Oct. 14, 1958 J. M. ROPER 2,855,710

ILLUMINATED INSTRUMENT PANEL

Filed Sept. 11, 1956 2 Sheets-Sheet 1

FIG. 1

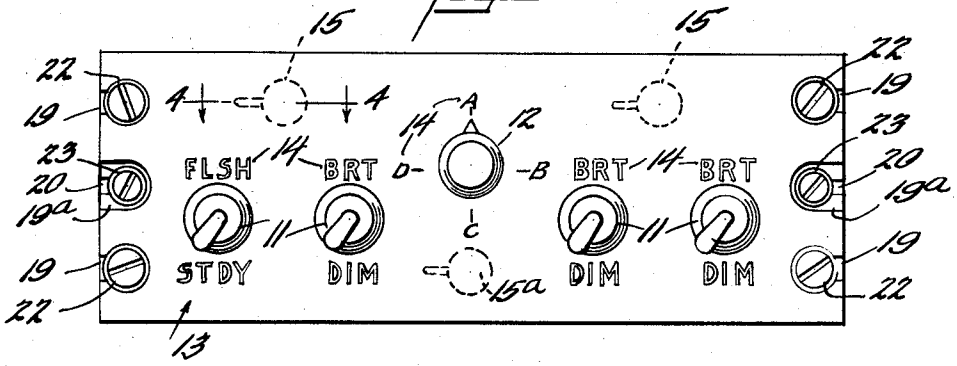

FIG. 2

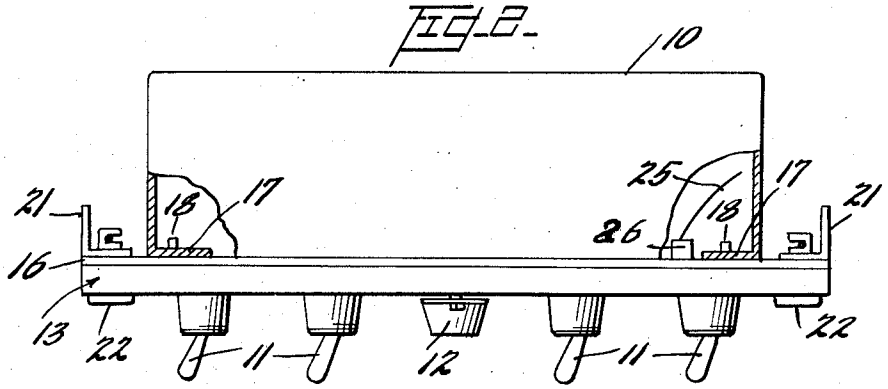

FIG. 4

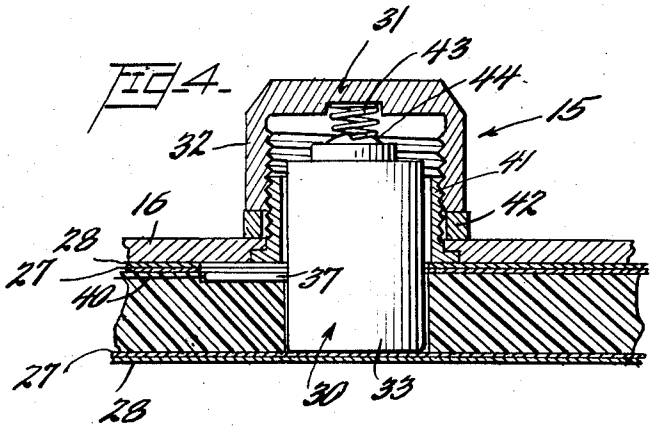

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FIG. 3.

