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2,985,968

DISPLAY DEVICE AND METHOD FOR MAKING THE SAME

Filed June 15, 1959

Fig. 1

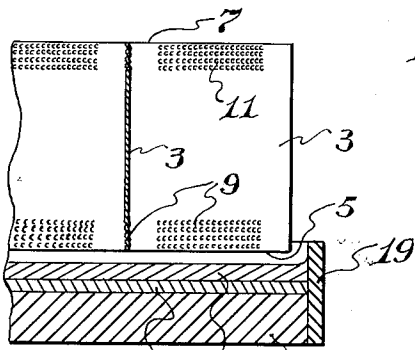
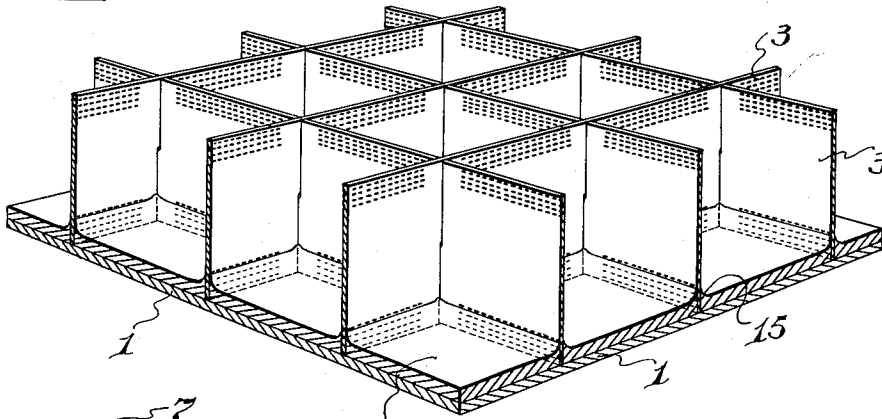


Fig. 2

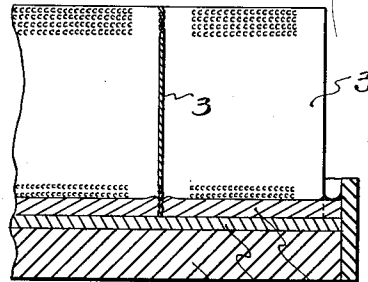


Fig. 3

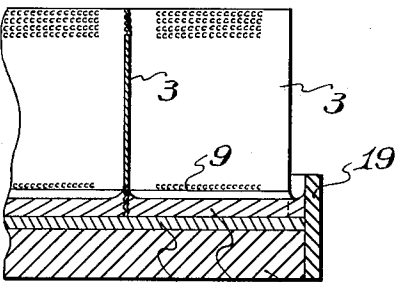


Fig. 4

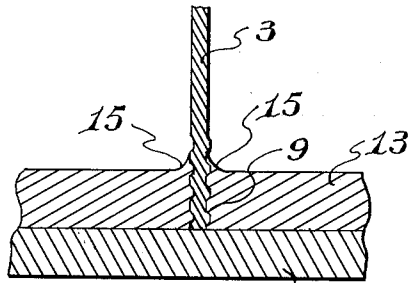


Fig. 5

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2,985,968

DISPLAY DEVICE AND METHOD FOR MAKING THE SAME

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5 Claims. (Cl. 35—1)

The present invention relates to display devices and methods for making the same, and more particularly to training panel assemblies for instruction or visual monitoring purposes in which a plurality of light sources such as electric lights indicate fluid flow systems, gas, electric circuitry, or traffic control or the like, as disclosed for example in my copending application Serial No. 679,510 filed August 21, 1957, now Patent No. 2,952,079 issued September 13, 1960 for "Training Panel Assembly," to which this is a continuation-in-part, and to methods for making the same.

It is an object of this invention to provide improvements on the structure disclosed in the above identified copending application.

Another object of the present invention is the provision of display devices and methods for making the same, characterized in that improved mounting means for the light sources are provided.

Still another object of the present invention is the provision of such display devices and methods for making the same, including strips secured to a light penetrable panel, in which an improved attachment is effected between the strips and the panel.

Finally, it is an object of the present invention to provide display devices which will be relatively inexpensive to manufacture, easy to operate, adjust, maintain and repair, and rugged and durable in use; and it is an object of the invention to provide methods for making the same which will be quick, easy and dependable to practice with uniformly good results.

