Aug. 19, 1969 J. J. KAUP 3,461,551

METHOD OF MAKING AN ILLUMINATED PANEL

Original Filed Sept. 19, 1963

Fig 1

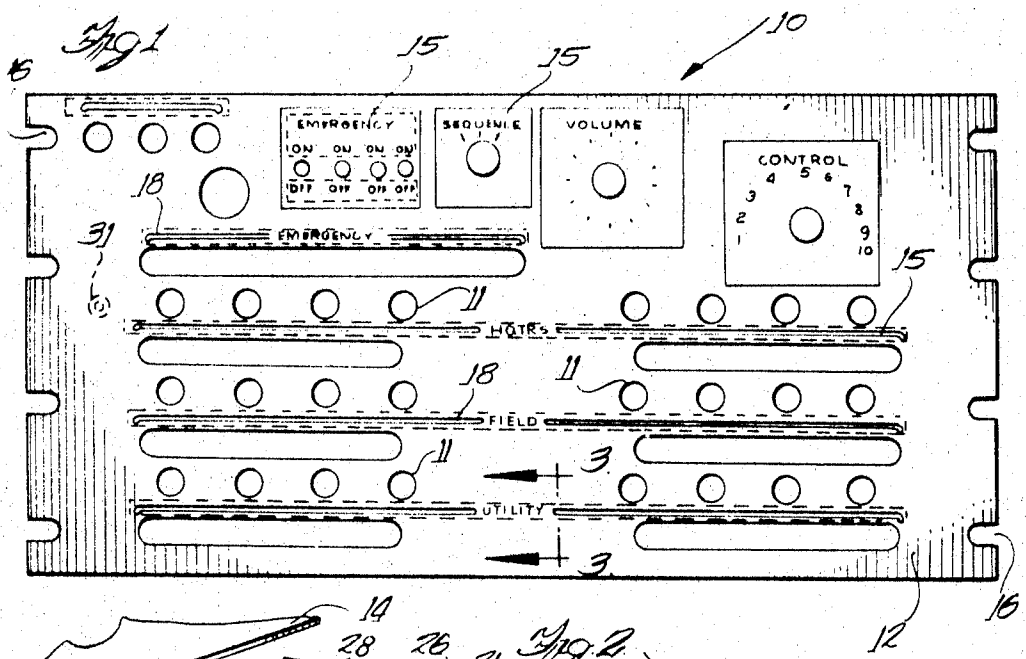


Fig 2

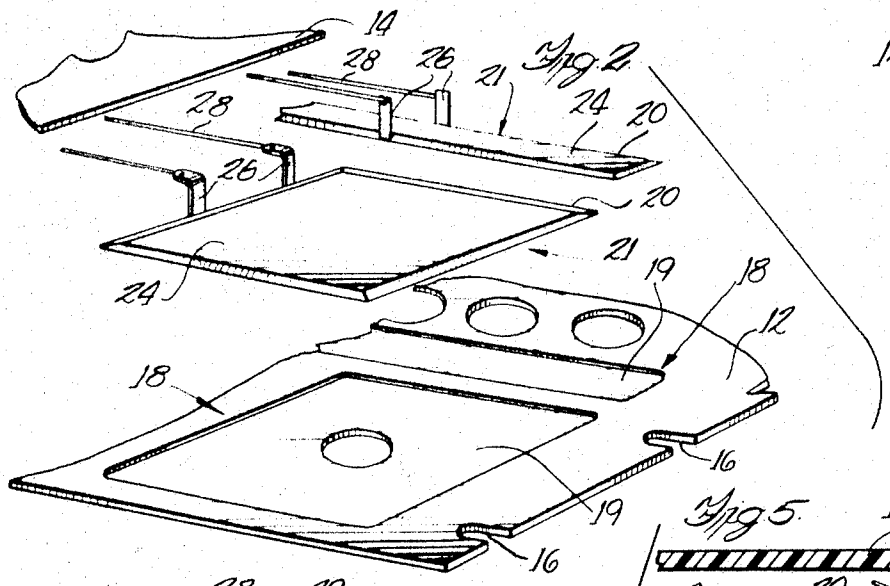


Fig 3

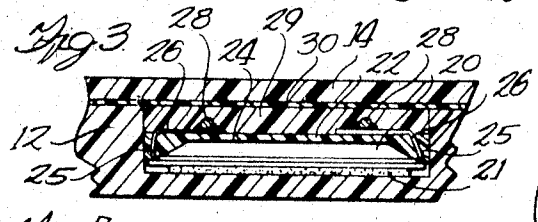


Fig 4

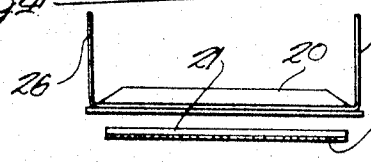
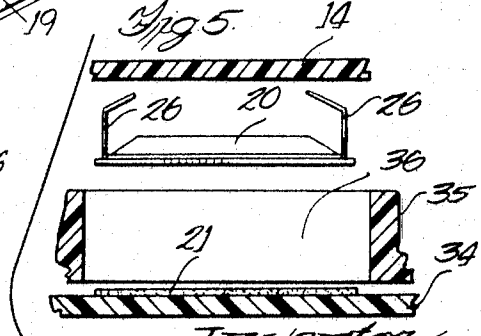


Fig 5



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METHOD OF MAKING AN ILLUMINATED PANEL

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Original application Sept 19, 1963, Ser. No. 309,977, now Patent No. 3,284,941, dated Nov. 15, 1966. Divided and this application July 20, 1966, Ser. No. 576,164
Int. Cl. B29d 3/00
U.S. Cl. 29—592 6 Claims

ABSTRACT OF THE DISCLOSURE

A method of manufacturing an illuminated panel employing a pair of plates, one of which is recessed in its rear portion to accommodate luminescent light panels which are embedded in the recessed areas after being appropriately treated to transmit light. The rear plate portion is used to fully enclose and hermetically seal the entire panel.

This application is a division of my application, Ser. No. 309,977, filed Sept. 19, 1963, and now Patent No. 3,284,941.

The present invention relates to a method for the preparation of an illuminated panel, and to the manufactured panel itself. Panels of this character find particular utility in airborne switch and communications equipment, but may also be utilized in various data processing control panels, and other control panels in which detailed lighted indicia are presented for viewing in darkened or completely darkened rooms.

Heretofore, various panels have been prepared in which luminescent lighting is employed. Luminescent lights of differing sizes are available which are formed by crystalline powders which are sandwiched between two electrically insulated surfaces, at least one of which is translucent. Such lights, however, are in flat form, and can be very expensive both from the standpoint of illumination as well as manufacture when cut into various sizes and shapes required for some of the complicated illuminated