

TITLE OF THE INVENTION

AN IMPROVED EMERGENCY LIGHTING UNIT WITH SMART CONTROLLER

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The invention relates generally to battery operated emergency lighting, (external illuminated) and self-illuminated, (internally illuminated) sign fixture and particularly relates to combinations of illuminated exit signs and the like with emergency lighting unit equipped with smart controller.

2. Background Art

10 Emergency lighting is mandated by building regulations throughout the world, especially for high-rise commercial buildings. The most common type of emergency lighting is EXIT sign indication, which is also the most noticed emergency indication as a result of non-stopping illumination and are therefore readily seen. Exit signs are typically placed above doorways or in each floor of staircase to indicate the direction of escape route in exiting a
15 building in a time of emergency.

It is a fact that emergency lighting operates in the event of emergency and is intended to provide appropriate illumination under emergency condition such as the loss of normal power. Since emergency conditions requiring the most immediate and effective use of both exit signs and emergency lighting units are normally associated with mains power
20 loss, backup power is necessary for the continued operation of an exit sign and for start-up and continuing operation of an emergency lighting unit. However the back-up power is provided by batteries, a typical exit sign having a battery and circuitry capable of switching to backup battery power from AC (mains power) on loss of AC (main power) to the exit sign.

25 As a result of the possibility for malfunction of the battery of the emergency lighting, in most cases, the emergency lighting would failed to operate in time of emergency or power outage due to battery failure. Accordingly, it is a long felt need to provide an emergency lighting that requires either no battery or very least battery energy to operate the emergency lighting.

30 There is also a variety of emergency lighting systems being known in the prior art and fundamentally these systems ensure that if a source of AC power which provides the

normal or regular lighting for a given environment should for any reason fail, emergency lighting is furnished. Generally what this involves is an automatic switching over from the normal or regular AC supply to an encased battery supply which furnishes the needed current to a lamp within the emergency lighting system.

- 5 GB Patent No. 1 498 483 discloses an emergency lighting system which comprises both sound and light sources disposed along the fixed escape route, and where the light sources may be caused to emit light sequentially so that the light is perceived to travel along the fixed, predetermined escape route in one direction only, towards one specific emergency exit. This GB Patent appears that the light sources are mounted on the wall
 10 approximately at head level above the floor in e.g. corridors, in such a way that there will be long voids between the light sources at door openings and openings to branching corridors as well as in open spaces, such as lobbies. Such discontinuities in the visual marking of the escape route contribute to the necessity of completing the system with sound sources which not only makes the system more expensive, but also the installation
 15 and operation of the same.

- With the systems described in GB Patent Application No. 2 215 105 and U.S. Pat. No. 4,347,499, respectively, attempts are made to overcome this problem by connecting the light sources to a control device linked to sensors disposed to detect possible blocking of corresponding emergency exits and which, if a blocking is detected, automatically
 20 provides for control of the travelling light from the light sources in the direction of exits which are not detected as being blocked. With the system described in GB Patent Application No. 2 215 105 it is also possible to initiate evacuation manually by means of trigger devices disposed along the escape routes. However, the escape route pattern which automatically adapts to the detected blockings cannot be amended, even when
 25 there are reasons for interfering and take command of the automatic system, which may be desirable e.g. in the event of an incorrectly detected blocking, or by a blocking of an exit, or the safety zone behind this, which cannot be detected automatically.

- A further disadvantage by the systems known from the publications mentioned above, is that their signal sources with the corresponding connecting wires, housing for integral
 30 mounting, and so on, are not particularly well suited for post-installation in buildings and crafts. For example, the light source housings which in U.S. Pat. No. 4,347,499 are shown lowered into recessions in the floor between the cabin and the cargo room of a passenger aircraft, would weaken the structure of the floor to such a large extent that utilization in practice hardly is permissible.

There are three types of emergency exit signage available in the market, such as those fabricated using luminaires material with backup batteries, using radioactive materials without backup batteries, and using photoluminescence PL without backup batteries. However, the short comings of these available emerging lighting include failure to comply with local fire code.

US Patent Publication 20160330811 discloses a constant power backup power supply for LED lighting fixtures. The power supply includes a storage battery that is charged while an AC power source is in an ON condition. When AC power transitions to an OFF condition, a capacitor bank charged by the battery supplies current to the primary side of a flyback converter operating in discontinuous conduction mode. The secondary side of the flyback converter supplies constant output power to the LED lighting fixture for an arbitrary output voltage within a predetermined range.

