

Oct. 2, 1962

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3,056,897

LIGHTING UNIT

Filed July 1, 1959

2 Sheets-Sheet 1

FIG. 1.

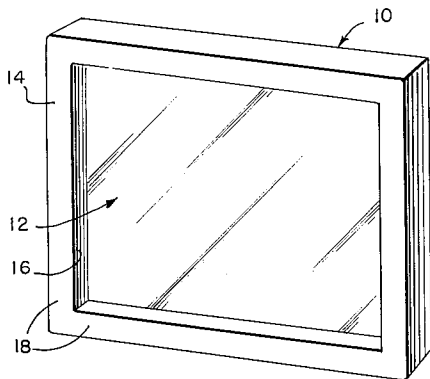


FIG. 2.

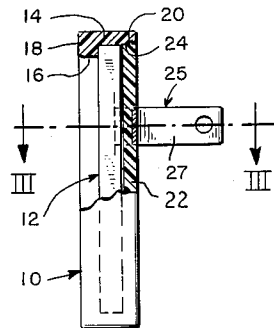


FIG. 3.

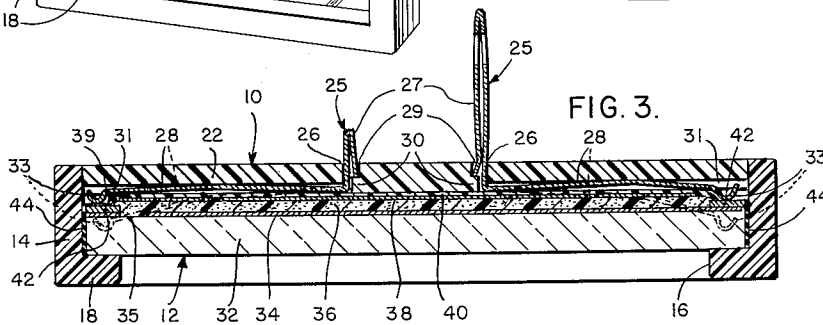


FIG. 5.

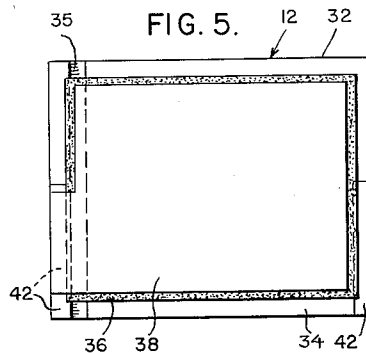


FIG. 6.

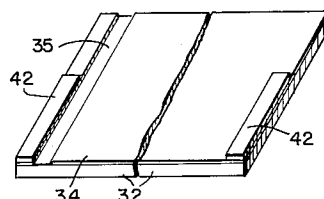
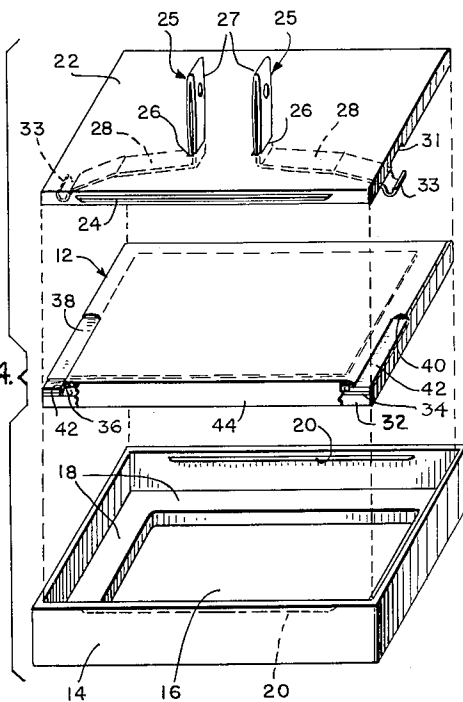


FIG. 4.



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FIG. 7.

