Sept. 29, 1964 J. M. ROPER 3,150,456

INSTRUMENT PANEL LIGHTING

Filed Feb. 25, 1955

FIG. 1.

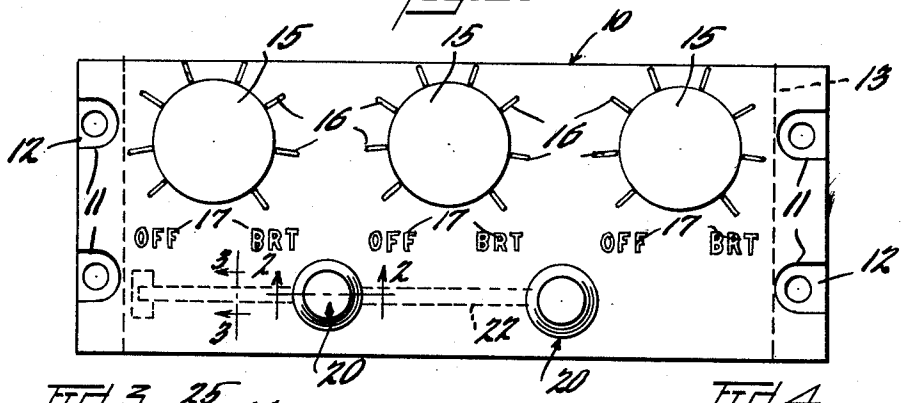


FIG. 3.

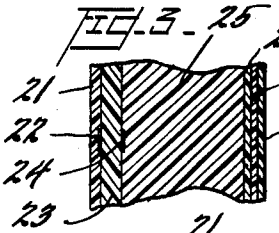


FIG. 2.

FIG. 4.

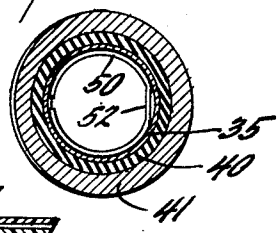


FIG. 5.

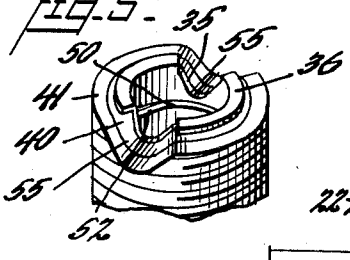


FIG. 6.

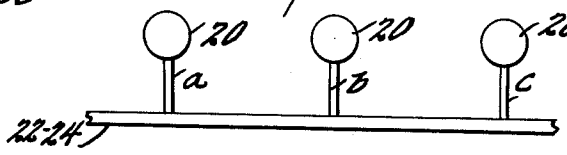
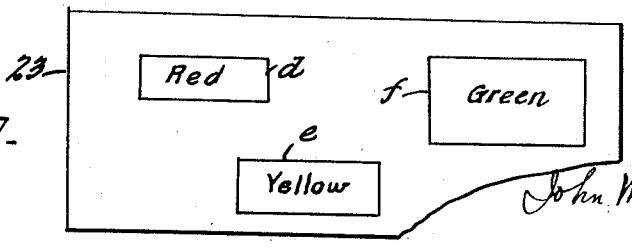


FIG. 7.



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INSTRUMENT PANEL LIGHTING

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This invention relates to instrument panels or dials and to means for illuminating them so that the indicia or legends carried thereon may be read at night or under other circumstances involving the absence of adequate natural lighting.

More particularly, the invention has reference to the illumination of the indicia applied to or incorporated in the panels by light transmitted through the material of which the panel is composed, and from a light source carried by the panel and located substantially in the plane thereof, whereby the rays of light are transmitted edgewise of the body of the panel.

A general object of the invention is to provide a novel and improved system of illumination of the class described, which will enhance the efficiency of the panel lighting, increase the compactness of the instrument assembly and facilitate its manufacture, widen the versatility of location of the light sources, and generally improve the provisions for illumination of the dials, instrument and console panels, and other indicia bearing surfaces, such as those to be found in the cockpits of aircraft, on shipboard, or elsewhere.

