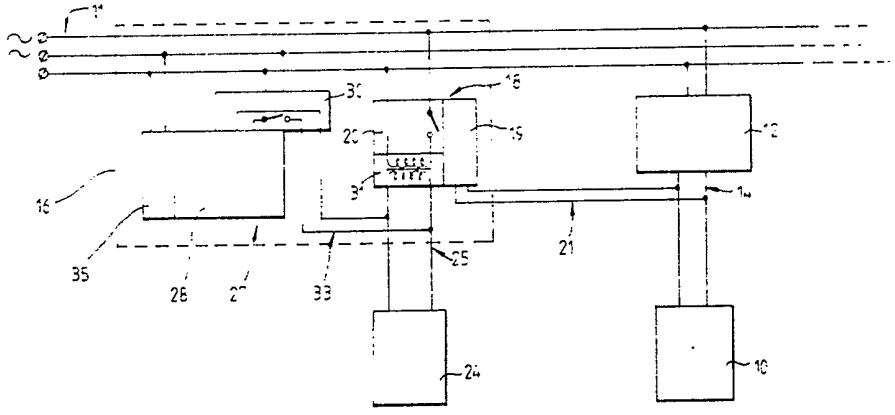
(54) Discharge lamp lighting system

(57) The system has at least one high pressure discharge lamp 10 connected to main power supply lines 11 an auxilliary lamp 24, a switch circuit 18 which connects the auxiliary lamp to the main supply lines 11 upon the discharge lamp extinguishing for example due to a momentary interruption of the main supply to provide illumination until the discharge lamp re-ignites, and an auxiliary power supply 28, e.g. a battery pack, to which the auxiliary lamp 24 is connected through operation of a voltage responsive circuit 30 in the event of the main power supply malfunctioning. The lamp 24 may be a low volt tungsten halogen type. In a large system having multiple discharge lamps, some only of the these may have associated auxiliary lamps, and only some of the auxiliary lamps may be used to provide emergency illumination on malfunction of the main supply.



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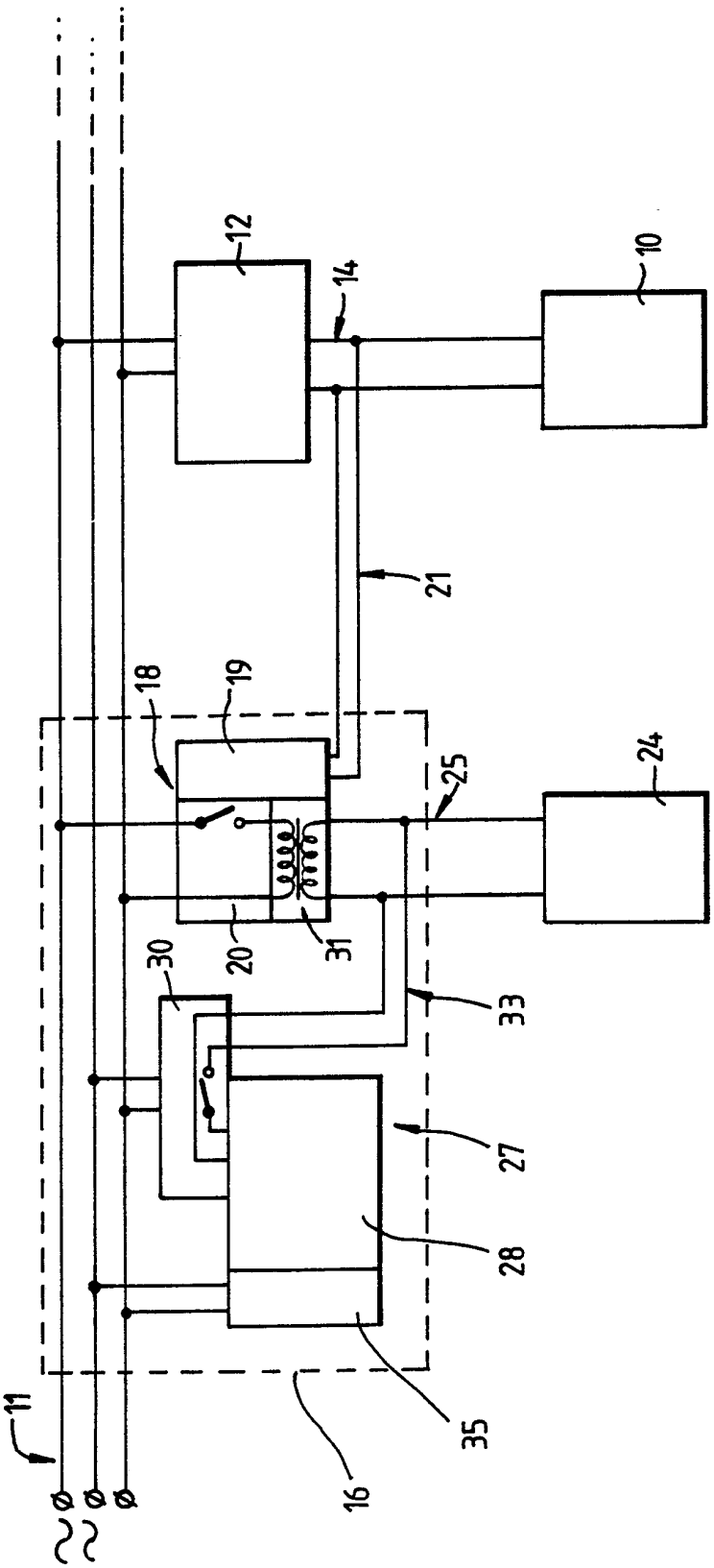
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.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DESCRIPTION