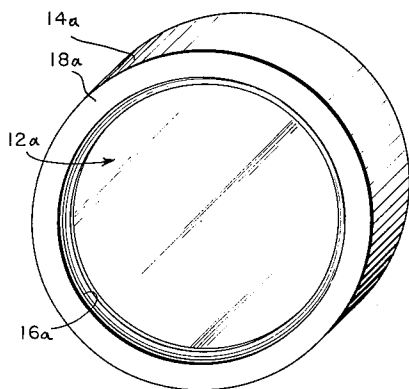


FIG. 8.

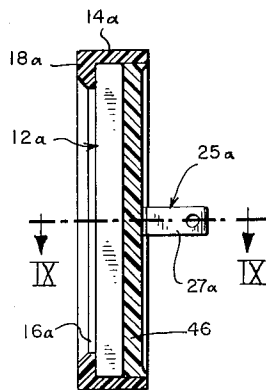


FIG. 9.

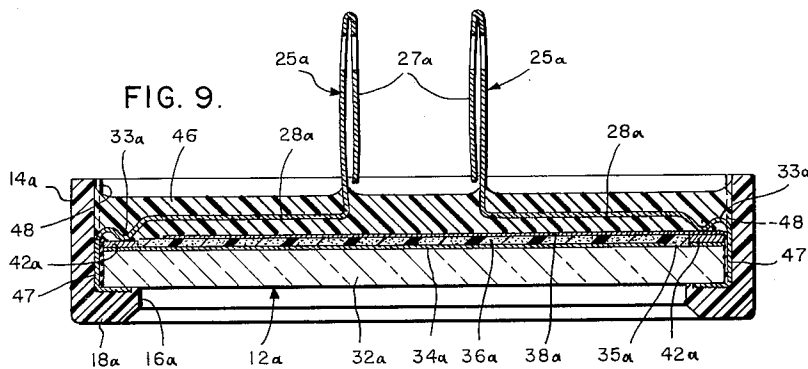


FIG. 11.

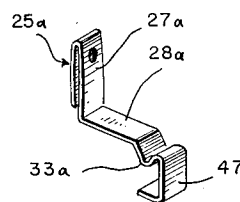
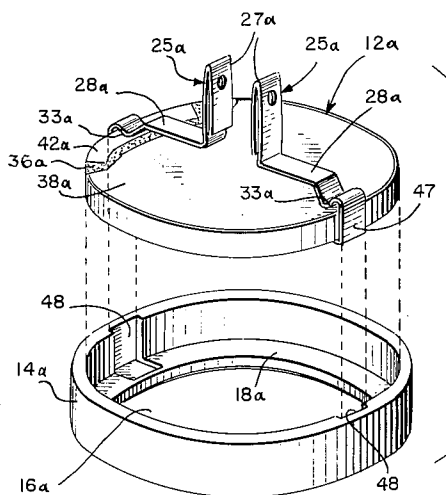


FIG. 10.



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LIGHTING UNIT

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11 Claims. (Cl. 313-108)

This invention relates to a lighting unit and, more particularly, to a lighting unit for display or low level illuminating purposes where a reliable light source of relatively low brightness and long life is required.

Lighting units which produce a diffused light of low intensity are well-known in the art and are extensively used where subdued lighting is desired over relatively long periods of time, as for example as night lights, darkroom lights and as safety lights for dark stairways or landings and the like. In order to be practical a device of this character must not only be inexpensive and economical to operate but must have a long life. To this end incandescent lamps of low wattage rating have customarily been employed in the prior art devices which lamps were mounted in a fixture having a switch and a suitable light shielding or diffusing means for masking the lamp and thus providing the desired subdued glare-free illumination. A switch was required because while the wattage and, hence, the power consumption of the incandescent lamp was small it was nonetheless appreciable and of sufficient magnitude to make it impractical from an economical standpoint to burn the lamp continuously over a long period of time. Moreover, since the life of any incandescent lamp is inherently limited the lamp would, of course, fail much sooner when operated continuously and thus require replacement at more frequent intervals. In addition, and of equal importance, incandescent lamps as is well known characteristically fail abruptly without any warning thereby constituting, at the very least, an inconvenience in that they usually had to be immediately replaced and in some instances creating a hazardous condition, especially when the lamp was being used as a safety light.

It is accordingly the general object of the present invention to avoid and overcome the foregoing disadvantages of and objections to the prior art devices by providing an improved lighting unit for display or illuminating purposes.