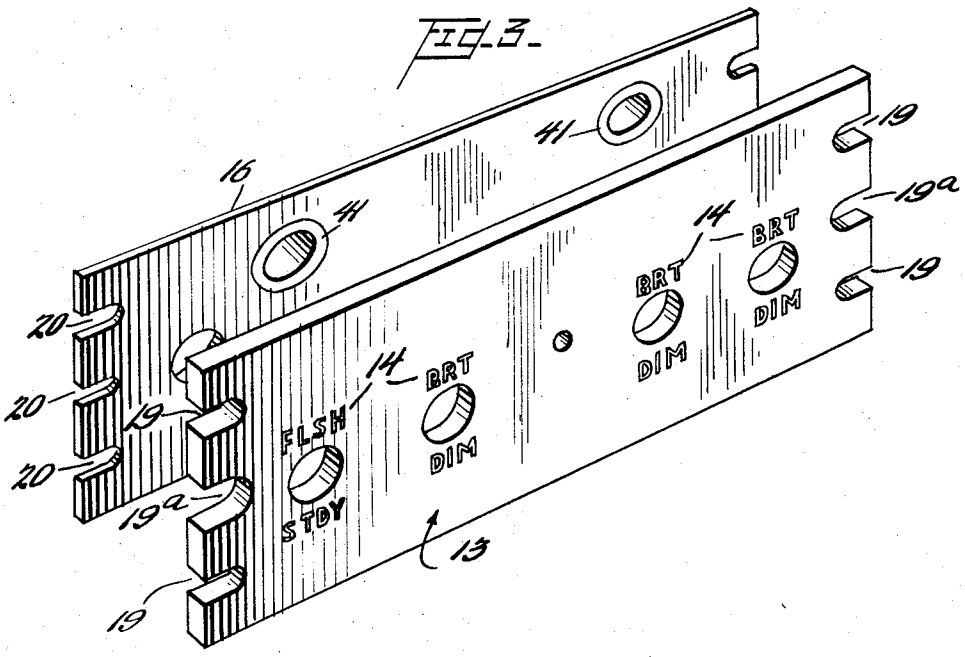


FIG. 5.

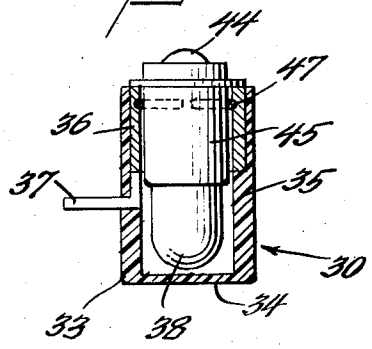
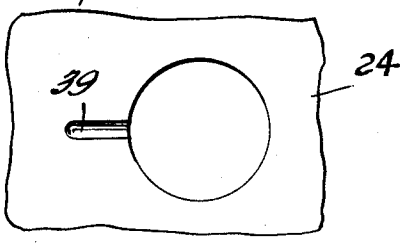


FIG. 6.



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United States Patent Office 2,855,710
Patented Oct. 14, 1958

2,855,710

ILLUMINATED INSTRUMENT PANEL

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Application September 11, 1956, Serial No. 609,289

8 Claims. (Cl. 40—130)

This invention relates to panels which are illuminated so that the legends and indicia carried thereon may be read at night or under other circumstances involving the absence of adequate natural lighting.

More particularly, this invention has reference to the illumination of instrumentation panels by light transmitted through the medium of the material of which the panel is composed. This light is usually supplied by a source which is coupled closely to the panel and located substantially in the plane thereof. The rays of light are transmitted edgewise of the body of the panel and confined therein except at the information areas defined by the legends or indicia.

In the usual practical installation of an illuminated panel of the foregoing type, the panel is fabricated from a plastic material which is transparent. The surfaces of the panel are processed with one or more coatings of material which may, for example, include a white vinyl layer applied directly to the surfaces of the panel, and an overlying layer of opaque black vinyl. The black vinyl layer is appropriately etched or engraved so as to expose portions of the white vinyl layer in accordance with appropriate indicia or legends. The panel thus fabricated is processed with one or more holes which individually receive an associated lamp. These lamps when energized illuminate the interior of the panel, and inasmuch as the light is readily transmitted they also illuminate the legends which are rendered easily readable in contrast to their opaque black background.