panel applications utilized in today's aircraft. If such luminescent lamps are punched, or otherwise modified under less than hermetical sealing and factory conditions, any moisture getting into the crystalline powders employed will vastly reduce the efficiency of the unit, and can greatly foreshorten its life if not destroy the same upon contact.

Accordingly, it is one of the primary objects of the present invention to provide an illuminated panel and method for making the same in which all military standards are met for illumination; which is economical to manufacture; durable in construction; and adaptable for a wide variety of applications.

A related advantage of the present invention is to furnish an illuminated panel in which the illumination is achieved to the most rigid specifications even through the panel is gray or black and white for daylight usage, the illumination being transmitted to the white portion, as a clearly defined red.

Still a further object of the invention looks to the uniform employment of a green phosphorous lamp delivering a maximum of illumination, and after an initial aging of 150 hours corrected to the aviation red standard of .60 foot lamberts.

Still another advantage of the present invention is achieved by illuminating only the indicia required so that the current drain and total power consumption per panel is held to a minimum.

Another and very important object of the invention is to provide a method for panel manufacture which permits the adaptability of manufacture readily to varying

panel designs, the same being promptly put into production on an economical basis.

A further and more detailed advantage of the invention looks to the pocketing of the light elements within the panel construction itself, thereby further insuring a hermetically sealed condition for the light.

Further objects and advantages of the present invention will become apparent in the following description of an illustrative embodiment in which:

FIG. 1 is a typical front elevation view of the type of panel in which the present illuminating features are achieved.