DISCHARGE LAMP LIGHTING SYSTEM

This invention relates to a lighting system comprising at least one high pressure discharge lamp arranged to be powered by a main power supply through associated control gear as appropriate, an auxiliary lamp, and a switch circuit for connecting the auxiliary lamp to the main power supply in the event of the discharge lamp extinguishing.

High pressure mercury, sodium and metal halide discharge lamps are commonly used in lighting systems for such purposes as industrial and commercial lighting, public amenity lighting and outdoor lighting, for example residential street lighting and floodlighting. High pressure discharge lamps are particularly suited to these purposes in view of their versatility, reliability, and cost effectiveness. However, they suffer from the drawback that in the event of a momentary interruption in their power supply they cannot be re-ignited for some time. If, for example, in a normal high pressure mercury discharge lamp the arc is extinguished due to the supply voltage temporarily disappearing the lamp will not restart until it has cooled sufficiently to lower the vapour pressure, and with it the breakdown voltage, to the point where the arc will re-strike with the voltage available. This time, termed the re-ignition or re-strike time, is typically around five minutes. Similarly, if in a metal halide discharge lamp, there is an interruption in the supply voltage and the lamp extinguishes, it can take approximately ten minutes before the pressure in the lamp has fallen sufficiently for the lamp to be re-ignited by its own igniter. For high pressure sodium discharge lamps, the re-ignition time is generally shorter, typically around one minute, although if the lamp has a built-in ignitor or ignition coil, it can be much longer.

In some application areas it is considered unacceptable for safety reasons that the lamps do not re-ignite virtually immediately after a short interruption of the supply voltage and

for this reason it is known to incorporate in the lighting system an auxiliary lamp. Energisation of the auxiliary lamp is controlled by a switching circuit which monitors current through the discharge lamp and upon this current dropping, signifying that the lamp has extinguished, switches to connect the auxiliary lamp to the main supply line so that the auxiliary lamp provides illumination until the discharge lamp re-ignites whereupon the switching circuit responds to current then flowing through the discharge lamp to disconnect the auxiliary lamp.

According to the present invention, a lighting system as defined in the opening paragraph is characterised in that the system includes an auxiliary power supply and means for connecting the auxiliary lamp to the auxiliary power supply upon malfunction of the main power supply.

This lighting system affords a significant additional benefit by virtue of the auxiliary lamp serving a dual purpose. Firstly, it operates in known manner to provide temporary illumination in the event of the discharge lamp extinguishing due to the momentary interruption of the main power supply. Secondly, however, the auxiliary lamp is arranged in conjunction with the auxilary power supply so as also to provide illumination in the event for example of disappearance of, or a change in power in the main supply because of a defective main supply network.