It is another object of this invention to provide a lighting unit for relatively low-intensity lighting applications which will be inexpensive to make and operate and have an exceedingly long life.

Still another object of this invention is the provision of a lighting unit capable of producing a pleasant subdued lighting effect and which is inherently "fail-safe" and can be operated directly from a conventional wall outlet.

The aforesaid objects, and others which will become obvious to those skilled in the art as the description proceeds, are achieved according to this invention by encapsulating all but the light-emitting face of a suitable area-type light source that has a long life and relatively low brightness, such as an electroluminescent lamp for example. The lamp may be permanently mounted in a suitable frame by sealing it therein with plastic material or it may be removably mounted in the frame by means of a panel that snaps into the back of the frame to form a casing that encloses all but the light-emitting portion of the lamp. Contactor members either embedded in the plastic or carried by the snap-in panel connect the lamp contacts with terminals that project through the back of the frame. According to a preferred form of the invention the terminals constitute a plug-in assembly for a con-

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ventional wall outlet so that the lighting unit can be plugged into and operated directly from such outlet.

A better understanding of the invention can be obtained by referring to the accompanying drawings wherein:

FIG. 1 is a front view in perspective of a lighting unit constructed in accordance with a preferred embodiment of this invention;

FIG. 2 is a side elevational view, partly in section, of the lighting unit shown in FIG. 1;

FIG. 3 is an enlarged cross-sectional view along the line III-III of FIG. 2, in the direction of the arrows, the end of one of the prong terminals being omitted for convenience of illustration;

FIG. 4 is an exploded perspective view of the frame, lamp and plug-in terminal-and-panel assembly illustrating the manner in which they interfit one with another according to the preferred form of this invention;

FIG. 5 is a plan view of the electroluminescent lamp shown in the preceding figures prior to the application of the protective coating;

FIG. 6 is a perspective view of the end sections of the conductively-coated light-transmitting base plate employed in the electroluminescent lamp shown in the preceding figures;

FIG. 7 is a front perspective view of an alternative embodiment of this invention;

FIG. 8 is a cross-sectional view of the lighting unit shown in FIG. 7;

FIG. 9 is an enlarged cross-sectional view along the line IX-IX of FIG. 8, in the direction of the arrows;

FIG. 10 is an exploded perspective view of the frame and the assembled lamp and contactor-terminal elements illustrating the manner in which they interfit preparatory to the sealing-in operation according to the alternative embodiment; and

FIG. 11 is a perspective view of one of the contactor-terminal elements employed in the alternative embodiment shown in FIGS. 7 to 10.

While various kinds of area-type light sources may be employed as the light generating component the present invention is especially adapted for use with an electroluminescent lamp and has accordingly been so illustrated and will be so described.

With specific reference to the drawings, in FIG. 1 there is shown a preferred embodiment of this invention wherein the lighting unit comprises generally a rectangular casing 10 and an area-type light source such as an electroluminescent lamp 12 removably locked in said casing. The lamp 12 is of substantially the same configuration as but slightly smaller than the casing 10 which, as shown in FIGS. 2 to 4, consists of a frame 14 and a panel 22. The frame 14 is of substantially uniform depth and has a rim 18 that defines a front opening of predetermined configuration and dimension, such as a rectangular window 16 as shown. The panel 22 is of sufficient length to extend across the back of the frame 14 and is preferably dimensioned to fit snugly therewithin and completely close the back thereof, as is shown in the drawing, thereby removably encapsulating all but the light-emitting front portion or face of the lamp 12.

To facilitate the assembly of the lighting unit and removal of the lamp 12 a suitable separable locking means for the casing 10 is provided according to the preferred form of this invention. While various kinds of clasps or catches may be employed a snap-in locking device is preferred. Such a locking device can be very simply and inexpensively fabricated by providing a protuberance such as ribs 24 on the panel 22 that preferably project laterally from opposite side edges thereof, and by forming cooperating indents such as grooves 20 in the inner side edge portions of the frame 14, as shown in FIG. 4, so that such ribs snap interlock with the grooves and hold the

panel 22 flush with the peripheral edge of the back of the frame 14, illustrated in FIGS. 2 and 3. The panel 22 carries a pair of terminals 27 and contactor arms 28 as hereinafter more fully described.