Various arrangements have heretofore been proposed in the prior art for particular panel construction, including the application of various overlying layers of material for covering a transparent panel, and the positioning and support of lamp sockets and the energizing conductors for these sockets upon the panel. In view of the considerable advances made within recent years in the instrumentation for aircraft and other devices requiring a panel type disposition of controls, considerable demand now exists for commensurate improvements in the illuminated panel arrangements associated with such instrumentation.

Aircraft controls are becoming increasingly complex, resulting in a requirement for more switches, control dials, and terminal jacks projecting or otherwise mounted at the control panel for access and manipulation by the operator. Heretofore, the lamp arrangements incorporated in the control panel for illuminating indicia or legends associated with the foregoing switches, dials and jacks in most instances have required that portions of the sockets for housing these components project from the front surface of the panel so that ready access may be had to the enclosed lamps. It may be readily appreciated that these socket projections interfered with the readability of the panel instruments by increasing the number of components projecting from the front surface of the panel and presenting a highly complicated array to the operator. In many instances, the projecting lamp sockets obstructed the visibility of meter scales or the like.

Moreover, because of the constant supervisory demands made upon present day aircraft pilots, close attention is not given in all instances to the operation of the control panel switches. These switches are quite frequently operated without directly viewing the control panel and on the basis of experience. The presence of the projecting lamp sockets quite often result in the inadvertent twisting of socket caps in lieu of the proper switches or dials, thereby detracting from the pilot's effective control over the aircraft.

Accordingly, a principal object of this invention is to provide an improved lighting arrangement for instrumentation control panels which is characterized by a complete absence of sockets or other lighting equipment from the front surface of the panel, thereby improving the visibility of the controls and the readability of the information legends and, at the same time, substantially reducing the number of components projecting from the front control panel surface which tend to complicate the appearance of the panel and confuse the operator.

Another object is to greatly simplify the construction of illuminated control panels so that they can be easily fabricated and installed.

Another object is to provide an illuminated control panel which will promote the more effective sealing of the chassis box or the like containing the electrical and mechanical components which are under control by the equipment operated from the panel.

A preferred embodiment of this invention comprises a control panel made of easily workable transparent material such as plastic. A coating of white vinyl is applied to the edge and surface portions of the panel with an overlying layer of opaque black vinyl material covering at least the entire front panel surface which is exposed to the operator. Portions of the opaque layer on the front surface are removed in accordance with desired information areas such as legends and indicia which are to be illuminated and which are associated with switches and control knobs, etc. A plurality of lamp housings are appropriately positioned throughout the panel and within receiving holes formed in this panel so as not to project through the vinyl layers overlying the front panel surface. The panel is also processed with a plurality of through apertures for receiving the shafts of the controls projecting from a chassis or the like mounted to the rear of the panel.

A preferred embodiment of each lamp housing includes a plastic cup for receiving a miniature lamp. The bottom and side walls of this cup are inserted within a receiving hole in the panel with the bottom flush with the panel surface portion carrying the information areas and with the side walls projecting only from the rear panel surface.

A tubular metallic sleeve is fixed within the cup so as to line a portion of the inner side walls removed from the bottom of the cup. A terminal lug electrically connected to this sleeve projects through the side walls of the cup and is keyed to the plastic member by means of a receiving groove, and an electrical conductor is connected to this terminal lug whereby the appropriate electrical circuit can be established for interconnecting all of the illuminating lamps.

A lamp is positioned within the lamp housing so as to have a base contact contacting the metallic sleeve and an end contact exposed relative the side walls of the housing cup.

A metallic panel is coupled closely to the rear surface of the plastic panel from which the lamp housing projects. A tubular sleeve is fixed to and projects through the second panel away from the first panel. This sleeve receives the projecting portion of the lamp housing. A metallic cap is coupled to the projecting portion of the latter sleeve

so as to fully seal the lamp within the housing when the first and second panels are positioned adjacent one another. A contact spring is fixed at the bottom of the metallic cap so as to establish contact with the lamp end contact.