Preferably, the means for connecting the auxiliary lamp to the auxiliary power supply comprises a voltage responsive switching arrangement operable in response to a predetermined change in the voltage of the main power supply. This predetermined change can be complete disappearance of the main supply voltage or a certain drop in the level of the main supply voltage.

The switch circuit for connecting the auxiliary lamp to the main power supply may conveniently comprise a circuit arranged to monitor current flow through the discharge lamp. This current flow disappears when the lamp extinguishes and the switch circuit

responds accordingly to connect the auxiliary lamp to the main power supply.

It is, of course, known to provide emergency lighting using a back-up power supply arranged to be connected either to the main lamp or lamps of the lighting system or one or more emergency lamps. For high pressure discharge lamp lighting systems the former arrangement is not feasible because of the re-ignition time. In the latter case, the emergency lamps form part of a separate circuit connected to the back-up supply which circuit operates independently of the main lighting circuit containing the main lamps, this separate circuit being activated by a sensor circuit monitoring the voltage in the main supply line of the main circuit.

The invention involves the recognition that the auxiliary lamp provided in a high pressure discharge lighting system can be utilised to provide the additional function of emergency illumination, thereby eliminating the need to provide emergency lamps specifically for this purpose as in existing systems. As a result, significant savings in cost can be achieved. Moreover, by effectively integrating an emergency lighting system and with the main lighting system a lighting system is produced which offers the advantage of comparative simplicity and which offers greater convenience when taking into account installational considerations.

The auxiliary power supply preferably comprises for convenience and simplicity a battery pack, which for example is trickle charged from the main supply, although a stand-by generator may be used. In the case of the auxiliary power supply comprising a battery pack in particular, the auxiliary lamp preferably comprises a low voltage lamp such as a 12v tungsten halogen lamp.

The switch circuit, connecting means and auxiliary lamp, and preferably also the auxiliary power supply where a battery pack is used, conveniently form together with the discharge lamp an integrated assembly. In this way a compact and easy to install

unit is obtained.

The system may further include one or more further auxiliary lamps arranged to be connected to the main power supply through operation of the switch circuit. One or some of these further auxiliary lamps, but preferably not all for power conservation reasons, may be connected to the auxiliary power supply through operation of the connecting means.

The lighting system may comprise a plurality of high pressure discharge lamps each associated with a respective auxiliary lamp or lamps and connected to a common mains supply. Each discharge lamp and associated auxiliary lamp may in this case be associated with a respective said auxiliary power supply and connecting means.

A lighting system according to the present invention will now be described, by way of example, with reference to the accompanying drawing which shows schematically in block diagram form the primary components of the system.

Referring to the drawing, the system includes a main lamp comprising a high pressure discharge lamp 10, which may be a sodium, mercury or metal halide type of high pressure lamp.

The discharge lamp 10 is powered by a 240V mains voltage supply through supply lines 11, operation of the lamp being controlled by associated lamp control gear 12 (comprising ballast and starter although the latter may be incorporated in the lamp with certain types) as applicable to the type of discharge lamp used whose output 14 is connected to the lamp 10. The upper, middle and lower supply lines 11 depicted in the drawing comprise respectively a switched "live" line, an unswitched (continuous) "live" line,and a "neutral" line. Normal on/off switch control of the lamp 10 is accomplished using the upper, switched "live" supply line. Connected to the supply lines 11 and associated with the lamp 10 is a control unit 16. The control unit 16 includes a mains interrupt unit 18 which, in normal operation of the system, monitors by means of a current sensing circuit 19 connected via lines 21 to the output 14 of the lamp control gear

12 electrical current flowing through the lamp 10. The mains interrupt unit 18 further comprises a switch circuit 20 controlled by the current sensing circuit 19 and operable to connect power from the supply lines 11 to an auxiliary lamp 24 through feed lines 25. The lamp 24 is a low voltage lamp, for example a 12V AC/DC tungsten halogen lamp, and therefore the unit 18 includes a transformer circuit 31 connected between the switch circuit 20 and the lines 25 to drop the supply voltage to the appropriate level.