FIG. 2 is an exploded perspective view of an illustrative rear portion of the panel shown in FIG. 1 illustrating the sequential positioning of the electroluminescent lights and their wiring.

FIG. 3 is an enlarged transverse sectional view taken along 3—3 of FIG. 1 through one of the lighting elements illustrating the various layers of sealant, luminescent paint and other details of the panel.

FIG. 4 is a partially diagrammatic exploded view of the same area as shown in FIG. 3 but illustrating an alternative embodiment thereof.

FIG. 5 is a further alternative embodiment of the construction of FIG. 3 taken from the same position in diagrammatic exploded transverse section.

In broad outline, the invention contemplates the employment of a pair of plates, one of which is recessed in its rear portion to accommodate the luminescent light panels of the invention, the light panels being embedded in the recessed areas after being appropriately treated to transmit the light to the specifications required; the rear plate portion being used to fully enclose and hermetically seal the entire panel in illuminated condition.

Referring now to the drawings, and more particularly FIG. 1 thereof, it will be seen that a panel 10 of an illustrative character has a plurality of holes 11 throughout it which, for purposes of illustration could be used for switchboard plug-ins. Varying other reasons for the porosity or perforations in apertures may exist in practice. It is within the scope of the invention to provide a method for determining the design of each individual panel, and then fabricating and assembling the same in accordance therewith. There will first be described the method employed and in conjunction with this method, the various elements of the exemplary panel will become apparent.

Upon determining the particular intelligence to be transmitted by the panel, the designer then orients the various illuminated indicia in a linear, or curvilinear form, the same being isolated into either elongate paths, or into clusters of rectangular or square nature. Every attempt is made to eliminate circular openings which are enclosed by arcuately oriented indicia, but if the same is required, it is then concentrated into an area which can be defined by a rectangle of a given dimension.

After concluding the lamp layout, a clear acrylic plastic front plate 12, as in one commercial embodiment approximately .125 inch thick, is sawed to an oversized rectangular size, or other configuration required. The material found highly adaptable in commercial usage is sold under the trademark Plexiglass. The back plate 14 is similarly sawed to an oversized configuration, and is normally in such commercial embodiments approximately .060 inch thick.

The front plate 12 is then silk-screened with the copy on its face. The purpose of silk-screening the front plate first is to hold the cost of the particular elements to a minimum prior to the insertion of the lamps in the event that spoilage or rejects are encountered in the course of testing with the lamps in place. Furthermore, after the lamps have been inserted in the unit and tested satisfac-

torily, the risk of damage in the course of silk-screening is substantial.

A white silk screen coating of approximately one mil in thickness is first applied. Any epoxy base paint is employed in silk-screening the white in place. With this thickness, the covering paint is translucent, and screens out only approximately thirty to forty percent of the transmitted lighting behind it.

A black reverse screen coating over the white is then employed, the black thereby leaving showing the white beneath in the identical configuration of the indicia **15** to be illuminated. The black reverse screen coating employed over the white one mil epoxy base paint is applied to a thickness of approximately one to two mils.

Thereafter, depending upon the color of the host portion of the panel, a reverse screen from the black screen coating is applied. The colors grey, blue, or black are commonly employed, but not necessarily to the exclusion of other colors. The base color is normally designed to provide a daylight differential in illumination between the printed indicia **15** and the host portion, and yet sufficiently opaque to cover the entire panel. One of the advantages of first applying the black reverse screen coating, and then the ultimate color is to hold to the irreducible minimum the possibility of any coincidental pin holes through which undesired illumination might appear.

Thereafter, at least two locating holes **16** are drilled through the front and back plates **12**, **14** positioned so that they can subsequently be employed as mounting holes. These holes are drilled undersize, and to a dimension that is desirable for use in holding the front and rear plates in position for subsequent machining and assembly steps.

While the front plate is then held in position, a profile is prepared for the routing of the mounting channels **18** of the lamps as well as the mounting of the wiring in parallel. The layout of the mounting channels **18** are shown in dotted lines in FIG. 1. The routing is done to a depth of approximately .060 inch (3/64 inch) and finished to as smooth a channel base surface **19** as conveniently compatible with accepted manufacturing techniques.