If desired, the cap structure mounted on the second or metallic panel may be soldered thereto so that this metallic panel may establish an effective moisture seal or cover for a component chassis mounted on the rear of this panel.

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

Figure 1 is an elevation view of an instrumentation control employing the panel of this invention,

Figure 2 is a plan view of the structure of Figure 1 and showing in detail the association of the first and second panels of this invention with respect to a chassis containing instrumentation components which are rack supported,

Figure 3 is a perspective view showing the front panel removed from the rear panel and otherwise in position for placement in operative association therewith,

Figure 4 is a partial sectional view taken along line 4—4 of Figure 1 and showing the positioning of lamp socket with respect to the panels,

Figure 5 is a sectional view of the lamp housing shown in Figure 4, and

Figure 6 is a view showing the form of the receiving hole required for each lamp housing.

Referring now to Figures 1, 2 and 3 of the drawings, the preferred embodiment of the illuminated panel of this invention is shown in operative association with instrumentation or control apparatus which is confined within box-like chassis **10** (Figure 2). The components (not shown) located within box **10** are generally of an electrical and/or electronic nature and the circuitry thereof is manually controlled, for example, by a plurality of toggle switches **11** and a pointer knob **12** controlling a rotatable component such as a capacitor rotor.

The switches and knob are exposed for operation relative an illuminated front panel **13** which contains information legends **14** which are to be illuminated by lamps individually contained within each of sockets **15** (Figure 4). The actual contact mechanism of each switch **11** and the capacitor plates controlled by knob **12** are located within box **10**, and a threaded shank of each component projects through the overlying panels for exposure at the face of illuminated panel **13**. Box **10** is usually fabricated of material to provide some measure of shielding for the components disposed therein and also a common ground. In order to afford a completely effective shield and also a moisture and dust seal it is, of course, obvious that box **10** should be covered during the circuit operation by a metallic plate or the like, and therefore a covering metallic panel or plate **16** is secured to the flanges **17** formed integrally with the end walls of box **10** by means of screws **18**. As will be hereinafter outlined in detail, metallic panel **16** also serves as a backing plate for illuminated panel **13** in such a manner as to appropriately support a portion of the sockets containing the illuminating lamps.

As is best shown in Figures 1 and 3, panel **13** is formed with a plurality of cutouts **19** and **19***a*, and panel **16** is formed with a plurality of cutouts **20**. It should be noted that cutouts **19***a* are substantially larger than the underlying cutouts **20** whereby the latter cutouts are exposed. This arrangement of cutouts enables panels **13** and **16** to be mounted relative relay rack **21** so that panel **13** may be removed without disturbing backing panel **16**. In particular, as is best shown in Figure 1, fasteners **22** are seated with respect to the cutouts **19** on panel **13** so as to secure panel **13** to the relay rack **21**. Fasteners **23** are seated with respect to cutouts **20** on panel **16** whereby this latter panel is individually secured to rack **21** in the event that the overlying panel **13** is removed.

The removal of panel **13** is effected simply by loosening the set screws for pointer knob **12** and removing this knob, withdrawing the retaining rings or nuts coupled to the threaded shafts of toggle switches **11**, and removing fasteners **22**. With these operations, panel **13** may be withdrawn from the backing metallic panel **16** as is best shown in Figure 3. It will be noted that there are no components projecting from the front surface of the removed panel **13** and that the smoothness of this surface is disturbed only by the apertures for receiving the switches **11** and knob **12**. A portion of the sockets **15** for each of the illuminating lamps projects from the rear surface of panel **13** as will be hereinafter outlined in detail. In addition, a terminal prong (not shown) projects from the rear surface of panel **13**. This prong establishes the necessary electrical connection to the illuminating lamps within sockets **15** whereby these lamps may be energized by an external filament supply source which is connected to conductor **25** for panel socket **26** mounted on the rear surface of backing panel **16** (Figure 2).

The number and position of the various holes formed in panel **13** are determined by the particular elements which project from chassis **10** and which are to appear at the front surface of panel **13**. The toggle switches and pointer knobs shown herein are merely illustrative, and it should be understood that the principles of this invention are applicable to other arrangements of components on an illuminated panel.

