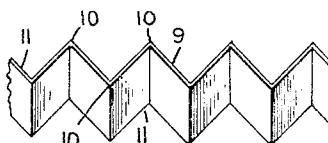
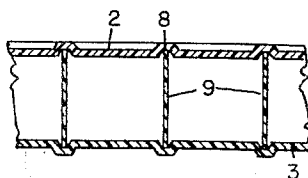
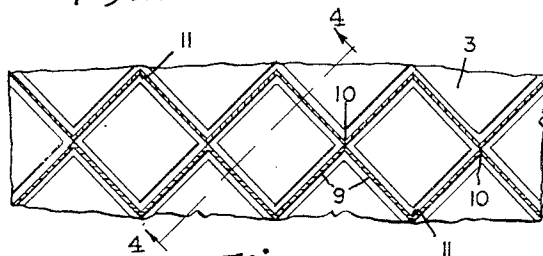
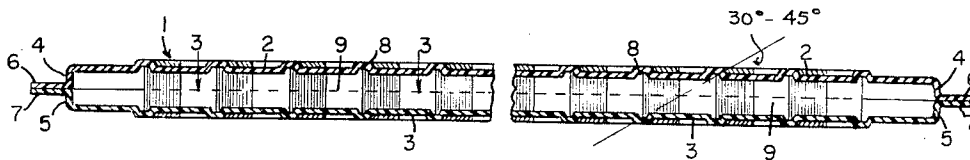
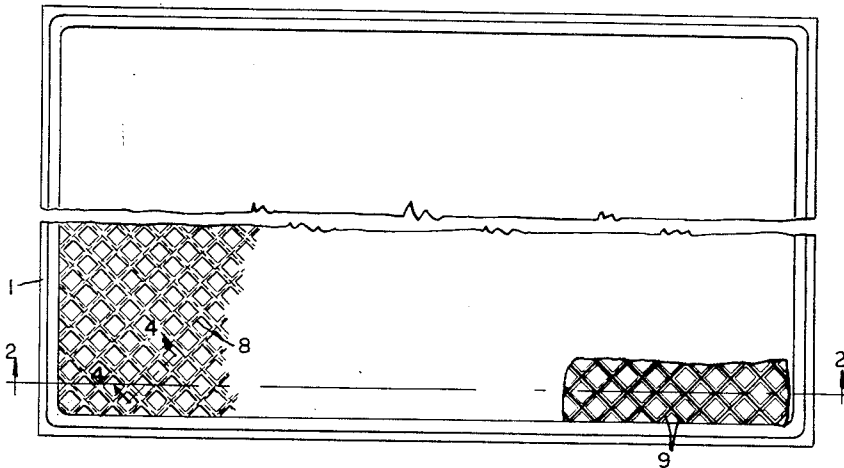