Other objects and advantages of the present invention will become apparent from a consideration of the following disclosure, taken in connection with the accompanying drawing, in which:

Figure 1 is a fragmentary perspective view of a portion of the rear of a display device according to the present invention;

Figures 2, 3 and 4 are fragmentary cross-sectional views showing stages in the production of a display device according to the present invention; and

Figure 5 is an enlarged fragmentary cross-sectional view showing the attachment of the strips to the panel of the present invention.

Referring now to the drawing in greater detail, there is shown a flat, light-penetrable panel 1, which may for example be a sheet of glass fiber impregnated with a cured thermosetting resin. Secured to panel 1 is a plurality of intersecting strips 3 each of which is a straight, flat, thin metallic member, which may for example be aluminum or aluminum base alloy. Each strip 3 has a longitudinal side edge 5 contiguous to panel 1 and a longitudinal side edge 7 parallel to edge 5 and remote from panel 1. The edges 5 of all strips 3 are disposed in the same plane, which is the plane of the rear face of panel 1. All of the edges 7 of strips 3 are disposed in another common plane which is parallel to the first-mentioned common plane and to the panel. The strips intersect each other at substantial angles, which are right

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angles in the illustrated embodiment, by means of inter-engaging slots about half way through each strip, the lines of intersection thus formed being perpendicular to both of the common planes described above and to panel 1.

All of the structure recited thus far is described in greater detail in the above-identified copending application, to which reference is had to avoid the unnecessary repetition of detailed disclosure.

Extending along edge 5 of each strip is knurling 9, which in the illustrated embodiment is embossed on one side of the strip and embossed on the other side of the strip, this knurling having been formed by a knurling roller which provides in effect a multiplicity of small punches that deform the thin material of strips 3. Obviously, this knurling may be formed in a variety of ways, as by the described method, or by cutting but not deforming the surface so as to roughen the same, and so on; but regardless of the method of producing it, the knurling is characterized by portions of varying distance from the plane of the surface of strip 3. Knurling 11 is also provided along edge 7 of each strip, this latter knurling serving not only to provide anti-slip surfaces for the retentions of clip-on light sources, but also to prevent bowing of the strip as would result from knurling along one edge only. The knurling is preferably provided on both sides of strip 3 as well as along opposite longitudinal side edges thereof.

Disposed on the rear or strip side of panel 1 is a layer of hardened plastic material 13, which may for example be hardened thermosetting or thermoplastic resin. A particular example of a suitable substance is a cured epoxide resin comprising the condensation product of bisphenol A and epichlorohydrin. But regardless of the composition of the hardened plastic material, it is essential that it be light-penetrable and rigid.

The surface of the hardened plastic material 13 remote from panel 1, that is, the exposed rear surface, is glossy and is generally flat except that adjacent the strips 3 and the intersections of those strips, it curves away from panel 1 toward the planes of the strips in rounded fillets 15, which extend along the intersections between the surface and the strips and into the corners formed by the intersections between the strips, to provide in effect rounded corners at the bottoms of the cells which are defined between the panel and the strips and which are open to the rear. It is particularly to be noted, however, that the surface of hardened plastic material 13, regardless of its irregularities, is disposed between the parallel planes in which edges 5 and 7 lie. The fillets 15 thus assure that a width of strip 3 will be contacted by the hardened plastic material and that this contacted width of the strip will be substantially greater than the depth of the hardened plastic material at other places, thereby to provide in effect bracing webs along the strips at their intersections, so as to improve the strength of the assembly.

To produce a display device according to the present invention, it is necessary only to lay a thin sheet of light penetrable hardened plastic material, preferably impregnated glass fiber, on the upper surface of a vibratory table 17. Side strips 19 are then provided projecting a substantial distance above the panel, and a plastic material in liquid phase such as an epoxide resin is poured on the upper surface of panel 1 and is retained thereon by strips 19. Specifically, to a portion of epoxide resin in a liquid state, 25% by weight of a curing agent consisting of metaphenylene diamine is added and mixed. The epoxide resin is sold commercially by Shell Corporation as "Epon 828," an epoxide resin having a melting point of 9° C., a viscosity of 12,400 centipoises at 25° C., a specific gravity at room temperature of

1.1676, an epoxy value of 0.52 as measured by the pyridinium chloride method, a hydroxyl value of 0.08 as measured by the lithium aluminum hydride method, and an esterification value of 1.26. The coating is applied to a depth of about $\frac{1}{16}$ " and extends over the entire upper or exposed surface of panel 1 on table 17. In order to assure that the liquid resin rapidly takes on a uniformly smooth surface, the table bearing the panel may be vibrated on a vibratory bed as disclosed in Patent No. 2,555,688, at a frequency of, for example, 1000 cycles per second.