Panel **13** is preferably fabricated of a transparent plastic member **24** whereby light energy introduced into the edges of the panel at the holes for receiving lamp housings **15** may be transmitted throughout the entire panel. In order to prevent the undesired absorption of light introduced into the panel by means of the environmental structure, member **24** is preferably coated by a highly reflective white vinyl layer **27** as is best shown in the sectional view of Figure 4. Layer **27** is covered by an overlying layer **28** which is preferably of opaque black vinyl. These coatings may be applied by any of the techniques which are now conventional in the art.

Legends **14** are formed by engraving or otherwise removing the necessary portions of black vinyl **28** so as to expose in letter or numeral form the underlying white vinyl layer **27**. The walls of the holes for receiving toggle switches **11** and the shaft controlled by pointer knob **12** are also preferably coated by both layers **27** and **28** in order to prevent the undesired escape of illumination at these areas.

The number and disposition of the sockets which are to illuminate the legends **14** are determined so as to adequately illuminate the legends and at the same time not interfere with the location of the operative components such as switches **11** and knob **12**.

As is best shown in Figure 4, socket **15** comprises two principal subcombinations, namely, a lamp housing **30**, and a socket closure **31** for lamp housing **30** in the form of a removable end cap **32**. Lamp housing **30** is supported by illuminated panel **13** and socket closure **31** is supported by metallic panel **16**.

Lamp housing **30** in a preferred embodiment comprises a translucent plastic cup **33** (Figure 5) which has a bottom **34** which forms a closure for cup side walls **35**. It should be noted that the exterior surface of cup bottom **34** is flush with the front face of transparent member **24** (Figure 4) so that vinyl layers **27** and **28** are not interrupted in their smooth surface contours.

As is shown in the sectional view of Figure 5, an annular metallic sleeve **36** lines a portion of the walls of cup **33** remote from bottom **34**. Terminal lug **37** is fixedly connected to metallic sleeve **36** and projects through side wall **35** so as to provide an external electrical connection to a lamp **38** positioned within lamp housing **30**. Terminal lug **37** is preferably keyed to

member 24 by means of a receiving groove 39 which is shown in Figure 6. An appropriate electrical conductor 40 is connected to terminal lug 37 whereby the sockets may be electrically connected as desired. Conductor 40 may be applied to the rear surface of panel 13, or, in the alternative, it may be positioned in the interior of panel 13 by any of the techniques now well-known in regard to this art.

The side walls 35 of lamp housing 30 project rearwardly from panel 13 in such a manner that they may be received within flanged sleeve 41 (Figure 4) fixedly supported on panel 16. Sleeve 41 projects from the rear surface of backing panel 16, and the projecting portions are threaded so that they may receive the mating threads of metallic socket cap 32. Ring 42 is preferably placed over the threaded projecting portion of sleeve 41 whereby a moisture and dustproof seal may be effected by the cap 32 and sleeve 41.

A contact spring 43 is fixed to the bottom of cap 32 so as to establish electrical contact with the end contact 44 of lamp 38. It should be noted that this end contact projects slightly to the rear of the side walls of lamp housing cup 33. The glass envelope of lamp 38 is optically coupled to the interior of panel 13 inasmuch as the inner side wall portion of cup 33 between the cup bottom 34 and sleeve 36 is not lined. Accordingly, lamp 38 is energized by current flow in a circuit including conductor 40, lug 37, base contact 45 of lamp 38, the filament of lamp 38, end contact 44, contact spring 43, cap 32, sleeve 41 and metallic panel 16. Inasmuch as the socket closures 31 for all of the sockets 15 are connected in multiple with respect to one another by means of metallic panel 16, all of the lamps within the respective sockets 15 are connected in parallel. A series connection can be established by appropriately insulating the socket closures with respect to metallic panel 16 in the event that such a connection is desired. The parallel connection is advantageous, however, inasmuch as filament failure in one of the lamps will not seriously affect the operation of the other lamps and in many instances sufficient illumination can be obtained with this lamp condition so as to permit equipment operation until lamp replacement can be made.