US Patent Publication No. 20080232102 discloses an emergency light fixture comprising: at least two light sources; and a reflector, the at least two light sources being at least partially disposed within the reflector, the reflector comprising a first concave surface formed by rotating a first curve about a first central axis of the first curve, the reflector comprising a second concave surface formed by rotating a second curve about a second central axis of the second curve, the reflector comprising a third concave surface formed by translating a third curve along a substantially straight line, the third concave surface intersecting the first concave surface and the second concave surface, the reflector forming a single cavity.

US Patent No. 5248919 discloses a lighting control device for controlling the state and light intensity level of at least one lamp, comprising a) user-actuatable intensity selecting means for selecting a desired intensity level between a minimum intensity level and a maximum intensity level, b) a single control switch, independent of said user-actuatable intensity selecting means, for generating control signals in response to an input from a user, and c) control means operatively coupled to said intensity selecting means.

U.S. Pat. No. 4,649,323 discloses a microcomputer-controlled light control which provides a fade function. The control disclosed in that patent is operated by a pair of non-latching switches which provide inputs to a microcomputer. The microcomputer is programmed to determine whether the switches are tapped or held (i.e., whether they are touched for a transitory duration or for a longer period of time).

There is thus a need for an improved emergency lighting unit with small controller avoiding the drawbacks of the prior controls. The present invention fills that need.

SUMMARY OF THE INVENTION

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Thus, there is a need for an improved emergency lighting unit with smart controller, which is self-illuminated sign indicator whereby

in according to the intended purpose in different emergency situations, the lighting unit is suitable for general applications, when it is desirable to guide a group of persons to a selected place, for instance within a building, such as a hotel, and where the light sources together with the associated equipment are designed to be post-mounted or suspended in a simple way on any substantially flat surface.

An object of the present invention is to provide an improved emergency lighting unit with smart controller comprising (a) a typical word sign or pictogram face plate (b) a light distribution medium with a first and second light source being mounted adjacently. (c) a photo luminescence plate, hereinafter referred to as "PL", having a front surface and a rear surface; and (d) a light reflector mounted closely to the PL to reflect any light to the PL layer; and (e) an integrated smart monitoring gadget or a smart controller positioned within the housing unit to monitor the status of the light sources and provide communication and information to user, whereby the photo luminescence plate absorbs light energy when the lighting unit is in operation to light up the words or pictogram face plate. The PL panel that is charged by the light sources during normal operation will provide light energy to light up the face plate when there is an incoming electrical power supply failure.

Yet still a further object of the present invention is to provide an improved emergency lighting unit with smart controller, wherein as the PL plate is energized or charged by internally illuminated light sources and the PL plate discharges light when there is a loss of electrical supply to maintain the visibility of the face plate.

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Another object of the present invention is to provide an improved emergency lighting unit with smart controller, wherein the both the surface of the PL are energized by the internally lighted luminaires via the light distribution medium.

Another main object of the present invention is to provide an improved emergency lighting unit with smart controller, wherein the unit has the advantages of environment friendly as no backup battery is used as compared to the existing products in the market.

- 5 Still a further object of the present invention is to provide an improved emergency lighting unit with smart controller, wherein the PL plate is always fully charged by the internal luminaire therefore the use of backup batteries is eliminated.

- 10 Yet still a further object of the present invention to provide an improved emergency lighting unit with smart controller, further comprising compartment means for housing electrical circuitry operable with the light source.

- 15 Another objective of the present invention is to provide an improved emergency lighting unit with smart controller, further comprising a single housing being substantially formed of a plastic or metal material to contain the combination of the lighting unit.

- 20 Yet still another object of the present invention to provide an improved emergency lighting unit with smart controller, further comprising an illuminated/indicating light for identifying main AC power status, a push switch that enables temporary removing AC power to the combination.

- 25 A further object of the present invention is to provide an improved emergency lighting unit with smart controller, wherein the smart controller monitors the functionality of the light sources and communicates to the users.

Yet a further object of the present invention is to provide an improved emergency lighting unit with smart controller, wherein the smart controller automatically switches over to the second light source when the first light source fails.

- 30 Still yet another object of the present invention is to provide an improved emergency lighting unit with smart controller as, wherein the smart controller provides status and information of the unit via wired or wireless to user.

- 35 It is an object of the present invention to provide an improved emergency lighting unit with smart controller, wherein the smart controller monitors the status of power supply and light sources to the unit and communicate to users.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a conventional emergency lighting.