Athough the edge illumination of plastic panel lighting systems has been in use for some time, difficulty and inconvenience have been experienced in the matter of the awkward rearward projection from the panel of parts of the lighting installation and the interference of such projecting parts with the instruments or instrument casings disposed behind the panels.

It is well known that space in the cockpit of an aircrafts, is at a premium and the various instruments, housings, and panels must be crowded as close together as possible, and the various fastenings, electrical connections and accessories must occupy a minimum of space and not interfere with the compact assemblage of the controls. Heretofore, the manufacturers of control instruments for aircraft had to take into consideration in the planning of the instruments and their housings and casings, the accommodation of the rearwardly projecting parts of the instrument or console panel, with the various components positioned behind the panel so as to minimize conflict. The present invention enables the manufacture of the console equipment and the manufacture of the instrument panel and the locating of the lighting fixtures therein to be planned independently, the one without reference to any possibility of conflict with the other.

According to a preferred embodiment of the invention, a specialized socket construction is incorporated into an instrument panel which comprises various laminated layers in such a manner that the lighting fixtures and the conductors therefor are advantageously integrated within the panel and without any projection of components rearwardly of the panel. In particular, the necessary lamp conductors are applied on both flat surfaces of a layer of translucent material in the form of relatively thin films or strips. The coopertaing socket is provided with a pair of conducting flanges which engage the conductor strips by friction contact and without the soldering of wires to terminal lugs or the like. The foregoing arrangement is particularly satisfactory for use in the parallel connection of a plurality of physically displaced panel lamps. The appropriate disposition of socket receiving holes, and the insertion of the lamp sockets within these holes so as to establish friction contact with the conducting strips

is generally all that is necessary to estabilsh the lamp energizing circuitry.

This particular structure of this invention employing conducting strips also provides some measure of control over the illumination brightness of the panel legends and figures. One of these strips can be advantageously placed partially under those legends and figures which are normally too bright because of their closeness to the light sources, and this partial obscurance decreases their brightness to a desired uniform value with respect to the remaining panel sections. Control over the lamp illumination can also be provided electrically by constructing appropriate ones of the conducting strips of resistive material so as to introduce desired voltage drops before the application of the energizing potential to selected lamps.

Another feature of the invention resides in the socket construction which is provided with a lamp holder having a cut away portion for facilitating manual removal of the lamp by a positive finger grip.

Another companion feature directed to the socket is the provision of a small insert spring within the lamp holder which holds the lamp in place and prevents its falling out on an overhead panel construction when the socket protective cap is removed.

In order that all of the structural features for attaining the objects of this invention may be clearly understood, reference is herein made to the drawings wherein:

FIGURE 1 is a view in front elevation of a portion of an illuminated instrument or console panel embodying the principles of the invention;

FIGURE 2 is a sectional view taken on line 2—2 of FIGURE 1 and showing in detail the novel socket construction of this invention and its incorporation into an instrument panel;

FIGURE 3 is a sectional view taken on line 3—3 of FIGURE 1 and showing the inclusion of the conducting strips into an instrument panel;

FIGURE 4 is a sectional view taken on line 4—4 of FIGURE 2 and showing in detail the inclusion of the retaining spring in the lamp structure of FIGURE 2;

FIGURE 5 is a perspective view showing the lamp holder of the socket herein with a pair of cut away portions for facilitating the removal of a lamp;

FIGURE 6 is a schematic representation of an arrangement of conducting strips for varying the applied energizing potentials to a plurality of parallel connected lamps; and

FIGURE 7 is a simplified representation of a panel arrangement for varying the color of illumination of various portions of the panel.

In FIGURE 1 of the drawings there is illustrated an exemplary arrangement of a small section of an instrument or console panel for an aircraft or the like.

This panel section is indicated generally by the reference numeral **10** and as in some conventional constructions, it is provided with cutouts **11** for the application of standard securing or fastening elements which serve to attach the panel to an underlying supporting plate **12**, portions of which are shown within the confines of the cutouts **11**. This plate **12** may in practice be the front plate of casings or housings for the instruments or equipment behind the lighting panel. In the particular suggestive embodiment shown in FIGURE 1, the portions **12** may be projecting flanges from an instrument box, the boundaries of which box are indicated by the broken lines **13**.