It should be noted that inasmuch as lamp sockets 15 do not project from the front panel surface of panel 13 obstructions which would otherwise interfere with the movements of elements requiring considerable panel surface such as pointer 12 are eliminated. Outline 15*a* in Figure 1, which represents the lamp for illuminating letters B, C, and D, in no way interferes with pointer 12. In the prior illumination arrangements, the projecting socket cap which is usually exposed with respect to an illuminating panel which corresponds to the present illuminated panel 13 would interfere with the present disposition of pointer 12 and, therefore, an optimum positioning of control components could probably not be attained so as to provide desired symmetry.

It is obvious, of course, that the panel arrangement of this invention simplifies the presentation of operational components inasmuch as no socket projections appear from the front surface of the operating panel, thereby minimizing confusion and reducing erroneous operation of the controls through inadvertency of a type which usually results in the twisting of the light sockets in lieu of the knob or the like. Additionally, the illuminating lamps may be easily checked and replaced if desired by simply removing pointer knob 12 and fasteners 22 and withdrawing panel 13 away from backing panel 16. Inasmuch as each of the lamps is held within their respective sockets by means of retaining spring 47 (Figure 5), the lamps are withdrawn from the companion socket closures 31. The lamps may be thereafter manually removed and checked, and replaced without the necessity for individually unscrewing socket end caps or the like.

The illuminating panel arrangement of this invention also promotes an improved moisture and dust seal for the components housed within box 10. If desired, cap 32 may be soldered relative flange sleeve 41 and ring 42 whereby a very effective seal can be made at areas where the socket closures are fixed to the backing panel 16. In the alternative, ring 42 can be omitted, and the space now occupied by the ring can be filled with solder. Accordingly, proper sealing of panel 16 with respect to box 10 and also the component shafts extending through panel 16 results in a highly efficient arrangement protecting against the harmful effects of dust with respect to the components housed within box 10.

It is to be understood that the above-described arrangements are illustrative of the application of the principles of this invention. Numerous other arrangements may be devised by those skilled in the art without departing from the scope of the invention.

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

1. Panel lighting apparatus comprising a first panel including a member of light transmitting material, means to be illuminated fixed relative to said member and viewed from a front panel surface, a light conductive lamp housing positioned partially within a receiving hole in said panel flush with the front surface of said member and projecting past a rear surface of said panel, a second panel having a front surface mating closely with the rear surface of said panel with said two panels being generally parallel one another, and means including an end cap projecting from the surface of said second panel away from said first panel and receiving the projecting portion of said lamp housing.

2. Panel lighting apparatus comprising a panel of light transmitting material, means to be illuminated fixed relative to said member and viewed from a front panel surface, a lamp housing positioned partially within a receiving hole in said panel projecting only from the rear surface of said panel, a second panel having a front surface mating closely with the rear surface of said panel with said two panels being generally parallel one another, and closure means for said lamp housing projecting from the surface of said second panel away from said first panel and receiving the projecting portion of said lamp housing.

3. Panel lighting apparatus comprising a panel including a member of light transmitting material, means to be illuminated fixed relative to said member and viewed from a front panel surface, a coating of light reflecting material covering the front surface of said member, a lamp housing positioned partially within a recess in said panel substantially flush with the front surface of said member in contact with said coating of light reflecting material and projecting past a rear surface of said panel, a second body having a front surface mating closely with the rear surface of said first panel, and closure means supported on said body and receiving the projecting portion of said lamp housing.

4. Panel lighting apparatus comprising a first panel including a member of light transmitting material, means to be illuminated fixed relative to said member and viewed from a front panel surface, a lamp housing including a light conducting cup having a bottom and side walls for receiving a lamp therein, said cup being positioned partially within a recess in said panel flush with the front surface of said member and the side walls projecting past a rear surface of said panel, a second panel having a front surface mating closely with the rear surface of said first panel, said two panels being generally parallel one another, and means including an end cap projecting from the rear surface of said second panel away from said first panel and receiving the projecting side wall portions of said lamp housing.