The electroluminescent lamp 12 is of conventional construction and as shown may comprise a well-known glass-plastic type cell wherein an electroluminescent phosphor-dielectric layer 36 is deposited over a light-transmitting electrode 34, such as a coating of tin oxide or the like, applied to a glass base plate 32. A portion of the light-transmitting electrode 34 is removed from the base plate 32 to provide a clear strip 35 that extends across said plate inward from an edge thereof, as shown in FIGS. 5 and 6. This serves to electrically isolate contact areas such as bus bars 42 provided at opposite side edges of the base plate 32 and enables an electrical potential to be applied across the phosphor-dielectric layer 36 through one of the bus bars 42 and a metallic electrode 38, such as a coating of evaporated aluminum, that overlies but does not extend beyond the aforesaid phosphor-dielectric layer and the other of said bus bars, as is well known in the art. The metallic electrode 38 terminates short of and is thus electrically insulated from the bus bar 42 that connects with the light-transmitting electrode 34 in accordance with conventional lamp-making practice.

In order to prevent the ingress of water vapor and the deleterious effects thereof on the phosphor a protective coating 40 (FIGS. 3 and 4) of wax or suitable plastic such as epoxy or the like is applied to the back of the lamp 12 before it is assembled with the casing 10. The only areas which are not so coated are the bus bar 42 that connects with the light-transmitting electrode 34 and the part of the metal electrode 38 that overlaps the other bus bar 42 at the opposite edge of the lamp 12 thereby providing widely-spaced contacts that are of planar configuration and constitute portions of the back of the lamp 12. Since light will be generated and emanate from that portion of the base plate 32 that is coated with the phosphor-dielectric layer 36, only a predetermined front portion of the lamp 12 will be light-emitting. The window 16 is accordingly so dimensioned that only the aforesaid light-transmitting portion of the lamp 12 will be exposed when the lamp is mounted and locked in operative relation within the casing 10.

To insure a positive permanent connection between the metal electrode 38 and the bus bar 42 which it overlies, a strip of conductive paint may be applied over the metal electrode along the abutting edges of the phosphor-dielectric layer 36 and the aforesaid bus bar to form an overlapping conductor strap 39, as shown in FIG. 3.

To assemble the casing 10 and lamp 12 the latter is merely placed into the frame 14 so that the front peripheral edge of the lamp rests against the rim 18. The lamp 12 is preferably of substantially uniform thickness and slightly smaller than the inside dimensions of the frame 14 so that it will be automatically centered therein and only the light-emitting front portion of the lamp will appear in the window 16. The panel 22 is then aligned with the frame 14 and slightly tilted in such a direction as to permit one of the ribs 24 to be inserted into the groove 20 in the mating inner edge portion of said frame. The opposite end of the panel 22 is then pressed inwardly until the rib 24 thereat snaps into the opposite groove 20 thereby securely but removably securing the panel 22 to the frame 14 and locking the lamp 12 in its mounted position within the casing 10. The depth of the frame 14 is preferably greater than the thickness of the lamp 12 by an amount approximately equal to the thickness of the panel 22 so that the latter, when snapped into the frame 14, will seat firmly against the back of the lamp 12 and securely lock the lamp 12 within the casing 10.

To facilitate the connection of the lamp 12 with an electrical power supply a pair of generally L-shaped spring metal strips 25 are inserted through slots 26 provided in the panel 22. As shown in FIGS. 2 to 4, one