However, the present invention in its general aspects is applicable to a wide variety of instrument and console installations, whether in the cockpit of an aircraft, on the bridge of a ship, or in any other installation where excellent controlled lighting is needed. The novel arrangement is particularly useful in situations where the

lighting panel 10 is applied to the front wall 12 of the instrument box and in close contact therewith.

The particular panel used for illustrative purposes in the drawings is provided with three control knobs 15 with their associated markers or indicator lines 16 and printed legends 17. The markings 16 and the legends 17 are illuminated from within the panel 10 which is made in part of light conducting material which may be selected from well-known plastics or other materials having the property of conducting or transmitting light. The major portion of the surface of the panel where the markings and legends do not occur is coated with an opaque material preferably having a black surface.

As sources of illumination for transmitting light through the body of the panel 10 to the legends and markings which are to be illuminated, there are provided the lighting fixtures indicated generally by the reference characters 20. These lighting fixtures are disposed at strategic points upon the panel so as to be uniformly distributed with respect to the legends to be illuminated. As these lights are so designed as to not project into the control box beyond the lighting panel, they can be located as desired without regard to the arrangement of equipment in the control box. The two lamp assemblies 20 shown in FIGURE 1 are symmetrically disposed with respect to the markings for the three switches 15.

The lamp installations 20 will now be described in detail, in connection with the laminar construction of the panel itself.

Referring particularly to FIGURE 2 of the drawing, panel 10 comprises a body lamination 25 which is formed from a layer of transparent material. This material may be of clear light-conducting plastic, glass, or other suitable material. Transparent body 25 is sandwiched between an upper layer 23 of relatively rigid, translucent materal and a lower layer 26 which may be translucent film formed from vinyl sheeting. The upper surface of translucent layer 23 is coated with an opaque film 21 which may be formed from a black vinyl sheeting or black paint.

In the preferred embodiment shown in FIGURE 2 translucent film 26 is coated on the lower side with a light reflecting layer 27. This layer may be vacuum evaporated, electro-plated, chemically deposited or a printed surface of aluminum, silver or the like, or any material having a high specular reflectance of light. The lower surface of coating 27 is coated with an opaque film or layer 28 which may be formed from black vinyl sheeting or by black paint processing. In the usual instance layer 28 will be formed of the same material and in generally the same manner as layer 21. The outer vinyl coating layers may be of colors other than black, generally however, black is preferable inasmuch as it will not readily reflect light and provides a contrasting background for the illuminating legends and markings.

The markings and legends formed on panel 10 and shown in illustrative detail in FIGURE 1 are prepared by any conventional or suitable means for removing the requisite portions of opaque layer 21 upon the face of the panel so that the underlying translucent layer 23 will be exposed. In certain applications, if it is desired, the prepared opaque surface can be covered with a clear vinyl film (not shown) for protecting the engraved lines and indicia from dirt and other deleterious materials.

A pair of conductor strips 22 and 24 are applied to the upper and lower surfaces of translucent layer 23 for the purpose of applying the requisite energizing potentials to lighting fixtures 20. Conducting strips 22 and 24 may be applied by any techniques well known in the art for forming an adhering coating of a thickness preferably not greater than 1 to 2 mils to a plastic layer such as 23. Materials such as, for example, aquadag or silver paint, are satisfactory for the present application.

Lighting fixtures 20 are disposed at the required locations with respect to panel 10 by processing layers 21, 23 and 25 and conductor strips 22 and 24 with suitable socket receiving holes, whereby the bulb portion of lamp 31 may be disposed within the socket-receiving hole portion formed from layer 25.

The socket for lamp 31 comprises a metallic lamp retaining sleeve 35 which is formed with an upper shoulder 36 which engages the projecting base flange 33 of miniature flange base 32.

The lower portion of retaining sleeve 35 is formed with a circular contact flange 37. The upper surface of contact flange 37 forms a friction contact with conducting strip 24 whereby electric current flow is provided for one terminal of lamp 31 through conductor strip 24, contact flange 37, lamp retaining sleeve 35, and lamp base 32 to one terminal of the lamp filament.