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FIG. 2 is a perspective exploded view of an improved emergency lighting unit with smart controller in accordance with a first embodiment of the invention,

FIG. 2A is a perspective exploded view of another embodiment similar to that of FIG.2, wherein a first light source and a second light source are positioned next to the light distribution medium, and a smart controller is located at the vicinity of the light distribution medium .

FIG. 3 is a perspective exploded view of a second embodiment of the invention, wherein a first pictogram and a second pictogram of the emergency lighting unit sandwiched the light distribution medium, the two light sources ,in accordance with the present invention;

FIG. 3A is a schematic perspective exploded view of another preferred embodiment similar to that of FIG. 3 in accordance with the present invention, wherein two light sources, two light distribution medium and smart controller are used;

FIG. 4 is a front view of the conventional emergency lighting unit shown in FIG. 1.

FIG. 5 is a section view of the improved emergency lighting unit in accordance with the present invention.

FIG. 6 is a perspective view of the improved emergency lighting unit in accordance with the present invention.

FIG. 7 is an exploded view of another preferred embodiment of the improved emergency lighting unit in accordance with the present invention.

FIG. 8 is a chart showing the Luminescent Intensity (mcd/m^2) after a period of time in accordance with the present invention.

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FIG. 8A is a graph plotting the luminescent intensity (mcd/m^2) against time in minutes in accordance with the present invention.

5 DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

As will be appreciated by the ordinary person skilled in the art, the various embodiments of the emergency lighting unit with an integrated smart monitoring device or a smart controller that are presented herein may operate in conjunction with a variety of other
 10 devices, equipment, etc., and as such, the embodiments presented herein are presented by way of example and are not intended to be limiting.

FIG. 1 is a perspective view of a conventional emergency lighting available in the market.

15 Turning now to the drawings, FIGS. 2 to 3A, show preferred embodiments of the emergency lighting unit with a smart controller in accordance with the present invention.

FIG. 2 provides a schematic view of structure for an exemplary embodiment of an improved emergency lighting unit with smart controller in accordance with the present
 20 invention. The lighting unit has a word sign or pictogram being designated as (100) comprising (a) a word sign or pictogram, for instance a word like EXIT as a face plate (10), and a light distribution medium (20), mounted adjacently, wherein the light distribution medium distributes uniformly the light to a photoluminescence (PL) plate (30). A light
 25 source (40) is disposed close to the light distribution medium (20) to deliver light energy to the light distribution medium (20) so as to energize the PL plate (30) to provide illumination.

The combination word sign or pictogram and emergency lighting unit is also provided with a light reflector (50) mounted closely to the PL plate (30) to reflect light to the PL plate (30). Accordingly, the combination unit will give illumination when there is a power failure
 30 to the top light source (40).

Referring to FIG. 2A, there is shown a schematic view of structure for another exemplary embodiment of a combination word sign or pictogram emergency lighting unit with smart controller in accordance with the present invention. The improved emergency lighting unit having a smart controller comprises (a) a face plate (10) having word sign or pictogram ,
 35 wherein a bottom light source (41) is positioned adjacent to the a light distribution medium

(20); (b) a light distribution medium (20) having mounted with a top light source (40) being mounted adjacently to the face plate (10) sandwiching the bottom light source (41); and (c) a light reflector (50) mounted closely to the PL plate (30) to reflect light to the face plate of the word sign; and (d) an integrated smart monitoring gadget (70) or a smart controller positioned inside the housing to monitor the light sources (41, 40) and to provide communication and information to user, whereby the PL material (30) absorbs light energy when the lighting unit is in operation and the PL plate (30) provides light energy to light up the words or pictogram (10) combination when there is a power failure to the light sources (40, 41). A PL plate (30) is positioned between the light reflector (50) and the light distribution medium (20).

FIG. 3 provides a schematic view of structure for another exemplary embodiment of a combination word sign or pictogram and emergency lighting unit in accordance with the present invention. In this preferred embodiment, the words or pictogram is two sided. The two sided combination structure comprises (a) two face plates (10, 10') having word sign or pictogram; (b) a photo luminescence (PL) plate (30), (c) light distribution media (20, 20'), mounted adjacently to the photoluminescence plate (30); (d) a top light source (40) to light up the light distribution medium (20, 20') to energize the PL plate (30) to provide self illumination; (d) whereby the combination is lighted when there is a power failure to the light source (40).

As shown in FIG. 3, there is shown a combination word or pictogram with emergency lighting unit (100) constituting a double-faced unit (100) having two word sign or pictogram. In a preferred embodiment, the unit (100) can be a direct wall and ceiling mounted installation on a fixture (not shown). In accordance with the present invention, the PL plate (30) is cooperating with the word sign or pictogram (10) to allow illumination when the light source (40) is being turned off. The PL plate (30) is being energized by lighted luminaires connected to the light source (40).