leg of each of the metal strips 25 extends outwardly from the back of the panel 22 whereas the other legs of said strips extend laterally in opposite directions along the inner face of said panel within recesses 31 provided therein. The aforesaid backwardly extending legs provide a pair of prong terminals 27 and the laterally extending legs resilient depressible contactor arms 28 which are normally biased outwardly from the inner face of the panel 22, as shown in FIG. 4 and the dotted line portion of FIG. 3. The ends of the contactor arms 28 are bent to form curved outwardly protruding contactor heads 33, so that when the panel 22 is snapped into the frame 14 the contactor arms 28 are compressed into the recesses 31 and lie between the panel 22 and back of the lamp 12. The contactor heads 33 are thus clamped in positive electrical engagement with the bus bar 42 connected to the light-transmitting electrode 34 and with the exposed segment of the metal electrode 38 that overlies the other bus bar 42 at the opposite edge of the lamp 12, as shown in FIG. 3. Electrical juncture of the contactor arms 28 with the widely-spaced contacts on the back of the lamp is thus achieved automatically during the assembly of the lamp 12 with the frame 14 and panel 22. It should be noted that even though the planar contact areas at the back of the lamp 12 are recessed with respect to the protective coating 40, positive electrical engagement therewith is insured at all times by virtue of the fact that the contactor arms 28 and heads 33 are normally biased toward the lamp and are compressed thereagainst when the panel 22 is locked in its assembled position.

If the panel 22 or frame 14 are not fabricated from insulating material suitable means must be provided to prevent the short circuiting of the terminals 27, contactor arms 28 and lamp contacts 42. For this reason the frame 14 and panel 22 are preferably molded from a suitable plastic, such as polyethylene that has been modified to render it non-inflammable, or polystyrene in which case the interlocking grooves 20 and ribs 24 may be formed as integral parts of the respective members. A strip of non-inflammable plastic tape 44 (FIGS. 3 and 4) may be applied around the edges of the lamp 12 to obviate any remote danger whatsoever of a fire hazard in the event arcing should occur across the phosphor-dielectric layer 36. However, if the casing 10 is made from a non-inflammable type plastic such as those referred to above, the unit is inherently fire-proof and the tape 44 can be omitted.

It has been found advantageous according to the preferred form of this invention to so dimension and arrange the terminals 27 that they form a plug-in assembly for a conventional wall-type electrical outlet. To this end the legs of the L-shaped metal strips 25 which extend outwardly from the panel 22 may be made of such length that when bent back upon themselves they form the desired flat parallel-spaced prong terminals 27 as well as resilient tongues 29 (FIG. 3), which tongues are adapted to snap behind ledges 30 in the panel formed by suitably enlarging the panel slots 26 at their outer ends. Thus, the prong terminals 27 are not only rigidly anchored to the panel 22 but may be very conveniently assembled therewith merely by inserting the metal strips 25 into the slots 26 and pressing the contactor arms 28 against the inner face of the panel 22 until the tongues 29 snap and are firmly seated behind the ledges 30.

It has also been found advantageous according to this invention to locate the prong terminals 27 along and centrally of the vertical axis of the casing 10 and to space them a predetermined distance inward from an edge of the casing 10 that is normal to the flat surfaces of the terminals such that no more than half of a conventional duplex wall outlet will be covered when the lighting unit is plugged into one of the outlets and the aforesaid edge is disposed toward the other outlet. As a specific example, it has been found that the foregoing relationship is obtained when the line connecting the

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centers of the terminals 27 is spaced approximately 11/16 of an inch from an edge of the casing 10 that is normal to the flat surfaces of the terminals. While the overall dimensions of the casing 10 are not critical and may vary considerably it has been found that a casing approximately 2 1/4 inches wide and approximately 2 3/4 inches long constitutes a very compact night light or safety light. A unit of this size with prong terminals 27 located as above-described can be plugged into one side of a duplex outlet without obstructing or preventing the use of the other side or, if more light or an illuminated area twice as great is desired, two such units can be operated side-by-side from one duplex outlet.

Alternatively, instead of the lamp component being removably locked in a casing 10 as above described, it may simply be permanently secured to a frame by means of a suitable cement such as a thermosetting plastic material. This type of construction is illustrated in illustrated in FIGS. 7 to 10 wherein an electroluminescent lamp 12a of circular configuration, for example, is sealed within a frame 14a of the same configuration. The frame 14a is slightly larger in diameter than the lamp 12a and is provided with a rim 18a that defines a circular window 16a in which the light-emitting face of the lamp is disposed when the lamp is in its assembled position. The lamp 12a may be of the same glass-plastic type of construction described above in connection with the preferred embodiment except that the bus bars 42a are of course, arcuate in form and the back of the lamp is not coated with a protective layer prior to assembly with the frame 14a.