Metallic cap retaining sleeve 41 is electrically insulated from lamp retaining sleeve 35 by means of an intervening insulator sleeve 40. The upper surface of insulator sleeve 40 rests in part beneath shoulder 36, and the lower surface of the insulator sleeve contacts the upper surface of translucent layer 23. It should be noted that conductor strip 22 located on the upper surface of layer 23 terminates at the outer edge of insulator sleeve 40 and does not make contact with lamp retaining sleeve 35. This structural arrangement is necessary in order to prevent short circuiting conductor strips 22 and 24 to one another.

The lower edge of sleeve 41 is formed with a contact flange 43 which engages an upper surface portion of conductor strip 22 by friction contact. The outer surface of cap retaining sleeve 41 is formed with external threads 42 which engage the internal threads 46 of protective cap 45.

Electrical current flow to the second terminal of lamp 31 is provided through conductor strip 22, flange 43, sleeve 41, cap 45, spring 44, and contact 34 to the second terminal of the filament for lamp 31. It will be noted that the threaded engagement of cap 45 with respect to the remaining socket assembly and lamp is required in order to provide for the energization of the enclosed lamp 31.

The foregoing socket construction is particularly adapted for advantageous use with the panel structure of this invention. In the fabrication of the panel assembly, the body layer 25 and its adhering layers 26, 27 and 28 may be fabricated as a single unit, and relatively rigid layer 23 and its adhering conductor strips 24 and 22 and the overlying opaque layer 21 can be fabricated as a second unit. The requisite socket receiving holes can then be located at the desired positions and lamp retaining sleeve 35 and cap retaining sleeve 41 together with the intervening insulator sleeve 40 can be mechanically coupled to the panelling unit comprising layer 23. It will be noted that this particular socket and panel construction completely eliminates the expensive and cumbersome requirement for terminal lug and solder connections commonplace in the energizing circuitry for many prior art panel constructions. In addition, this construction is readily adaptable for production, inspection and rejection of components with a minimum of effort and expense. In the event that the one unit comprising transparent layer 25 or the other unit comprising translucent layer 23 is defective, only the defective section need be rejected and the remaining panel section or unit can be retained for further use inasmuch as both units are separately constructed prior to joining together by techniques well known in the art.

Protective cap 45 is, of course, readily removable by appropriate manual operation in order that lamp 31 may be inserted or removed within the lighting fixture as desired. As is shown in FIGURE 1, the exterior or operative viewing surface of panel 10 is so arranged that protective cap 45 of lighting fixtures 20 projects from the exposed operating surface of the panel in such a manner that access to the enclosed lamp can be attained without removal of the panel from its supporting brackets or frame.

As shown in the fragmentary sectional view of FIG-

URE 3, conducting strips **22** and **24** can be fabricated so that they have a relatively small or narrow width, which covers only a small portion of the overall panel surface as is shown in FIGURE 1. The electrical conducting strip **22** may, however, take an alternative construction which provides for covering the entire upper surface of layer **23**. In this latter form, in order to provide for the illumination of the markings **16** or legends **17**, it will be necessary to engrave or cut through the conducting layer **22** so as to have optical access to layer **23**. In the event, however, that the narrow strip form shown in the drawing is employed for conductor **22**, it will usually not be necessary to engrave or cut through the constructing strip for the reason that the strip will be physically displaced from the markings **16** and legends **17** as is shown in FIGURE 1. The conducting strip **24** positioned on the lower surface of translucent layer **23** is preferably constructed in all cases in the form of a narrow strip so as not to interfere with light passing from transparent layer **25** to translucent layer **23**.

In certain constructions the conducting strip **24** can be advantageously placed partially under those legends and markings which are normally excessively illuminated because of their closeness to one or more light sources. This partial obscurance of these markings and legends decreases their brightness and effectuates a uniformity of illumination of the overall panel. Likewise, the reflecting layer **27** could be deleted below the markings and legends which are excessively bright and thereby facilitate in attaining a uniform illumination over the panel. In the alternative, the use of reflecting layer **27** without the intermediate translucent layer **26** could be advantageously employed in certain panel sections in which the markings and legends are not sufficiently illuminated.