Referring to FIGs. 2 & 3, the light distribution medium (20) distributes light from the light source (40) to the photo luminescence (PL layer) to illuminate the words or pictogram (10). The photo luminescence plate (30) is the medium energized by the light source (40).

FIG. 3A provides a schematic view of structure for another exemplary embodiment of a combination word sign or pictogram emergency lighting unit with smart controller in accordance with the present invention.

In this preferred embodiment, there are two face plate (10, 10'), two pieces of light distribution medium (20, 20'), two top light sources (42, 40), that is a top pair (42, 40) and a bottom pair (41, 43), and a photo luminescence (30), and a smart controller (70). In this preferred embodiment, the words or pictogram is formed on face plate (10, 10'). The two sided combination structure comprises (a) two word sign or pictogram on the face plate (10, 10'); (b) two light distribution medium (20, 20') wherein, each of which is mounted in adjacent to the face plate (10, 10') and in between the two light distribution medium (20, 20'), a photo luminescence material (30) is provided; (d) a plurality of light source (40, 41, 42, 43) to light up the light distribution medium (20, 20') to energize the PL plate (30) to provide self illumination, and (e) a smart controller (70) being provided close to the photo luminescence plate (30) for the controlling of the lighting unit, whereby the combination is lighted when there is a power failure to the light source (40, 41, 42, 43).

In a preferred embodiment of the present invention, the combination word sign or pictogram and emergency lighting unit (100) can further include a compartment means which is used to house an electrical circuitry operable with the light source (40). The emergency lighting unit (100) can be optionally mounted within a housing which is formed of a plastic or metal material to contain the combination of the lighting unit (100), further comprising an illuminated/indicating light for identifying main AC power status and a switch that enables temporary removing AC power to the light source (40).

In accordance with the present invention, the smart controller (70) monitors the functionality of the light sources (40, 41, 42, 43). The light sources (40, 42) are the main light sources, wherein (41, 43) will only automatically switch on respectively as controlled by the smart controller (70) when the related main light sources fail. The smart controller (70) provides status and information of the unit via wired or wireless to a user. The smart controller (70) monitors the status of power supply to the lighting unit (100).

In accordance with the present invention, an electrical circuitry is provided operable with the light source. A compartment means is to house the electrical circuitry. Similarly, a housing is used to contain the lighting unit, and the housing is made of plastic or metal material.

FIG. 4 is a perspective view of the combination word sign or pictogram and emergency lighting unit in accordance with the present invention. In the preferred embodiment, the thickness of the components such as the word or pictogram, the PL plate (30), the light distribution medium (20) etc. are ranging from 4-8 mm, the entire unit (100) is small and is convenient to be installed and displayed.

FIG. 5 is a section view of the emergency lighting unit in accordance with the present invention.

5 FIG. 6 is a perspective view of the emergency lighting unit in accordance with the present invention. As shown in the figure, the light source (40) provides light energy to the light distribution medium (20), which then distributes light to the PL plate (30).

10 In operation, in the event of an emergency due to power failure, the emergency lighting unit (100) will continue to be lighted as a result of the PL plate (30) as the PL plate (30) has been energized by lighted luminaires via the light distribution and transmission panel (20). Due to the fact that the PL plate or panel (30) is always fully charged by the internal luminaire, therefore no backup batteries are used. The combination of word sign or pictogram and emergency unit of the present invention provides the best cost advantage
15 when compared to all other types of market available emergency Exit signage.

FIG. 7 is an exploded view of another preferred embodiment of the emergency lighting unit in accordance with the present invention. As shown in the figure, a combination word sign or pictogram and emergency lighting unit comprises (a) a word sign for instance EXIT
20 or pictogram being printed onto a photoluminescence (PL) material plate (30) as a face plate, (b) a light distribution medium (20), mounted adjacently to the PL material plate printed with word sign or pictogram, being used to distribute uniformly the light to the photoluminescence plate (30). A light source (40) is disposed close to the light distribution medium (20) to deliver light energy to the medium (20) so as to energize the PL plate (30)
25 to provide illumination. A reflector (50) is mounted closely to the light distribution medium (20) and the light source (40) to reflect light to the PL plate (30). In this preferred embodiment, when the light source (40) is not in operation due to power failure, the signage EXIT will be seen as a result of the photoluminescence material and the light distribution medium (20).