5. Panel lighting apparatus comprising a first panel including a member of light transmitting material, means to be illuminated fixed relative to said member and viewed from a front panel surface, a lamp housing including a

light conducting cup having a bottom and side walls for receiving a lamp therein, said cup being positioned partially within a recess in said panel, the bottom of said recess being substantially flush with the front surface of said member and the side walls projecting past a rear surface of said panel, a second panel having a front surface mating closely with the rear surface of said panel with said two panels being generally parallel one another, a sleeve positioned on said second panel and projecting from the rear surface of said second panel, said sleeve receiving the projecting side wall portions of said lamp housing, and an end cap coupled to the projecting portion of said sleeve and closing said housing.

6. Panel lighting apparatus comprising a thin plastic member of transparent material, a layer of white vinyl material overlying a substantial surface portion of said member, a layer of opaque black vinyl material overlying a substantial surface portion of said white vinyl layer with portions of said opaque layer being removed in accordance with desired information areas which are to be illuminated, a lamp housing including a plastic cup having a bottom and side walls inserted within a receiving hole in said member, said bottom being flush with the surface of said member, said side walls projecting only from said member opposite the panel surface portion carrying said information areas, a tubular metallic sleeve fixedly positioned within and lining a portion of the inner side walls of said cup removed from the bottom of said cup, a terminal lug electrically connected to said sleeve projecting through the side walls for said cup and keyed to said member by means of a receiving groove in said member, a metallic panel coupled closely to the surface of said plastic panel from which said lamp housing projects, and a metallic cap coupled to the projecting portion of said sleeve including a contact spring fixed to the bottom thereof.

7. Panel lighting apparatus comprising a thin panel including a member of transparent plastic material, a layer of light reflecting material overlying a substantial front surface portion of said member, a layer of opaque material overlying a substantial surface portion of said light reflecting layer with portions of said opaque layer being removed in accordance with desired information areas which are to be illuminated, a lamp housing including a plastic cup having a bottom and side walls inserted within a receiving hole in said panel with the bottom flush with the surface portion carrying said information areas and the side walls projecting only from the panel surface portion opposite the panel surface portion carrying said information areas, a tubular metallic sleeve fixedly positioned within and lining a portion of the inner side walls

of said cup removed from the bottom of said cup, a terminal lug electrically connected to said sleeve projecting through the side walls for said cup and keyed to a receiving groove in said member, a lamp positioned within said housing having a base contact contacting said metallic sleeve and an end contact exposed relative the projecting side walls of said cup, a second metallic panel coupled closely to the surface of said plastic panel from which said lamp housing projects, and a metallic cap coupled to the projecting portion of said sleeve including a contact spring fixed to the bottom thereof and contacting said lamp end contact.

8. Panel lighting apparatus comprising a thin panel including a member of transparent plastic material, a layer of white vinyl material overlying a substantial surface portion of said member, a layer of opaque black vinyl material overlying a substantial surface portion of said white vinyl layer with portions of said opaque layer being removed in accordance with desired information areas which are to be illuminated, a lamp housing including a plastic cup having a bottom and side walls inserted within a recess in said member with the bottom flush with the surface portion carrying said information areas and the side walls projecting only from the member surface portion opposite the member surface portion carrying said information areas, a tubular metallic sleeve fixedly positioned within and lining a portion of the inner side walls of said cup removed from the bottom of said cup, a terminal lug electrically connected to said sleeve projecting through the side walls for said cup and keyed to said member by means of a receiving groove in said member, a lamp positioned within said housing having a base contact contacting said metallic sleeve and an end contact exposed relative the projecting side walls of said cup, a metallic panel coupled closely to the surface of said thin panel from which said lamp housing projects, and a metallic cap coupled to the projecting portion of said sleeve including a contact spring fixed to the bottom thereof and contacting said lamp end contact.

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