In the preferred construction of the panel of this invention, transparent layer **25** is immediately sandwiched between translucent layers **23** and **26** in order to provide proper diffusion of the transmitted light so as to minimize glare in the illuminated markings and legends. The inclusion of the overlying reflector layer **27** minimizes the loss of light and facilitates maintaining a relatively high intensity within transparent layer **25**, whereby sufficient illumination can be attained at the indicia and markings. Opaque layers **21** and **28** prevent the loss of light to the environmental media for the panel, and in addition layer **21** provides a contrasting background for the illuminated media. Layers **26** and/or **27** in appropriate circumstances can be eliminated in order to further facilitate and simplify the construction of the panel.

In certain modifications, in which, for example, layer **23** is not sufficiently rigid to provide adequate support for lighting fixtures **20**, an eyelet type contact to the lamp base and to the interior conducting strip **24** can be provided. In this arrangement conducting strip **24** would be positioned on the lower surface of transparent layer **25**, and lamp retaining sleeve **35** would pass completely through the transparent layer **25** in such a manner that the contact flange **37** would frictionally engage the lower conducting strip **24** positioned on the lower surface of layer **25**. In order to permit the transmission from light from lamp **31** to transparent layer **25**, retaining sleeve **35** should preferably consist of relatively thin posts in the area adjacent transparent layer **25**. In such an arrangement the positioning of the conducting strip **24** on the lower surface of the layer **25** would serve an additional function in that it could provide for light reflection from the lower surface thereby eliminating in part or in whole the need for light reflector layer **27**.

As is shown in FIGURE 6, either or both of conducting strips **22** and **24** can be provided with branch conductors A, B or C as is necessary and which are connected to lighting fixtures **20**. These branch conductors are resistive elements which are designed to introduce various voltages drops in the energizing potential of conducting strips **22** and **24** before application to the panel

lamps. Such an arrangement can be advantageously employed to obtain better uniformity in the brightness of the panel markings and the legends.

As is shown in FIGURE 2, a cylindrical color filter **30** can be inserted between lamp **31** and the adjacent sections of transparent layer **25** so as to render a colored illumination in the indicia marks and legends. An alternative arrangement is shown in FIGURE 7 in which color filter **30** is eliminated. In particular, translucent layer **23** is provided with color sections *d*, *e* and *f* which are fabricated of colored translucent material and which will impart a colored illumination to the overlying markings and legends. Such an arrangement, for example, would readily enable the illumination of a panel with various colors at different sections as desired. In other situations it may be desirable to fabricate translucent layer **23** of colored material thereby imparting to all of the overlying markings and legends a single color. Such an arrangement would eliminate the necessity for colored filter sleeve **30**.

Lighting fixture **20** may advantageously incorporate a lamp retaining spring **50** as is shown in FIGURES 2 and 4. Retaining spring **50** is positioned within a groove formed in the inner wall of lamp retaining sleeve **35**. Spring **50** is formed with a relatively flat portion **52** which projects partially into the cylindrical bore of retaining sleeve **35** in such a manner as to establish friction contact of base **32** with lamp **31**. This spring feature has a desirable application in those panel installations in which an overhead positioning of the panel is desired and in which lamp **31** would fall from its associated socket in the event that protective cap **45** were removed. In these installations retaining spring **50**, and in particular portion **52** thereof, provides sufficient friction force to lamp **31** so as to overcome the falling forces introduced by gravity.

An additional advantageous feature of lighting fixture **20** is shown in detail in FIGURE 5. In this arrangement sleeves **35**, **40** and **41** are provided with a diametrically opposed pair of cuts **55**. The provision of cuts **55** enable base flange **33** of the lamp **31** to be positively and easily engaged by manual gripping whereby the enclosed lamp may be readily removed for replacement or inspection.

