Nov. 17, 1959 G. GILLEARD 2,913,576

LOUVER-DIFFUSER

Filed March 18, 1957

FIG. 1

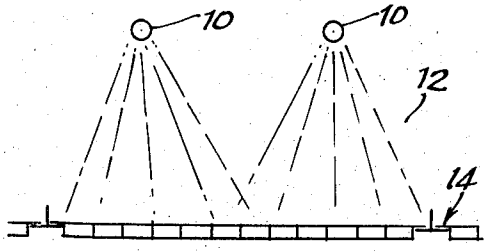
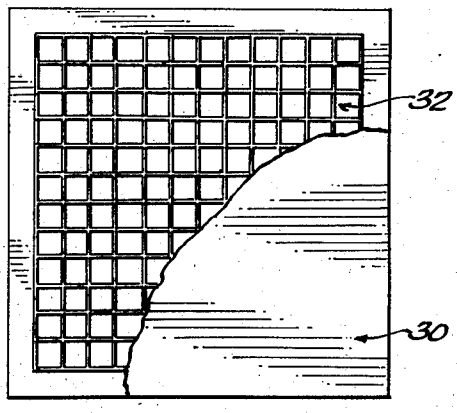


FIG. 2



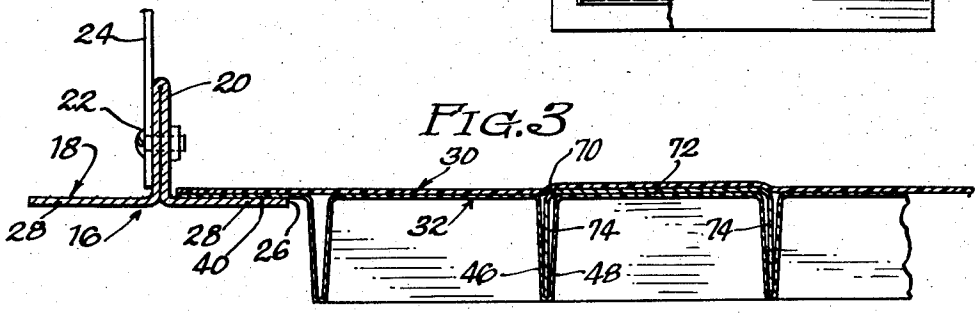
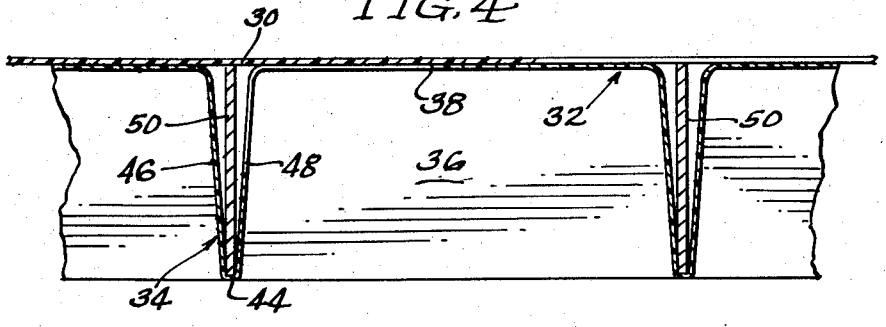


FIG. 3

FIG. 4



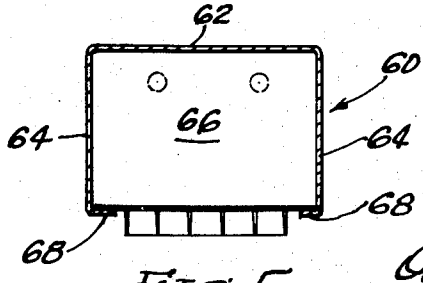


FIG. 5

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LOUVER-DIFFUSER

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13 Claims. (Cl. 240—78)

This invention relates to the art of room lighting and, more particularly, to a louver-diffuser assembly which provides for improved light transmission and distribution while also providing improved light shielding, and it is an object of this invention to produce a light assembly embodying a louver-diffuser having good light transmission, good light shielding, and which is capable of directional light control.

