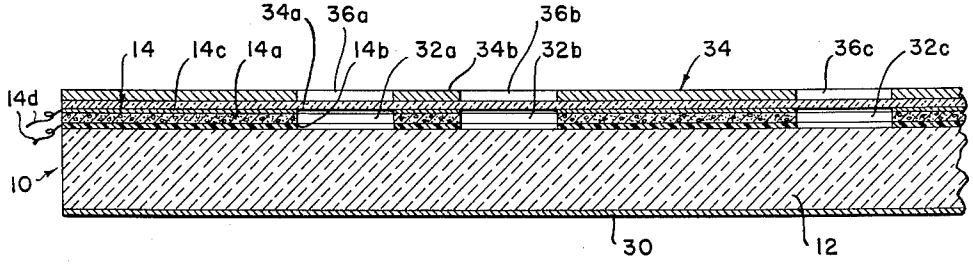
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PANEL ILLUMINATING SYSTEM

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INVENTOR
G. K. C. HARDESTY

BY

O. A. Miller
B. L. Zanguill
ATTORNEYS

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PANEL ILLUMINATING SYSTEM

George K. C. Hardesty, Box 156, Mayo, Md.

Original application Sept. 30, 1958, Ser. No. 764,462, now Patent No. 2,982,039, dated May 2, 1961. Divided and this application Nov. 19, 1959, Ser. No. 854,210
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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This application is a division of application Serial No. 764,462 filed September 30, 1958, now Patent Number 2,982,039.

This invention relates to the illumination of instrument dials, panels, plotting boards and the like, and particularly to the provision of an efficient and practical panel which is suited for many uses aboard ships, surface or submarine, aircraft and in other installations having large numbers of visual indicators.

More particularly, this invention relates to indirect lighting in combination with electroluminescent sources.

Heretofore, edge lighting, that is panel illumination wherein one or more light sources are located at the edge of a transparent panel and light rays introduced into the panel for transillumination thereof and indirect illumination thereby, has been carried out more or less exclusively by tungsten filament lamps, fluorescent lamps or the like located at the edge of the panel; hence the name edge lighting.

Electroluminescence, on the other hand, has been used only for direct viewing. That is, pointers, indicia or the like are either formed as electroluminescent members or are located directly in front of electroluminescent members to be made visible as silhouettes by visual contrast. A fire exit sign, for example might consist of a rectangular electroluminescent lamp and an opaque mesh concealing all of the lamp except the areas in the words "Fire Escape." This has obvious inefficiency as most of the energy is lost in the mask.

Electroluminescent light sources have certain inherent advantages over tungsten filament lamps. For example, for panel illumination, 6 volts is a practical maximum that may be used for the miniature lamps required. Tungsten filaments are rich in red light and they emit appreciable light through the several bands of the visible spectrum at this conservative voltage, and such lamps have a relatively long life. However, as tungsten filaments are dimmed, by design, the other bands of the visible spectrum disappear and substantially only red light is emitted. Electroluminescent light sources, on the other hand, operate most efficiently at around 250 volts. Electroluminescent sources can efficiently emit light rays from orange-yellow through blue, with practically no emission of red rays. The color characteristics of light rays emitted by an electroluminescent source, however, do not appreciably change with dimming.

An object of the present invention is to provide an efficient and practical illuminated panel in the nature of an indirectly illuminated panel in which all areas of the electroluminescent source contribute to the luminance of the panel markings.

A further object of this invention is to provide an illuminated panel utilizing electroluminescent sources for indirect lighting.

The broad principles of this invention may be applied to edge-lighted plotting boards and to "see thru" transparent illuminated scales, dials, pointers and the like.

Briefly, this invention facilitates the viewing of non-electroluminescent indicia and other graphic material

made luminous by light given off by concealed electroluminescent sources applied to suitable hidden surfaces of a transparent, light-conducting panel.

By this invention, the utility of electroluminescent lamps in instrument illumination is greatly extended, since it is not necessary that the electroluminescent material itself be viewed. The indicia or markings, for example, may be of suitable, high diffuse reflectivity, opaque or translucent, materials chosen for excellent daylight visibility as well as high apparent luminosity when viewed at night or in dark environments. The applied indicia may be any color or reflectivity paint, fired on composition, or the like, or the Corning Glass Works type of photosensitive graphic technique may be used to produce indicia within an edge illuminable glass member.

Although the instant invention may be used with a single panel illumination system such as applicant's Patent No. 2,805,505, it is particularly compatible with and may be used with the Duo-Panel System Edge Illumination System, illustrated and described in applicant's co-pending application Serial No. 369,976, filed July 23, 1953, now Patent No. 2,886,911.

The invention, together with the above and other objects and advantages thereof, is set forth in more technical detail in the following description when considered in connection with the accompanying drawing wherein like reference numerals designate like parts throughout the several views thereof and wherein the sole FIGURE illustrates a duo-panel embodiment indicated generally by the numeral **10**. In this figure a light-transmitting panel **12** is fabricated of highly transparent material such as glass or, preferably, an acrylic resin or methyl methacrylate plastic, with the front and back surfaces of the panel in parallel relation and polished to provide smooth optical surfaces. The back or reverse surface of the light-transmitting panel is preferably covered throughout its area with a material having high specular reflectivity. This material, indicated at **30**, may be polished-faced metal foil, polished metal sheets, evaporated metal deposited on the surface as a film, or oriented flake metallic-pigmented coatings. The front surface of the light-transmitting panel is at least partially covered with an electroluminescent light source, indicated generally at **14**. The electroluminescent material of this embodiment includes a transparent current carrying lamina **14*b***, an electroluminescent lamina **14*a***, and an opaque current carrying lamina **14*c***. A pair of leads **14*d*** are connected to conductors **14*b*** and **14*c*** and lead to and from a suitable source of A.C. current, not shown. The electroluminescent light source is provided with optionally-placed openings therein for transmission of light therethrough, which openings are indicated at **32*a***, **32*b*** and **32*c***.