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As shown in FIG. 8, in the first 15 minutes the luminescent intensity is at 838 mcd/m², and the intensity is decreasing until 90 minutes reaching at about 121 mcd/m². After 2 hours, the luminescent intensity is at 87 mcd/m². FIG. 8A is a graph indicating the decreases of luminescent intensity against time.

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The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, such as replacing the light distribution/transmission panel with a number of LEDs or equivalent lighted assembly to energize the PL panel, and the luminaires may be either in the front or back of the PL panel or any direction; and
5 it is, therefore, desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being made to the appended claims rather than to the foregoing description to indicate the scope of the invention.

What is claimed is:

1. An improved emergency lighting unit with a smart controller comprising (a) a face plate having word sign or pictogram having a front surface and a rear surface; (b) a light distribution medium having mounted with a top light source being mounted adjacently to the face plate sandwiching the top light source; (c) a PL plate mounted adjacent to the light distribution medium; (d) light reflector mounted closely to the PL plate to reflect light to the face plate; and (e) an integrated smart monitoring gadget positioned inside the housing to monitor the light sources, and incoming power supply and to provide communication and information to a user, whereby the PL plate absorbs light energy when the lighting unit is in operation and the PL plate provides light energy to light up the words or pictogram when there is a power failure to the light sources.
2. The improved emergency lighting unit with smart controller as set forth in Claim 1, further comprising (e) a photo luminescence (PL) plate mounted immediately to the light distribution medium.
3. The improved emergency lighting unit with smart controller as set forth in Claim 1 or 2, wherein the PL plate is cooperating with the word sign or pictogram to allow illumination when the light source is being turned off.
4. The improved emergency lighting unit with smart controller as set forth in Claim 1 or 2, wherein the photoluminescence plate is being energized by the light distribution medium or luminaires connected to the light source.
5. The improved emergency lighting unit with smart controller as set forth in Claim 1 or 2, wherein the light distribution medium distributes light from light source to the photo luminescence plate to illuminate the words or pictogram of the face plate.
6. The improved emergency lighting unit with smart controller as set forth in Claim 1 or 2, wherein the photoluminescence plate is a medium energized by the light source.
7. The improved emergency lighting unit with smart controller as set forth in Claim 1 or 2, further comprising compartment means for housing an electrical circuitry operable with the light source.

8. The improved emergency lighting unit with smart controller as set forth in Claim 1 or 2, further comprising a single housing being substantially formed of a plastic or metal material to contain the combination of the lighting unit.

9. An improved emergency lighting unit with a smart controller comprising

5 (a) a first face plate and a second face plate having word sign or pictogram made from a photo luminescence (PL) material mounted immediately to the word sign or pictogram, (b) a first light distribution medium and a second light distribution medium, wherein the distribution medium are mounted adjacently to each of the first and second word sign or pictogram; (c) a plurality of light sources positioned in between the word or
10 pictogram of the face plate and the light distribution mediums, and between the light distribution medium with a photo luminescence plate, and the photo luminescence plate with the second light distribution medium to light up the light distribution medium to energize the photoluminescence plate layer to provide self illumination; and (d) an
15 integrated smart monitoring gadget positioned along the edge of the light distribution medium to monitor the light sources, and to provide communication and information to a user, whereby the PL face plate absorbs light energy when the lighting unit is in operation and the PL face plate provides light energy to light up the words or pictogram when there is a power failure to the light sources.

10. The improved emergency lighting unit with a smart controller as set forth in Claim
20 9, further comprising a single housing being substantially formed of a plastic or metal material to enclose or hold the lighting unit.

11. The improved emergency lighting unit with a smart controller as set forth in Claim 9, further comprising compartment means for housing an electrical circuitry operable with the light sources.

25 12. The improved emergency lighting unit with a smart controller as set forth in Claim 7, wherein a backup power source is disposed within the compartment.

13. The improved emergency lighting unit with a smart controller as set forth in Claim 12, wherein the backup power source is a battery.

14. The improved emergency lighting unit with a smart controller as set forth in Claim
30 1 or Claim 9, wherein the smart controller monitors the functionality of the light sources.

16, The improved emergency lighting unit with a smart controller as set forth in Claim 1 or Claim 9, wherein the smart controller switches to another adjacent light source when the failure of light source is detected..

17. The improved emergency lighting unit with a smart controller as set forth in Claim 1 or Claim 9, wherein the smart controller provides status and information of the unit via wired or wireless to a user.

18. The improved emergency lighting unit with a smart controller as set forth in Claim 1 or Claim 9, wherein the smart controller monitors the status of the incoming power supply to the unit.