The mains interrupt circuit 18 operates as follows: if during normal operation of the system with mains power being supplied via the upper and lower lines 11 to the control gear 12 for energising the lamp 10 a momentary interruption of the mains power supply occurs in these lines leading to the discharge arc in the lamp 10 becoming extinguished, the resulting drop in current flow through the lamp 10 is sensed by the circuit 18 which responds by operating switch circuit 20 to connect the auxiliary lamp 24 to supply lines 11 through the transformer circuit 31 so that, upon resumption of power on supply lines 11, the auxiliary lamp 24 is immediately energised to provide temporary illumination whilst the lamp 10 is cooling sufficiently to be re-ignited under the action of the control gear 12. As soon as the lamp 10 is thereafter re-struck, the circuit 18 responds to the consequential current flow through the lamp and lines 14 to return the switch circuit 20 to its original state thereby disconnecting power supply from supply lines 11 to the auxiliary lamp 24 through lines 25. The mains interrupt unit 18 may be of any suitable type. Such units, which can be either solid state or electromechanical arrangements, are already well known in the art and hence will not be described here in detail.

Of course, the circuit described thus far will operate in a similar manner to energise the auxiliary lamp 24 should the lamp 10 fail open circuit through a defect as well as in the event of a mains supply interruption.

As the mains interrupt unit 18 is connected to the switched

"live" line, normal on/off switching of the lamp 10 will similarly control the supply of power to the mains interrupt unit 18.

The control unit 16 further includes an emergency unit 27 comprising a 12V battery pack 28 and a voltage responsive switching circuit 30.

A charger circuit 35 is also included in the unit 27 which is connected to the supply lines 11 to provide a trickle charging of the battery pack 28. The circuit 30 is connected to the neutral and unswitched live lines 11 and incorporates a mains voltage sensing circuit controlling the operation of a switch, for example a change over relay circuit, which when tripped connects the DC output from the battery pack 28 along lines 33 connected to the lines 25 leading to the auxiliary lamp 24. The circuit 30 monitors the voltage on the mains supply lines 11 and responds to the disappearance of the supply voltage, signifying a complete mains supply failure, or alternatively to a predetermined drop in the mains supply voltage from its normal level to a level below that required for proper operation of the lamp 10, by tripping and thereby connecting power from the battery pack 28 to the auxiliary lamp 24 to energise the lamp and provide emergency illumination. This energisation of the lamp 24 continues for either the duration of the mains failure or voltage reduction, or the useful lifetime of the battery pack. Upon resumption of the mains supply to its normal level, the circuit 30 is returned to its original state to break the supply of power from the battery pack 28 to the auxiliary lamp 24. However, the mains interrupt unit 18 may then operate to continue energisation of the auxiliary lamp 24 from the mains supply lines 11 in the aforementioned manner until such time as the discharge lamp has re-ignited.

Thus the auxiliary lamp 24 serves a dual role in providing illumination firstly during re-strike periods of the lamp 10 following momentary interruptions in the mains supply and secondly during prolonged periods of mains supply disruption.

The lighting system circuit arrangement is shown in the drawing in a simplified schematic form and is intended for illustrative purposes only. Suitable forms of circuits involved will be apparent to persons skilled in the art, with components such as for example the units 18 and 27 separately already known per se in lighting systems. Moreover it will be appreciated that protective devices may have to be used in practice, for example in view of the interconnection of the lines 33 and 25, although the circuits 30 and 18 would usually have in-built safety features.

In a typical installation, the discharge lamp 10 and its associated control gear 12 may be combined in a suitable luminaire. The control unit 16 may be situated remotely from this luminaire although preferably it is located in or adjacent the luminaire in the form of an integrated assembly. The auxiliary lamp 24 may also be located in the luminaire or alternatively at any suitable position for providing safety illumination. Whilst the mains interrupt unit 18 and emergency unit 27 are conveniently combined in a single unit 16 as described, they could instead be arranged separately.