Meanwhile, an assembly of strips has been formed by simultaneously knurling opposed longitudinal side edges of a continuous strip and then cutting the continuous strip to lengths equal to one of the two dimensions of panel 1. It is particularly to be noted that the simultaneous knurling of both longitudinal side edges of the strip prevents bowing of either edge of the strip, as would result if only one side edge were knurled. The strips are then sorted and assembled, and the assembly is lowered into the liquid coating of epoxide resin until it contacts and rests on panel 1. The step of lowering the assembly of strips into the liquid resin coating is shown in Figures 2 and 3.

As seen in Figure 3, the edges 5 of the strips upon penetrating the liquid resin form a positive or bowed meniscus, as the resin is quite tacky and has about the same consistency as honey. In order to destroy this positive meniscus, table 17 carrying the panel and strip assembly is vibrated at a frequency of about 1000 cycles per second, as for example on the vibratory bed described above, whereupon the liquid hardenable plastic material not only loses its positive meniscus but also rises along the side of the strips 3 into negative menisci, so that the strips are covered with plastic to a substantially greater depth than the average depth of the plastic on panel 1. The significance of this, as seen in Figure 5, is that an unusually great width of knurling 9 is contacted by the plastic, thereby to hold the strips even more firmly in place on the panel; and also the fillets 15 provided by these menisci serve as lateral reinforcement for the strips 3.

The assembly may then be subjected to radiant heating in an oven, in which the plastic material can be made to set up into a permanently hard, infusible material by heating at 300° F. for about 35 minutes. In this cured condition, the exposed surface of the plastic material is glossy and the cured plastic is almost transparent and just off-white.

It is particularly important to note that the knurling along those longitudinal side edges of the strips 3 performs a unique triple function, in that the simultaneous knurling along both edges prevents the knurling on either edge from causing the strip to bow in its own plane, as would be the case if the strip were knurled along only one edge, in that the knurling along edges 5 provides improved grip between the hardened plastic and the strips, particularly in view of the raised fillets of hardened plastic material along the strips, and in that the knurling along the edges 7 provides an anti-slip gripping surface for the clips by which the lights are attached to the exposed edges 7 of the display device.

From a consideration of the foregoing disclosure, it will be obvious that all of the initially recited objects of the present invention have been achieved.

Although the present invention has been described and illustrated in connection with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art will readily understand. For example, although an example of curing the plastic material at elevated temperature has

been given, it will be understood that plastic materials that harden at room temperature may also be used, as in the case of thermoplastic resins or epoxide resins of the type disclosed in Patent No. 2,651,589; and that a variety of plastic substances curing or hardening at elevated temperature may be used, for example those disclosed in Patents Nos. 2,506,486, 2,510,885 or 2,615,008. These and other modifications and variations are considered to be within the purview and scope of the present invention as defined by the appended claims.

What is claimed is:

1. An animated display device for use in training, comprising in combination, a flat generally translucent plastic front sheet observable from its front side; a cellular network of thin opaque strips mounted on their edges on the rear side of said front sheet to provide a plurality of hollow compartments each closed on their front ends by said sheet and open on their rear ends remote from said sheet, said thin strips including a first group of mutually parallel strips extending in a first direction and a second group of mutually parallel strips extending in a second direction at an angle to said first direction and intersecting said first group of mutually parallel strips, each of said strips having a plurality of partial transverse slits, with transverse slits of said first group engaged to mesh with transverse slits of said second group to provide said cellular network; and a hardened plastic material covering the rear face of said translucent sheet at substantially uniform depth over said sheet, the edges of said strips of said cellular network being embedded in said hardened plastic material, said compartments extending plural compartment widths in said two directions.

2. A display device comprising a light-penetrable panel, strip means defining a plurality of compartments on one side of said panel, said compartments extending plural compartment widths in two dimensions measured in the plane of said panel, each of said compartments being closed on one end by said panel and open on its opposite end, the portions of the walls of said compartments remote from said panel presenting a network of exposed wall edge portions, said strip means comprising a cellular network of interfitted opaque metal strips mounted on their edges on the rear side of said panel; a hardened plastic material covering said one side of said panel at a substantially uniform depth over said panel, the front edge of each of said strips being embedded in said hardened plastic material and the rest of each of said strips protruding from said hardened plastic material to form said compartments.

3. A device according to claim 2 in which said panel comprises a sheet of translucent impregnated glass fiber.

4. A device according to claim 2 in which said hardened plastic material comprises an epoxide resin.

5. A device according to claim 2 in which a plurality of said interfitted opaque metal strips are knurled along their edges.

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