The lamps **20** are silk-screened on the illuminated surface with a phosphorous red coating **21** to approximately .002 inch in thickness. Phosphorous red paints of this character are commercially available, one example is known as Velvaglow red manufactured by the Radiant Color Company of Oakland, Calif. Another is the Dayglow paint manufactured by the Switzer Company of Ohio. The silk-screening to the two mil thickness is preferably done in two steps in order to control the quality and red translucent characteristics of the treated lamp.

Thereafter the various lamps are positioned in the mounting channels **18**, and clamped on their rear portion in order to provide intimate contact between the phosphorous red coated surface **21** and the channel base surface **19**, and while clamped in this position are potted or otherwise secured in place by the application of an epoxy potting resin **22** to the back portion **24** of the illuminating lamp. As was indicated above, the depth of the routed out area is such that there is room for placing the epoxy over the rear which extends over the sidewalls of the illuminating lamp and contacts the vertical side walls of the routed area and forms an intimate side wall chemical contact **25** therewith, at the same time sealing the lamps into position. The electrical lamp leads extend outwardly from the lamp **20**, and are positioned so that they may be soldered with circuit wires **28** which are subsequently placed into position. Because of the dielectrical characteristics of the epoxy material used to pot the lamp in position, a bare copper tinned wire of .025 inch can be employed as a circuit wire **28**. The circuit wires **28** are then soldered into electrical connections with the leads **26** extending from the lamp. The circuit wires **28** are laid atop the first epoxy coating **22** in physical and electrical parallel relationship along the channels.

A second epoxy coating **29** is then placed into position

to approximately level off the routed area with the adjacent surface portion of the front plate **12**. While the second epoxy coating **29** is still in the soft condition, an ethylene dichloride solvent **30** is employed to the interfaces of the back plate and the front plate, and thereafter the back plate is subjected to pressure in order to permanently bond it to the front plate, and completely seal the instrument lamps **20** into position. Thereafter the instrument holes are machined out, and the final assembly made of the electrical connections. While the electrical connection for the ultimate illumination does not necessarily form a critical element of the invention, it has been determined that a bayonet type fastener **31** which extends through the back plate and is soldered or otherwise secured to the two parallel lead lines between the back and front plate is highly advantageous commercially.

Two alternative procedures are contemplated from the ones outlined above regarding the placing of the aricraft flourescent red on the outer portion of the lamps. In the first variation, (illustrated in FIG. 4) it is contemplated that the same thickness of red paint **21** be placed upon a thin sheet of vinyl type plastic material **32** approximately 2 to 10 mils in thickness, and thereafter, the sheet material positioned in the base portion of the routed out recesses in front of the lamps. In accordance with the second alternative method contemplated, (illustrated in FIG. 5) the base of the routed out portions are smoothed with a suitable solvent, or molded smooth, or employed with a 3 plate construction, and thereafter painted directly with the red phosphorous type paint. In either application, the red paint, or other color to be transmitted, is placed between the electroluminescent light and the top plate or outer top plate **34**. The top plate is finished in accordance with the method already described in detail.

A further alternative is illustrated in FIG. 5 wherein an outer front plate **34** has the indicia coating, and the lamp plate **35** has lamp openings **36** sawed or otherwise cut through its faces. The back plate **14** remains the same. In assembly, the outer front plate is bonded to the lamp plate **35** in the same manner as the back plate attachment has been described.

Although particular embodiments of the invention have been shown and described in full here, there is no intention to thereby limit the invention to the details of such embodiments. On the contrary, the intention is to cover all modifications, alternative embodiments, usages and equivalents to the illuminated panel and method for making same as fall within the spirit and scope of the invention, specification and appended claims.