Further discharge lamps, together with their associated control units and auxiliary lamps, may be included in the lighting system, each being connected at an appropriate point along the supply lines 11 in the manner described.

Although in the lighting system shown in the drawing and as described above the, or each, discharge lamp 10 has associated therewith only one auxiliary lamp 34, the system may in practice include a plurality of auxiliary lamps which are all energised through operation of the unit 18 in the event of the discharge lamp 10 extinguishing as a result of a momentary interruption in the mains power supply in order to provide an adequate illumination level. In this case, however, less than all the auxiliary lamps are arranged to be energised through operation of the emergency unit 27 so that power from the battery pack 28 is conserved. The number of auxiliary lamps actually energised

through the emergency unit 27 is chosen to be sufficient to provide adequate illumination levels for emergency purposes. As an example, four 12 volt halogen auxiliary lamps may be used all of which are energised through operation of the unit 18 but only one, or two, of which would be energised by the unit 27.

In a modified arrangement of the above-described system, the mains power supply may be in a two line, rather than three line, form comprising neutral and continuous (unswitched) live lines and in this case a manually-operable switch for normal on/off control of the lamp 10 would be connected in the live line intermediate the connections to the circuits 30 and 18. However, the three line version described above is preferred as it readily enables a number of lamps 10, together with their associated auxiliary lamps 24, control units 16 and gear 12, to be connected in the system at appropriate points along the mains supply lines 11.

For an alternative form of lighting system involving a plurality of discharge lamps and associated auxiliary lamps just one emergency supply unit 27 may be provided which is arranged to supply power to some or all of the plurality of auxiliary lamps in the event of mains failure, the battery pack 28 being suitably rated for this purpose. Such a system may also use a single mains interrupt unit 18 controlling energisation of the auxiliary lamps as a result of a momentary interruption in the mains supply, this unit 18 monitoring the current flowing through a single, and representative, discharge lamp.

Preferably, however, for convenience of installation each of the plurality of discharge lamps in the system is associated with a respective control unit 16. In a large area discharge lamp lighting installation, not all the discharge lamps involved need have an associated auxiliary lamp. Typically auxiliary lamps would be associated with only those discharge lamps located at strategic places. Likewise, not all these auxiliary lamps need be connected to an emergency unit 27 in the manner described, it perhaps being sufficient to utilise only some of the auxiliary

lamps present in the installation for the purpose of providing emergency illumination.

CLAIM(S)

1. A lighting system comprising at least one high pressure discharge lamp arranged to be powered by a main power supply through associated control gear as appropriate, an auxiliary lamp, and a switch circuit for connecting the auxiliary lamp to the main power supply in the event of the discharge lamp extinguishing, characterised in that the system includes an auxiliary power supply and means for connecting the auxiliary lamp to the auxiliary power supply upon malfunction of the main power supply.

2. A lighting system according to Claim 1, characterised in that said means for connecting the auxiliary lamp to the auxiliary power supply comprises a voltage responsive switching arrangement operable in response to a predetermined change in the voltage of the main power supply.

3. A lighting system according to Claim 1 or Claim 2, characterised in that the switch circuit is arranged to monitor and is responsive to current flow through the discharge lamp.

4. A lighting system according to any one of the preceding claims, characterised in that the auxiliary power supply comprises a battery pack.

5. A lighting system according to any one of the preceding claims, characterised in that the switch circuit, connecting means, and auxiliary lamp form together with the discharge lamp an integrated assembly.

6. A lighting system according to Claim 5 together with Claim 4, characterised in that the integrated assembly further includes the auxiliary power supply.

7. A lighting system according to any one of the preceding claims, characterised in that the system includes one or more further auxiliary lamps which are arranged to be connected to the main power supply through operation of the switch circuit.

8. A lighting system according to any one of the preceding claims, characterised in that the, or each, auxiliary lamp comprises a low voltage lamp.

9. A lighting system according to any one of the preceding claims, characterised in that the system comprises a plurality of high pressure discharge lamps each of which is associated with a respective switch circuit, connecting means, auxiliary power supply and one or more auxiliary lamps.

10. A lighting system substantially as hereinbefore described with reference to, and as shown in, the accompany drawing.

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