More specifically, it is an object of this invention to produce a louver-diffuser which can be formed of few relatively simple and readily available low cost parts; which can be easily and simply assembled into a composite structure; which can quickly and effectively be mounted in the desired relation to lamps in the ceiling structure for providing a novel and improved lighting effect; which offers a pleasant and attractive ceiling for the room; which provides for improved lighting from the standpoint of light transmission and light distribution; which, as a lighting element, gives any desired low angle of shielding and enables lights to be directed to provide light in predetermined areas with greater light shielding for less light in other areas; and which provides for directional lighting and low angle brightness in light shielded areas.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawings, in which—

Figure 1 is a schematic sectional view of a portion of the ceiling structure embodying the features of this invention;

Figure 2 is a plan view from the bottom side of a lighting panel employed in the structure of Figure 1, with a portion broken away to show the interior thereof;

Figure 3 is a sectional elevational view of a portion of the panel structure shown in Figure 2 in mounted relation on a hanger rod in the ceiling;

Figure 4 is an enlarged sectional elevational view of the louver-diffuser embodying the features of this invention, with a light baffle in position of use; and

Figure 5 is a schematic sectional view of a lighting fixture embodying the features of this invention.

In accordance with the practice of this invention, the light for the room treatment is provided, as by means of incandescent lamps, but preferably by means of a plurality of fluorescent tubes **10** aligned in spaced parallel relation across the room **12** between the beam structure above (not shown) and a dropped ceiling below, indicated by the numeral **14**. The drop ceiling is supported in the conventional manner, as by frame members **16** in the form of inverted T members **18** having the stem **20** of the T frame members joined, as by means of bolt and nut members **22**, to the lower ends of rods **24** hanging from the beam structure of the room, with the T frame members uniformly spaced lengthwise and crosswise throughout the area of the room to provide square, rectangular, or other polygonal-shaped openings **26** between

the inner edges of the horizontally disposed flanges **28** of the T-shaped frame members.

The louver-diffuser adapted to be supported on the flanges **28** across the openings **26** each comprises a pair of plastic sheets **30** and **32**, the upper one of which is in the form of a flat sheet **30** dimensioned to have a width greater than the distance between the inner edges of the adjacent crosswise flanges **28** but slightly less than the distance between the corresponding uprights **20**, and a length greater than the distance between the inner edges of the adjacent lengthwise flanges but slightly less than the distance between the corresponding uprights so that the upper sheet will fit into the space between the uprights defining the openings to come to rest upon the inwardly extending flanges thereof, as illustrated in Figure 3.

The lower sheet **32** is similarly dimensioned to correspond in length and width to the upper sheet, but it is vacuum molded or otherwise shaped to provide a plurality of downwardly extending ribs **34** aligned crosswise and lengthwise in spaced-apart relation in a waffle pattern to provide dished members **36** therebetween having the base **38** of the dished member at the same level of the original sheet and the edges **40** extending laterally outwardly all around from the outer ribs. The ribs, which initiate inwardly from the edge of the sheet by a distance corresponding to the flange support **28** in the framework, are each formed with walls that extend downwardly substantially perpendicularly at a very slight inward taper to meet in a narrowed section **44** at the bottom, having a space between the walls **46** and **48** of the ribbed members **34** sufficient to receive and support an insert **50** vertically therebetween.

The two thin sheets of plastic material, namely the sheets **30** and **32**, are joined one to the other at their outer parallel edges to provide a unitary structure. The joinder of the edges of the sheets extending outwardly adjacent to each other in parallel relation may be effected by the use of solvents, adhesives, or the like sealing means, but it will be preferred, when the sheets are formed of thermoplastic materials as represented by polystyrene, polymethylmethacrylate, polyvinyl chloride, vinyl chloride-vinyl acetate copolymer, polyvinylidence chloride and the like, to effect joinder by heat sealing.

While either of the elements in their separated relation would be incapable of being supported only at their edges to resist deformation or distortion even under their own weight, joinder of the sheets at their edges provides structural strength and rigidity which enables a composite panel to be supported at its edges on the flanges of the frame members without distortion, even under considerable load. Thus, the assembled sheets can be inserted into the openings of the supporting framework to bring the sealed edges of the panel to rest upon the flanges of the inverted T frame members accurately to mount the panels in the ceiling structure.