According to the aforesaid alternative form of the invention, each of the spring metal strips 25a are bent to form a prong terminal 27a and a contactor arm 28a disposed approximately normal to each other as before. However, in addition to the contactor head 33a formed at the end of the contactor arm there is also provided a retroverted cleat 47 that depends from said contactor head, as shown in FIGS. 9 and 10 and more particularly in FIG. 11. The cleats 47 are dimensioned to resiliently grip the end edges of the lamp 12a so that when they are clamped thereover the contactor heads 33a firmly seat against the metal electrode 38a and the exposed bus bar 42a that connects with the light-transmitting electrode 34a.

To assemble this modified lighting unit of FIGS. 7 to 10, the metal strips 25a are first clamped onto the edge of the lamp 12a in opposed relation and in engagement with the lamp contacts as above described. When thus disposed the strips will be self-supported and the contactor arms 28a will be spaced from the back of the lamp thereby obviating the danger of a short circuit through the metal electrode 18a when the unit is assembled and energized. The lamp-and-strip assembly is then oriented as shown in FIG. 10 and placed into the frame 14a so that the cleats 47 will slip into suitable recesses 48 provided in the frame 14a and rim 18a, thereby permitting the front peripheral edge of the lamp 12a to seat firmly against the aforesaid rim and form a seal therewith as indicated in FIG. 9. As shown most particularly in FIG. 9, the various components are so dimensioned that when assembled the back edge of the frame 14a extends considerably beyond the back of the lamp 12a and the contactor arms 28a, whereas the prong terminals 27a project through and beyond the back of the frame.

After the members have been assembled in the aforesaid manner, a suitable cement 46 such as a thermosetting plastic (an epoxy resin or the like, for example) is introduced while in its uncured state into the back of the frame 14a in an amount sufficient to cover at least the back of the lamp 12a and the contactor arms 28a. Preferably, enough cement 46 is used to substantially fill the back of the frame 14a, as illustrated in FIGS. 8 and 9. The cement 46 is then cured thereby not only

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permanently locking the contactor arms 28a in positive electrical engagement with the lamp contacts but also providing a protective insulating coating for the back of the lamp 12a and permanently sealing the latter within the frame 14a. If desired, the prong terminals 27a may be properly dimensioned and spaced to constitute a plug-in assembly for a wall outlet and properly located with respect to the frame 14a as to permit two units to be plugged into and operated from one duplex type outlet in the same manner as discussed above in connection with the preferred embodiment. Also, for usage in applications other than plugging into convenience outlets, still further types of exterior contacts may be substituted for the prong terminals 27, such for example as screw terminals and spring-pressed "battery" type terminals, to which the circuit wires can be readily connected.

While the composite lighting unit of this invention has been described in terms of a device adapted for low level lighting applications, as for example, a night or safety light, it is not limited thereto and can also be advantageously employed as a display device for transparencies or similar light-transmitting articles that lend themselves to backlighting. For such applications the article to be displayed is merely inserted into the frame before the lamp or attached to the front of the lighting unit. Alternatively, the same result can be achieved by providing a slot and suitable grooves in the rim 18 of the rectangular frame 14 to enable the transparency or similar article to be slipped into the frame in front of the lamp 12. As will be obvious, pictures or the like can also be made within the spirit of this invention which are not only self-illuminating but conveniently and attractively framed.

It will be apparent from the foregoing that the objects of the invention have been achieved in that a novel lighting unit has been provided which is not only simple and inexpensive to make but which does not require either a switching or light controlling means and can be operated directly from a conventional wall outlet. In addition, by utilizing an electroluminescent lamp as the light source component the unit not only inherently provides the pleasant subdued illumination desired for darkroom or safety lighting applications but, by virtue of the exceedingly low power consumption of this type lamp, enables the unit to be operated continuously both day and night thereby obviating the costly switch and shielding structures previously required in the prior art devices. It has been found, for example, that a unit of the dimensions referred to above in connection with the preferred embodiment and designed for 120 volt operation will have a power rating of only 1/200 of a watt and, at the prevailing electrical rates, can be operated continuously for one year at a cost of less than one penny. The combination of an electroluminescent lamp with the encapsulating frame and contactor-terminal assembly of this invention affords the additional advantage that even though the unit is operated continuously it will have an exceedingly long useful life and is inherently "fail-safe" in that it has a light output that will gradually decrease with time rather than terminate abruptly at an inopportune moment.