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2 Sheets-Sheet 1



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Nov. 30, 1954

G. P. WAKEFIELD

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LUMINOUS PANEL

Filed Jan. 18, 1947

2 Sheets-Sheet 2

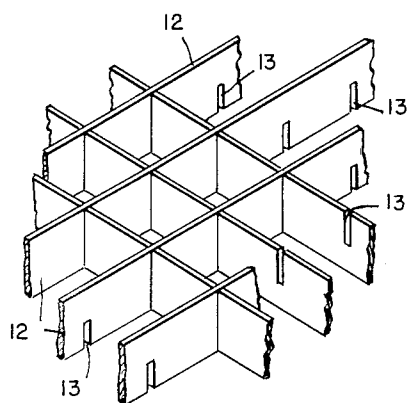


Fig. 6

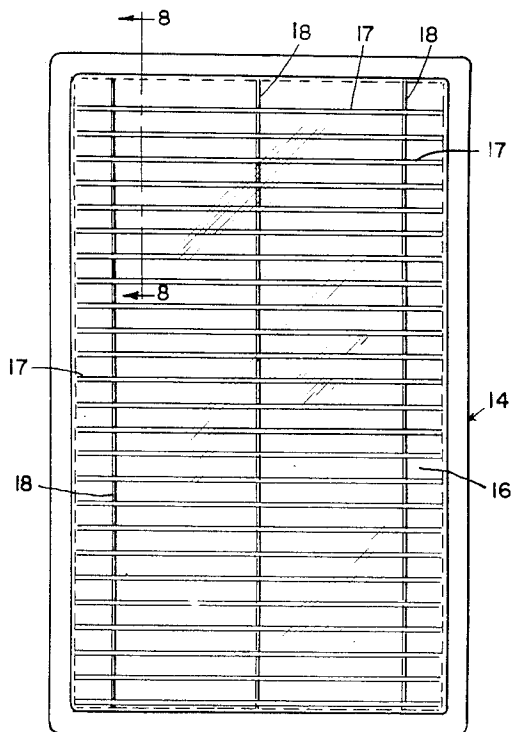


Fig. 7

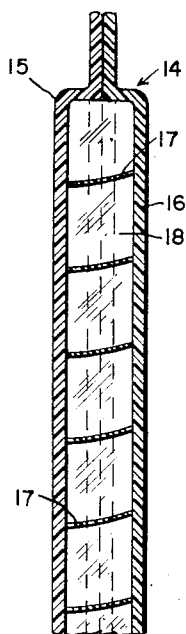


Fig. 8

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2,695,430

LUMINOUS PANEL

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Application January 18, 1947, Serial No. 722,919

6 Claims. (Cl. 20—56.5)

This invention relates to fenestrations, luminous ceilings, luminaires and the like and particularly to a new and improved panel therefor.

In the co-pending application of George P. Wakefield, Serial No. 599,868, filed June 16, 1945, and entitled "Luminous Ceilings," now abandoned in favor of continuation-in-part application Serial No. 93,620, filed May 16, 1949, there are set forth and described a luminous ceiling and illuminating means therefor. The panel of the present invention, while useful for other types of luminous ceilings, is particularly adapted for use in the luminous ceiling described in the above identified application.

The principal objects of the present invention are to provide panels which are adapted for use in luminous ceilings, luminaires, and various fenestrations and which provide effective diffusion of the light passing there-through; which not only are decorative but in which some of the decorative features are utilized as features of construction which add to the rigidity and strength of the panels; and in which directional louvres are so embodied as to reinforce and strengthen the panels and, in turn, to be themselves protected from the outside atmosphere, oxidation, dust, and the like by the panel.

Another object is to provide a panel which, in addition to the above advantages, has substantial heat insulating and sound deadening qualities.

Another object is to provide a luminous ceiling panel which may be economically manufactured and easily installed.

Other objects and advantages will become apparent from the following description wherein reference is made to the drawings in which:

Figure 1 is a top plan view of a luminous ceiling panel embodying the principles of the present invention, part thereof being shown in section for clearness and illustration;

Figure 2 is a cross section of the panel shown in Figure 1, and is taken on line 2—2 thereof;

Figure 3 is an enlarged fragmentary horizontal sectional view taken on line 3—3 of Figure 2;

Figure 4 is an enlarged sectional view taken on line 4—4 of Figure 3;

Figure 5 is an enlarged perspective view of a directional louvre used in connection with the present invention;

Figure 6 is a perspective view of a modified form of louvre;

Figure 7 is a fragmentary front elevation of a window or door panel embodying the principle of the present invention; and

Figure 8 is a fragmentary sectional view taken on line 8—8 of Figure 7.

As more fully described in the above identified application, luminous ceilings are generally in the form of panels which, at their margins, rest on top of suitable horizontal supporting beams or decorative channels. The beams or channels usually are suspended on rods from the conventional ceiling of the room and support the luminous panels in spaced relation beneath the ceiling. The illumination means generally are carried by the supporting rods, either in spaced relation above the luminous ceiling or in the decorative channels which underlie the margins of the panels. Thus direct rays of light from the illuminating means supported above the panels, or the indirect rays from the illuminating means carried in the channels, are utilized for illuminating the panels.