In assembly, the panel is mounted with the waffle pattern or ribbed sheet **32** lowermost so that the design will extend downwardly into the room below the supporting frame members and so that the flat sheet, at the same level as the supporting frame members, will be at the top to provide a flat surface which facilitates cleaning and which militates against the accumulation of dirt. If it were otherwise arranged, the flat sheet **30**, when lowermost, would block the waffle construction from full view from the under side and the dished members would provide pockets in which dirt and dust could easily accumulate to detract from the appearance and from the utility of the unit.

An important concept of this invention resides in the ability in the construction described to embody direc-

tional lighting and shielding while at the same time improving efficiency in light transmission.

Because of the stiffness made available by the joinder of the two sheets at their edges, it has become possible to fabricate the unit of relatively thin sheets of plastic material such as sheets ranging from .005–.030 inch, as represented by a structure having a top sheet formed of plastic sheet stock of .010 inch thickness while the bottom sheet, preferably deformed by vacuum molding, is formed of sheets of about .015 inch in thickness.

From the standpoint of use as a louver-diffuser, most efficient operation is achieved when the vertically disposed walls **46** and **48** of the ribbed members are formed to as nearly a vertical position as possible and with as closely spaced a relationship as possible to provide for the diffusion of light through a minimum thickness of plastic in the vertical direction, while increasing the thickness through which the light must travel from the lamps in an angular direction, thereby to give maximum light transmission coupled with maximum shielding. This is because the light would be required to pass through only two closely spaced, thin sheets of the plastic material throughout the area overlying the dished portion **38** of the bottom sheet, while the number of thicknesses of plastic material through which the light must travel increases with the increased angular relationship of sight. In the preferred practice, the ribbed members **34** in the bottom sheet should be formed to about ½ to 3 inches in depth and the squares or rectangles may be dimensioned to have lengths and widths within the range of 1½ to 3 inches. The depending ribs can be formed to tapers of less than a few degrees with lesser angles being made possible by vacuum molding of the thermoplastic sheets.

Directional lighting and shielding can be effected, in accordance with the practice of this invention, by the use of the ribbed members **34** as pockets in which thin strips **50** of opaque or other members incapable of light transmission to the desired degree can be supported vertically therein in a sufficiently closely spaced-apart relation to block the transmission of light rays in a certain direction. For example, if it should be desired to minimize light transmission crosswise in the room, the strips **50** of blocking material can be inserted in each of the lengthwise extending ribs of the lower sheet prior to joinder with the top sheet in the assembly of the louver-diffuser panel. If it should be desirable to minimize light transmission lengthwise through the room, the shielding strip can be inserted to be received in upright position in the crosswise ribs extending continuously across the lower sheet. In the event that the panels are formed square, then the described unidirectional shielding strips may be inserted in any one set of ribs so that the panels can thereafter properly be located within the supporting frame for the desired directional light shielding.

It is possible, in the construction described, to provide for full angular shielding in all directions by filling ribs with material having low light transmission as by continuous strips extending in one direction through the one set of ribs while introducing shorter strips for filling the spaces therebetween in the ribs extending in the opposite direction. With such construction, light transmission will be limited chiefly to the downward direction. Instead, elongate strips of paper, plastics or other shielding material can be interleaved in a criss-cross pattern for fitting into the grid work of the ribs in the diffuser sheet. Still further, since the ribs extend downwardly from their base, the ribs may be filled with a free-flowing material such as pigmented silica, sand, beads or the like which would provide a decorative effect as well as the desired light shielding.

It will be understood that a plurality of panels of the types described may be preassembled for use in rooms to give new and novel lighting effects. Where light concentration in a certain direction is desired in one portion of the room as distinguished from others, panels having the desired baffling for light shielding to give the desired effects may be employed, such as panels having longitudinal baffles for crosswise lighting in combination with panels having no baffles for full lighting in other portions of the room.

The plastic sheets of which the panels are formed may be fabricated of clear plastic material but it will be preferred to make use of sheets having a certain amount of opacity built in, as by the incorporation of fillers or pigments into the plastic material of which the sheets are formed, or by providing surface roughness on the sheets, as by means of an etch or blast with abrasive material.

It will be understood that panels of the type described with directional shielding of the light may be embodied as an element in light fixtures, as illustrated in Figure 5 of the drawing. As illustrated, the fixture will include a housing **60** having a top wall **62**, side walls **64**, and end walls **66** with ledges **68** extending inwardly a short distance from the lower edges of the side and end walls to provide an open space dimensioned to enable the ribbed portion of the panel to extend downwardly therethrough while the joined edges rest on the ledges for support.