Mounted in front of the light-transmitting panel is an indicia panel **34**. The indicia panel comprises a lower lamina **34*a***, made of transparent or translucent plastic, as desired, and an upper lamina **34*b*** made of an opaque material. Indicia-forming openings **36*a***, **36*b*** and **36*c*** are cut in the upper or opaque lamina and are in line with the openings **32*a***, **32*b*** and **32*c*** formed in the electroluminescent light source. With the arrangement of the illustrative figure, light rays from the electroluminescent source are transmitted through the upper surface of the light-transmitting panel and into the panel at various angles for transmission therethrough. Certain of such light rays are reflected by the mirrored surface **30** back through the openings **32*a***, **32*b*** and **32*c*** in the light source to thereby illuminate the indicia formed by the openings **36*a***, **36*b*** and **36*c*** in the opaque lamina **34*b***. Thus, as with the other embodiments, the indicia are indirectly illuminated by an electroluminescent source which itself is not seen. If desired, the indicia may be colored inserts in the openings **36*a***, **36*b*** and/or **36*c*** and may be in optical

contact with light transmitting panel **12** with further enhancement of indicia luminance.

As pointed out hereinbefore, the electro-luminescent light source may or may not, as desired, be placed in optical contact with the light-transmitting panel. In certain installations it is desirable that the electroluminescent light source be readily removable from the panel, in which case optical contact would not be provided between the transparent conductor and the adjacent surface of the light-transmitting panel by the mere interface relation of such surfaces. Partial advantages may result from the provision of light diffusing characteristics to the surfaces of the light-transmitting panel in those areas that intercept light from the electroluminescent light source. These diffusing characteristics may be provided by roughening the surfaces of the light-transmitting panel which are adjacent the electroluminescent light source and by applying a diffusing surface to the opposite or light reflecting surface of the light-transmitting panel. Where optical contact is provided, light can be regarded as originating under the principal surfaces of the light-transmitting panel and roughening is of less utility.

Having thus described the invention, it is to be understood that the foregoing disclosure relates to only preferred embodiments of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and the scope of the invention as set forth in the appended claims.

What is claimed is:

1. A duo-panel illuminating system comprising a transparent light-transmitting panel having parallel front and rear surfaces arranged for specular reflection of light therebetween, an electroluminescent light source positioned adjacent the front surface of the light-transmitting panel for introducing light rays into such panel for specular reflection of light therethrough, said electroluminescent light source covering substantially the entire upper surface of the light-transmitting panel and having openings therein at selected areas thereof for transmission of light from the panel, light reflecting means formed on the rear surface of the light-transmitting panel for reflecting light rays out of such panel and through the openings in the electroluminescent light source, an indicia panel positioned adjacent the front surface of the electroluminescent panel in parallel relation thereto, and indicia forming means on said indicia panel in line with the openings in the electroluminescent light source for illumination thereby.

2. A panel illuminating system comprising a transparent light-transmitting panel having parallel front and rear surfaces arranged for specular reflection of light therebetween, an electroluminescent light source positioned adjacent the front surface of the light-transmitting panel for introducing light rays into such panel for specular reflection of light therethrough, said electroluminescent light source covering substantially the entire upper surface of the light-transmitting panel and having openings therein at selected areas thereof for transmission of light from the panel, a metallic light reflecting layer formed over the rear surface of the light-transmitting panel for reflecting light rays out of such panel and through the openings in the electroluminescent light source, an indicia panel positioned adjacent the front surface of the electroluminescent panel in parallel relation thereto, and indicia forming means on said indicia panel in line with the openings in the electroluminescent light source for illumination thereby.

3. An instrument panel illumination system comprising a first panel of transparent light-transmitting material having principal surfaces operative specularly to reflect light rays therebetween, an electroluminescent light source adjacent the front surface of the light-transmitting panel for introducing light rays into such panel for specular reflection of light therethrough, said electroluminescent light source covering substantially the entire upper surface of the light-transmitting panel and having at least one opening therein at a selected area thereof for transmission of light from the panel, light reflecting means formed on the rear surface of the light-transmitting panel for reflecting light rays out of said panel and through the openings in the electroluminescent light source.

4. A panel illuminating system comprising a solid light transmitting panel of transparent material, said panel having parallel front and back faces polished to provide smooth optical surfaces over the entire areas thereof; a metallic light reflecting layer on said back surface over the entire area thereof, an electroluminescent light source positioned adjacent the front surface of said panel and covering substantially the entire surface thereof but having openings therein at selected areas for transmission of light from the panel, an indicia panel positioned in front of said electroluminescent source in parallel relation thereto, and indicia forming means on said indicia panel in line with the openings in the electroluminescent light source for illumination thereby.

References Cited in the file of this patent

UNITED STATES PATENTS

2,791,050	Neugass	May 7, 1957
2,795,069	Hardesty	June 11, 1957
2,805,505	Hardesty	Sept. 10, 1957
2,872,567	Strange	Feb. 3, 1959
2,919,366	Mash	Dec. 29, 1959