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In such structures, after installation, it is very difficult to clean the panels and usually removal and replacement is necessary for the cleaning operation. Such a problem ordinarily would be aggravated by the addition of directional louvres which necessarily are even more difficult to clean than the panels themselves.

Again, it is desirable to space the supports for panels of luminous ceilings a considerable distance apart, and therefore the panels must be of considerable extent parallel to the plane of the ceiling. As a result there is a tendency for the panels to bow or sag between their supported margins.

In the present structure various features are combined in such a manner as to take advantage thereof in improving the appearance and illuminating effect of the ceiling and in increasing the structural strength and rigidity of the panels.

Referring to the drawings, there is shown for purposes of illustration a square flat panel, indicated generally at

1. The panel 1 comprises a top section 2 and a bottom section 3, each of which is generally flat or planar, except for surface embossing or corrugations later to be described. The top section 2 and bottom section 3 have continuous upturned peripheral margins 4 and 5, respectively, with continuous marginal flanges 6 and 7 extending outwardly from the top edge of the upturned peripheral margins 4 and 5, respectively. The sections are preferably, but not necessarily, duplicates of each other and are assembled to form the panel by placing each in inverted relation to the other with the peripheral flanges 6 and 7 in juxtaposition and with the generally planar face of each spaced apart flatwise from the planar face of the other a distance equal to twice the depth of the upturned margin of each. If desired, the panel sections may have faces which are other than planar,—for example, curvilinear,—depending upon the final shape desired in the undersurface of the luminous ceiling.

The sections 2 and 3 preferably are of synthetic plastic material of which a large number are known; for example, cellulose acetates, acrylic resins, and the like. Glass may be used in some instances.

The sections may be slightly light diffusing, the diffusion being obtained by choice of a plastic material having inherent diffusing characteristics or by configurations or surface finish of the panels. On the other hand, one or both of the sections may be clear.

In the form illustrated, the section 2 is slightly diffusing and the section 3 is clear.

For securing the sections together, they are first assembled and heated to approximately 140° F. and then sealed hermetically by electronic welding or otherwise along their entire periphery so as to form a sealed chamber therebetween. A slight vacuum is maintained within the interior of the panel or chamber during the sealing operation or produced by subsequent cooling. As a result, distortion of either the top or bottom planar faces of the assembled panel out of its normal plane due to heating and resultant expansion of entrapped air is reduced or prevented. Also, due to the subatmospheric pressure within the panel, the air therein is sufficiently rarefied to provide a substantial heat insulating effect.

As mentioned in the objects, it is desirable that the panel be decorative and also that means be provided for preventing the passage of light rays directly from the source through the panel. For the former purpose, the top and bottom planar surfaces of the panel are corrugated, each with a grid of criss-cross corrugations 8. The panels are preferably formed of material of uniform thickness so that the crests of the corrugations form an embossed criss-crossed decorative design on the outer planar surface and the troughs of the corrugations form a corresponding criss-cross grid on the inner planar surface. The corrugations also render the sheets of material more rigid.

In the form described, the depth of the depressions between adjacent corrugations on the outer faces of the sections are sufficient to provide a sound trap so as to reduce the reflection of sounds from the panel to the floor of the room. Accordingly, the panels have a sound deadening effect somewhat in the nature of acoustical

plasters or acoustical wall surfacing materials and this is augmented by the fact that a subatmospheric pressure is maintained between the panel sections.

When the panels are assembled, the corrugated grids are aligned with each other vertically. Interposed between the upper and lower sections of the panel are a plurality of directional louvres 9 for cutting off the direct passage of light between the top and bottom of the panel in certain directions. In the form illustrated, each of the louvres 9 is formed of a corrugated strip of relatively rigid material, such as plastic or metal, as best illustrated in Figure 3, which is disposed between the top and bottom of the panel and interfits with and is anchored in, the inwardly exposed troughs of the corrugations 8. The corrugations of adjacent strips are oppositely arranged so that alternate crests 10 thereof are in substantial contact and alternate troughs 11 thereof are spaced apart from each other and aligned in a direction transversely of the panel. Each corrugated strip interfits with corrugations of the panels which are aligned with its upper and lower edges. The louvres thus reinforce the panel against distortion out of its normal plane because of their interfitting relation with the corrugations and their own corrugated formation. On the other hand, they are protected from dust and foreign matter by being sealed within the panels. They also render the panel rigid against collapsing forces of outside atmospheric pressure and thus permit a substantial amount of subatmospheric pressure to be provided within the panels.