While two best known embodiments of this invention have been illustrated and described in detail in accordance with the patent statutes, it is to be particularly understood that is is not limited thereto or thereby.

We claim:

1. A lighting unit comprising, a frame, a planar light source loosely mounted in said frame, said light source having a light-emitting face at least a portion of which is disposed in the front opening of said frame, a pair of spaced contacts on portions of said light source other than its light-emitting face, a body of insulating material attached to and closing the back of said frame, and a pair of elongated contactor members extending through said body of insulating material to said contacts and having exposed end portions that serve as terminals for said light-

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ing unit, said light source being locked within said frame and said contactor members being locked in positive electrical engagement with said light source contacts and in spaced apart relation with respect to one another solely by said body of insulating material.

2. A lighting unit as set forth in claim 1 wherein, said light source comprises an electroluminescent lamp, and said spaced contacts comprise portions of the back of said lamp.

3. A lighting unit as set forth in claim 1 wherein, said spaced contacts are located at opposite sides of said light source, said elongated contactor members are of generally L-shaped configuration, one leg of each of said contactor members is anchored to said insulating body and protrudes rearwardly thereof, and the exposed portions of said legs comprise a pair of plug-in terminals.

4. A lighting unit as set forth in claim 1 wherein, said body of insulating material comprises a cured filling of thermosetting plastic that covers the back of said light source and the portions of said contactor members that are in electrical engagement with the light source contacts.

5. A lighting unit as set forth in claim 1 wherein, said body of insulating material comprises a panel that is secured to the back of said frame and together with said frame constitutes a casing that completely encloses the sides and back of said light source.

6. A fail-safe lighting unit comprising, a frame, an electroluminescent lamp loosely mounted in said frame, a pair of spaced contacts on the back of said lamp, a panel of insulating material removably fastened to and closing the back of said frame, and a pair of contactor members fastened to and passing through said panel, each of said contactor members having a resilient laterally-extending arm portion that is located between said panel and said lamp and is pressed by said panel into electrical engagement with said lamp contacts, said contactor members being held in spaced apart relationship and in positive electrical connection with said lamp solely by means of said panel.

7. A fail-safe lighting unit as set forth in claim 6 wherein, said frame and panel are fabricated from non-inflammable plastic, and said panel has a protuberance that laterally extends from an edge thereof and is snapped-interlocked with an indentation in the inner peripheral edge of said frame.

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8. A fail-safe lighting unit as set forth in claim 6 wherein, said contactor members comprise spring metal strips of generally L-shaped configuration, and one leg of each of said strips extends through an aperture in said panel and projects therebeyond to provide a pair of rigid prong terminals at the back of said unit.

9. A fail-safe lighting unit as set forth in claim 6 wherein, the exposed ends of said contactor members constitute a pair of plug-in prong terminals for a conventional wall outlet, and said prong terminals are spaced from an edge of said frame that is transverse to the flat surfaces of said terminals a distance such that at least half of a conventional duplex wall outlet is left exposed when said terminals are plugged into one of the outlets and the said edge of said frame is disposed toward the other outlet.

10. A fail-safe lighting unit comprising, a frame, an electroluminescent lamp mounted in said frame, spaced contacts on the back of said lamp, a pair of generally L-shaped spring metal contactor members each having a cleat at one end that is clamped around the edge of said lamp and maintains a portion of said contactor members in electrical engagement with the respective lamp contacts, and a layer of thermosetting electrically non-conductive plastic covering the back of said lamp and the portions of said contactor members in electrical engagement with said lamp contacts, said lamp and contactor members being locked together in operative relation and permanently sealed as a unit within said frame solely by said plastic layer.

11. A fail-safe lighting unit as set forth in claim 10 wherein the free ends of said contactor members protrude beyond the back of said frame and constitute prong terminals adapted to be plugged into a conventional wall outlet.

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