For greater rigidity, the sheets may be joined periodically throughout the body portion intermediate the ends, as by tacking the dished portion of the bottom sheet to the adjacent portion of the top sheet. The sheets may be provided in different degrees of opaqueness to vary the brightness as desired in the room. By way of still further modification, use may be made of stiffening and strengthening members in the form of U-shaped members **70**, a top wall **72** dimensioned to correspond to the distance between adjacent ribs, and walls **74** depending from the edges of the top wall dimensioned to have a length corresponding to the depth of the ribs to enable the U-shaped member to be inserted between the sheets with the depending walls extending through adjacent ribbed portions as illustrated in Figure 3.

It will be understood that other changes with respect to the details of construction, arrangement and mounting may be practiced without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. A panel for use in lighting fixtures having horizontally disposed spaced-apart ledges defining an opening of predetermined length and width therebetween, said panel comprising a pair of thin, light-transmitting sheets of plastic material having their body portion arranged in face-to-face parallel relation and joined one to the other at their edge portions in superposed relation without joinder through the major portion of the area therebetween to provide a diaphragm, the upper sheet comprising a flat sheet dimensioned to have a length and width greater than that of the opening and forming the top surface of the panel, the lower sheet having ribs extending downwardly substantially perpendicularly in spaced-apart parallel relation to provide a ribbed section covering an area having a length and width dimensioned to fit through the said opening and spaced inwardly from the edges of the lower sheet whereby said ribbed section can be positioned to extend downwardly through the opening while the outwardly extending edge portions of the panel rest on the ledges to support the panel in the opening, and blocking elements of opaque material vertically disposed within said ribs to decrease the brightness in the shielded direction.

2. A panel for use in lighting fixtures having horizontally disposed spaced-apart ledges defining an opening of predetermined length and width therebetween, said panel comprising a pair of thin, light-transmitting sheets

of plastic material arranged in face-to-face parallel relation and joined one to the other in their edge portions in superposed relation without joinder through the major portion of the area inbetween, the upper sheet comprising a flat sheet forming the top surface of the panel, the lower sheet having ribs extending downwardly in closely spaced-apart relation from the edges of the sheet and spaced one from the other in parallel relation throughout the remainder of the body portion of the sheet to provide a ribbed section dimensioned to have a length and width slightly less than the length and width of the opening whereby the ribbed section can be positioned to extend downwardly beyond the opening while the outwardly extending edges come to rest on the ledges to support the panel in the opening, and blocking elements in the form of elongate strips of material having low light reflectivity and low light transmission dimensioned to have a width less than the depth of the ribs and positioned in the ribs to provide light shielding in one direction.

3. A panel as claimed in claim 2 in which the strips are dimensioned to extend continuously through ribs from one edge to the other in one direction.

4. A panel as claimed in claim 2 in which the ribs criss-cross with one another through the ribbed section and in which the blocking elements extend from one edge to the other in the ribs in both directions.

5. A panel as claimed in claim 2 in which the ribs extend crosswise and lengthwise in parallel relation through the body portion of the lower sheet and in which the blocking material is located in the ribs extending in at least one of the directions.

6. A panel as claimed in claim 1 in which the top and bottom sheets of the panel are translucent.

7. A panel as claimed in claim 1 in which the top and bottom plastic sheets are selected to have a thickness within the range of 5 to 30 mils.

8. A panel as claimed in claim 1 in which the ribs extend downwardly for a distance within the range of ½ to 3 inches from the top of the sheet.

9. A panel as claimed in claim 1 in which the ribs are spaced apart one from the other by a distance within the range of 1½ to 3 inches.

10. A panel as claimed in claim 1 in which the ribs are formed with side walls having a taper of less than 4 degrees with the vertical.

11. A panel as claimed in claim 1 in which at least some of the ribs are filled with a free-flowing material having low light reflection and low light transmission.

12. A panel as claimed in claim 2 in which the areas between the ribbed portions comprise dished portions having their base at a level with the edge portions and in which some of the dished portions are tacked to adjacent portions of the top sheet.

13. A panel as claimed in claim 1 in which the pair of sheets are joined at spaced-apart points in the area between the joined edges for support.

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