The relation of the spacing of the corrugations of the panel from each other relative to the height of the louvres is preferably such that the louvres cut off any direct rays of light through the panel which strike the general plane of the upper surface of the panel at an angle of 30° or less.

If desired, the shape of the corrugations of the panels and, correspondingly, the shape of the louvres, may be modified without departing from the principles of the present invention. However, the form illustrated lends itself particularly to ease in manufacturing and assembling. Likewise, if desired, the louvres may have highly reflective surfaces, depending upon the effect desired in the finished ceiling and, since they are sealed within the panel, such reflective surfaces do not become dull due to oxidation or to the deposition of foreign suspended matter thereon.

It should be noted also that while the use of subatmospheric pressure is preferred, the panels may be filled with an inert or non-oxidizing gas at any desired positive or negative pressure.

Since the entire assembly is heated to a temperature of about 140° F. before the final welding at the flanges 6 and 7, the louvres and panel sections are either intimately interlocked or bonded together so that the entire panel is a substantially rigid unitary structure. Due to the interfitting of the louvres into the inner troughs of the corrugations, leakage of direct rays of light between the edges of the louvres and the top and bottom of the panel is prevented.

As mentioned, the louvres 9 may be plastic or metal. They may be semi-diffusing or opaque, or if desired, they may be reflective on one or both faces.

Instead of the louvres 9 being of corrugated strips, they may be flat strips 12 having notches 13 by which they are interfitted in the manner of egg-crate spacers, as illustrated in Fig. 6.

Referring next to Figs. 7 and 8, there is illustrated a panel 14 similar to the panel 1 but particularly useful in fenestrated areas, for example as a light admitting pane of a window, door or the like.

In the modified form the panel sections 15 and 16 are hermetically sealed at their peripheral margins and the inner and outer wall surfaces may be smooth or configured. When such panels are used in outside windows, it is desirable to pass a maximum amount of light while reducing glare. For this purpose, a series of horizontal louvres are positioned between the sections and sealed therein. They may be supported by the sections themselves as in the form illustrated in Fig. 2, but advantages are obtained by supporting them on upright supports 18 which are notched and interfitted with notches in the horizontal louvres, in the manner described in connection with Fig. 6. Adjacent uprights are spaced apart laterally a much greater distance than the distance between adjacent horizontal louvres 17, for example, about six to eight times as far.

Assuming the section 15 is the outdoor face of the panel and the section 16 the indoor face, the louvres 17 preferably extend upwardly at a slight angle from their outer to their inner edges, and may be slightly curved, as illustrated. The upper surfaces of the louvres 18 may be made light reflective and the lower faces light diffusing, so as better to distribute the light without too greatly reducing the amount thereof. The louvres 18 also may be made of translucent or opaque material.

In general, the section 15 is made of clear transparent material as also is the section 16, through either or both may be made diffusing if desired. It is best that a subatmospheric pressure be provided between the sealed sections so as to reduce heat conduction through the window in which the panel is installed.

While the forms of the invention illustrated in Figs. 1 through 5 have been referred to as wall panels they also may be used as window panes or in any fenestrated areas in the same manner as the form illustrated in Figs. 7 and 8.