Various changes and modifications may be made in the embodiments illustrated and described herein without departing from the scope of the invention as defined by the following claims.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. An instrument console panel, comprising a body formed from a layer of transparent material, a contacting layer of translucent material positioned on one face of said transparent body, a contacting layer of light reflecting material positioned over said translucent layer, a contacting layer of opaque material positioned over said light reflecting layer, a second contacting layer of translucent material positioned on the second face of said transparent body, a pair of relatively thin conducting films each disposed on different sides of said second translucent layer, a lighting fixture coupled to said console panel and including a cylindrical lamp retaining sleeve formed with a projecting flange which contacts the conducting film positioned on the underlying surface of the second translucent layer, a cylindrical insulating sleeve positioned in contacting coaxial relation to the lamp retaining sleeve, a cylindrical cap retaining sleeve positioned in contacting coaxial relation to the insulator sleeve and formed with a projecting flange which contacts the conducting film positioned on the outer surface of the second translucent layer, a protective cap coupled to the cap retaining sleeve and closing the exposed ends of the sleeves of the lighting fixture, and a contacting layer of opaque material positioned over the outer surface of the second translucent layer and processed with desired indicia apertures which are illuminated in response to the energization of a lamp positioned within said lighting fixture.

2. In an instrument console panel, the improvement comprising a panel including two conducting layers of light conducting material, a pair of relatively thin conducting films each disposed on different surfaces of said two conducting layers, a lighting fixture coupled to said console panel and including a cylindrical lamp retaining sleeve formed with a projecting element contacting one of said conducting films, a cylindrical insulating sleeve positioned in contacting coaxial relation to said lamp retaining sleeve, and a cylindrical outer retaining sleeve positioned in contacting coaxial relation to the insulator sleeve and formed with a projecting element which contacts the second conducting film wherein the edges of the sleeves of the lighting fixture project from one layer of the panel and wherein these edges are provided with a pair of diametrically opposed cuts to facilitate the manual insertion and removal of a lamp.

3. In an instrument console panel in accordance with claim 2 wherein the inner cylindrical surface of the lamp retaining sleeve is formed with a circular groove and a lamp retaining ring-like spring is positioned within said groove, said spring including a flat distorted portion projecting into the bore of the retaining sleeve so as to make friction contact with the base of an inserted lamp.

4. In an instrument console panel including a cylindrical lamp retaining sleeve formed with a projecting flange on one surface of said supporting panel, a cylindrical insulating sleeve positioned in contacting coaxial relation with said lamp retaining sleeve, a cylindrical cap retaining sleeve positioned in contacting coaxial relation to the insulating sleeve and formed with a projecting flange which contacts a second surface of the supporting element and a projecting cap coupled to the cap retaining sleeve and closing the exposed ends of the sleeve wherein the edges of the sleeve project from one layer of the panel and in which these edges are provided with a pair of diametrically opposed cuts to facilitate the manual insertion and removal of a lamp.

5. In an instrument console panel in accordance with claim 4 wherein the inner cylindrical surface of the lamp retaining sleeve is formed with a circular groove and a lamp retaining spring is positioned within said groove, said spring being ring-like and having a flat distorted portion projecting into the bore of the retaining sleeve so as to make friction contact with the base of an inserted lamp.

6. In an instrument console panel, the improvement comprising a panel including two contacting layers of light conducting material, said contacting layers being disposed in parallel relationship with one layer positioned in front of and overlying the other layer, a pair of relatively thin conducting films each disposed on opposite surfaces of said front layer, a layer having a high specular reflectance of light secured to the back layer of light conducting material, a plurality of lighting fixtures coupled to said console panel and each including a cylindrical lamp retaining sleeve formed with a projecting flange connected through a resistive element to one of said conducting films, said sleeve projecting only from the front layer of the panel, a cylindrical insulating sleeve positioned around and contacting coaxial relation to the lamp retaining sleeve and projecting only from the front layer of the panel, and a cylindrical outer retaining sleeve positioned around and in contacting coaxial relation to the insulator sleeve and projecting only from the front layer of the panel and formed with a projecting flange which contacts the second conducting film which is positioned on a front layer surface away from the back layer, certain of said resistive elements having different values whereby said plurality of lamps are energized at different potentials to obtain uniformity of brightness of the light throughout said layers of light conducting material.

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