What is claimed is:

1. A method for making an illuminated instrument panel comprising the steps of laying out to maximize the linear and imperforate lighting orientation, forming a front plate and back plate to oversize, screening a white translucent coating on the front of the front plate, screening an opaque reverse screen over the white thereby presenting translucent indicia for illumination, screening a second opaque coating to the final color to cover pinholes in the first opaque coat, forming recesses in the back of the front plate to receive electroluminescent lamps having lamp leads behind the translucent indicia, placing a red phosphorous layer of at least one mil thickness on the electroluminescent lamp, placing the lamp in the recess, applying a first potting coat of resin to cover the lamp while leaving the lamp leads extending into the recess, laying circuit wires over the top of the first potting coat and soldering the same to the lamp leads, filling the recess with a second potting coat thereby covering the circuit wires before curing of the second potting coat and while the same is soft aplying a mutual solvent to the front and back plate, and bonding the front plate to the back plate and potting material by juxtaposing the same under pressure until cured.

2. A method for making an illuminated instrument panel comprising the steps of forming a front plate and back

plate to oversize, forming translucent indicia on the front of the front plate, forming recesses in the back of the front plate to receive electroluminescent lamps having lamp leads behind the translucent indicia, placing a red phosphorous layer of at least one mil thickness on the electroluminescent lamp, placing the lamp in the recess, applying a first potting coat of resin to cover the lamp while leaving the lamp leads extending, laying circuit wires over the top of the first potting coat and connecting the same to the lamp leads, filling the recess with a second potting coat thereby covering the circuit wires and bonding the front plate to the back plate.

3. A method for making an illuminated instrument panel comprising the steps of laying out to maximize the linear and imperforate lighting orientation, forming a front plate and plate to oversize, screening a white translucent coating on the front of the front plate, screening an opaque reverse screen over the white thereby presenting the illuminated indicia in white, forming recesses in the back of the front plate to receive electroluminescent lamps having lamp leads behind the illuminated indicia, placing a red phosphorous layer of at least one mil thickness in the recess between the lamp and indicia, placing the lamp in the recess, applying a first potting coat of resin to cover the lamp while leaving the lamp leads extending, laying circuit wires over the top of the first potting coat and connecting the same to the lamp leads, filling the recess with a second potting coat thereby covering the circuit wires, applying a mutual solvent to the front and back plate, and bonding the front plate to the back plate.

4. A method for making an illuminated instrument panel comprising the steps of laying out to maximize the linear and imperforate lighting orientation, forming a front plate and back plate to oversize, screening a white epoxy paint translucent coating on the front of the front plate, screening an opaque reverse screen over the white thereby presenting the illuminated indicia in white, screening a second opaque coating to the final color to cover pinholes in the first opaque coat, forming recesses in the back of the front plate to receive electroluminescent lamps having lamp leads behind the illuminated indicia, placing a red phosphorous layer of at least one mil thickness on the electroluminescent lamp, placing the lamp in the recess, applying a first epoxy coat of resin to cover the lamp while leaving the lamp leads extending, laying circuit wires over the top of the first potting coat and

soldering the same to the lamp leads, filling the recess with a second epoxy potting coat thereby covering the circuit wires, applying a mutual solvent to the front and back plate, and bonding the front plate to the back plate and potting material.

5. A method for making an illuminated instrument panel comprising the steps of laying out to maximize the linear and imperforate lighting orientation, forming a front plate and back plate of an acrylic clear plastic to oversize, screening a translucent coating on the front of the front plate, screening an opaque reverse screen over the white thereby presenting the translucent indicia, screening a second opaque coating to the final color to cover pinholes in the first opaque coat, forming recesses in the back of the front plate to receive electroluminescent lamps having lamp leads behind the translucent indicia, placing a red phosphorous layer of at least one mil thickness on the electroluminescent lamp, placing the lamp in the recess, applying a first potting coat of resin to cover the lamp while leaving the lamp leads extending, laying circuit wires over the top of the first potting coat and soldering the same to the lamp leads, filling the recess with a second potting coat thereby covering the circuit wires, before curing of the second potting coat and while the same is soft applying a mutual solvent to the front and back plate, and bonding the front plate to the back plate and potting material by juxtaposing the same under pressure until cured.

6. In the method of claim 5, the intermediate step of forming the lamp recesses in a lamp plate by forming apertures therein, and covering the lamp plate with an outer front plate having the translucent indicia thereon.

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U.S. Cl. X.R.

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