With further reference to the panel structure illustrated in Figs. 1 to 5, the same is particularly adapted for employment in overhead lighting structures and in such employment the top sheet 2 when made of translucent light-diffusing material serves to uniformly diffuse the light passing downwardly therethrough thereby lowering the brightness in the reflected glare zone and thereby reduce the reflected glare brightness of the visual task. Furthermore, the directional louvres 9 beneath said top translucent sheet 2 provides a shielded direct glare zone of still less brightness because in this zone the top sheet is concealed from view and only the diffused light of low brightness can be reflected by the louvres into the direct glare zone even if said louvres have specular surfaces. The employment of the transparent bottom sheet 3 underneath the directional louvres permits full illumination while at the same time the unit as a whole is rendered dust-tight and easily cleanable. As previously mentioned, the criss-cross louvres 9 permit large areas to be used in a horizontal position, this feature being especially important in the case of large ceiling modules and for thermo-plastic sheets which have a tendency to cold flow and to sag.

Other modes of applying the principles of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In an overhead lighting structure, a horizontally disposed panel which comprises a horizontal top sheet of translucent, light diffusing material, a horizontal bottom sheet of transparent material, said sheets being secured together at their peripheries and spaced apart flatwise inwardly from their peripheries to form a chamber, and directional louvers in such chamber extending between and having opposite edges engaging the adjacent spaced faces of said sheets and thus reinforcing said sheets against deformation relatively toward each other.

2. In an overhead lighting structure, a horizontally disposed panel which comprises top and bottom horizontal sheets respectively of translucent, light diffusing and transparent material spaced part flatwise from each other and having on their adjacent faces, respectively, criss-cross corrugations with troughs of the corrugations of one sheet aligned with and parallel to the troughs of the corrugations of the adjacent face of the other sheet, means securing the sheets together in said spaced relation, and a grid of directional louvers between the sheets and interfitting at their edges with the troughs of corrugations of the sheets.

3. In an overhead lighting structure, a horizontally disposed panel which comprises top and bottom horizontal sheets respectively of translucent, light diffusing and transparent material each having marginal portions secured to marginal portions of the other, said sheets being spaced apart flatwise between the margins, each of said sheets being embossed on both surfaces by corrugations, the corrugations of one sheet being aligned with those of the other, directional louvers between the sheets, and each louver extending from one sheet to the other and having its opposite lateral margins received in the troughs of the corrugations of the respective sheets.

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4. In an overhead lighting structure, a horizontally disposed panel which comprises top and bottom horizontal sheets respectively of translucent, light diffusing and transparent material secured together at their margins and spaced apart from each other therebetween, each of said sheets having a grid of criss-cross corrugations on its inwardly disposed face aligned with corresponding corrugations on the inwardly disposed face of the other sheet, a grid of directional louvers between the sheets, each louver extending from one sheet to the other and having its margins received in the troughs of the corrugations of the sheets, respectively, and said grid of louvers comprising a plurality of strips of corrugated material disposed on edge between the sheets.

5. In an overhead lighting structure, a horizontally disposed panel which comprises top and bottom horizontal sheets respectively of translucent, light diffusing and transparent material having their marginal portions secured together and being spaced apart from each other flatwise between the margins, each of said sheets having a uniform grid of criss-cross corrugations aligned with the corrugations of the other sheet, directional louvers between the sheets, each louver extending from one sheet to the other and having its opposite margins received in the troughs of the corrugations of the respective sheets and each of said louvers comprising a single strip of uniformly corrugated material disposed on edge between the sheets, said louvers being arranged with alternate crests of corrugations of one strip in contact with alternate crests of corrugations of the other.

6. In an overhead lighting structure, a horizontally disposed panel which comprises top and bottom horizontal sheets respectively of translucent, light diffusing and transparent material having their marginal portions secured together and being spaced apart from each other flatwise between the margins, each of said sheets having a uniform grid of criss-cross corrugations aligned with the corrugations of the other sheet, directional

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louvers between the sheets, each louver extending from one sheet to the other and having its opposite margins received in the troughs of the corrugations of the respective sheets and each of said louvers comprising a single strip of uniformly corrugated material disposed on edge between the sheets, said louvers being arranged with alternate crests of corrugations of one strip in contact with alternate crests of corrugations of the other, said criss-cross corrugations of each sheet extending at right angles to each other and the louvers being disposed side by side in a row to define a rectangular grid of louvers between said sheets.

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