Sept. 27, 1966 D. E. WELTY 3,275,825

REFRACTOR

Filed Feb. 20, 1964 2 Sheets-Sheet 1

FIG. 1.

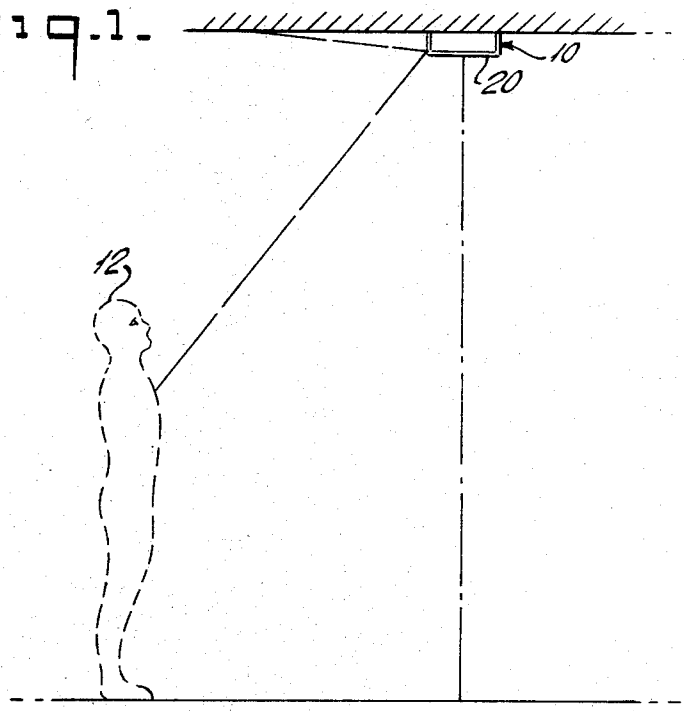
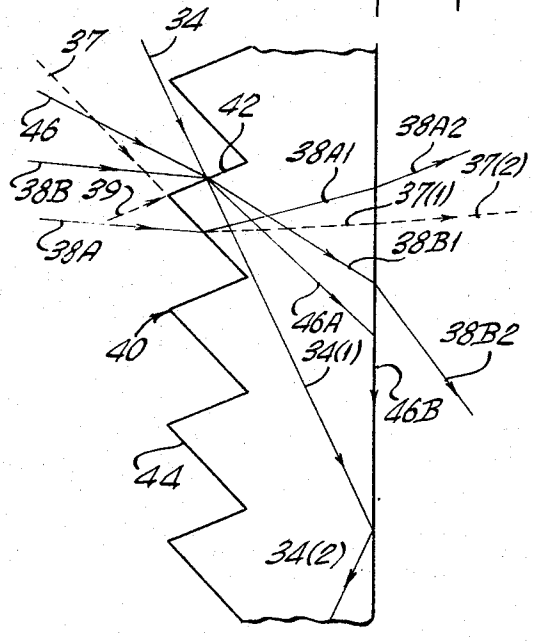


FIG. 5.



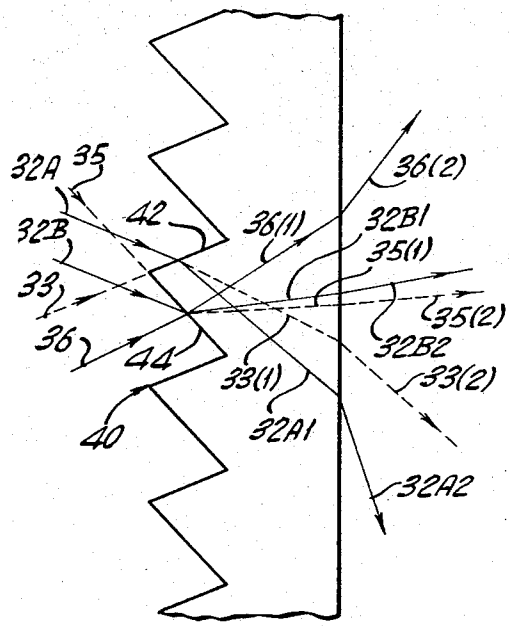


FIG. 4.

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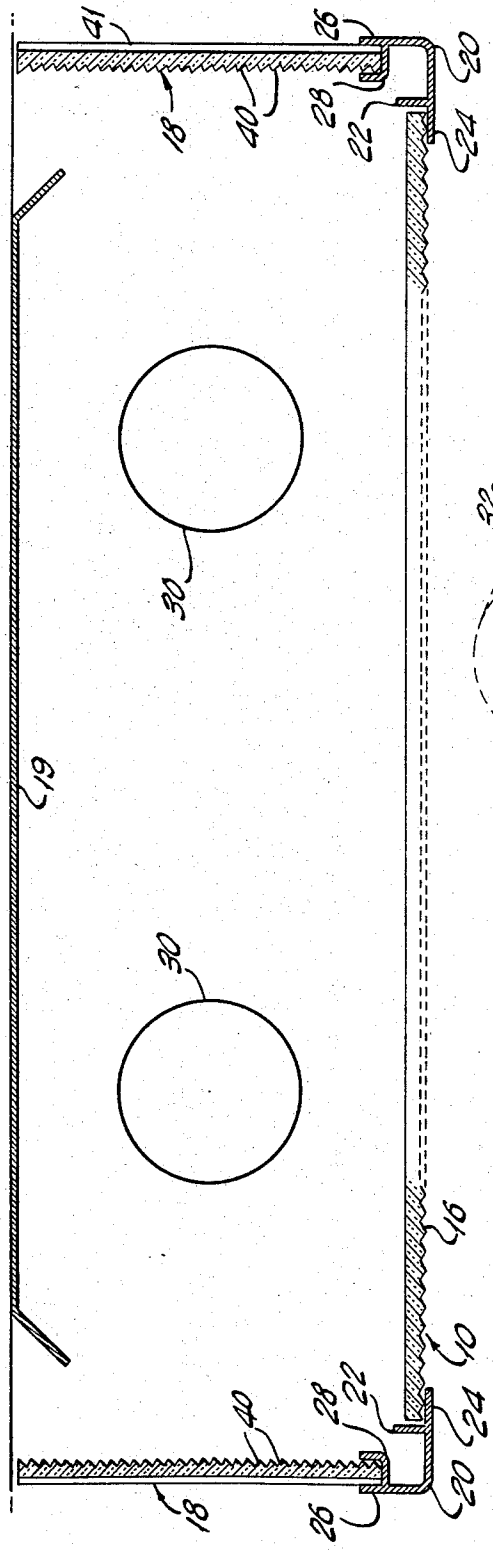


FIG. 2.

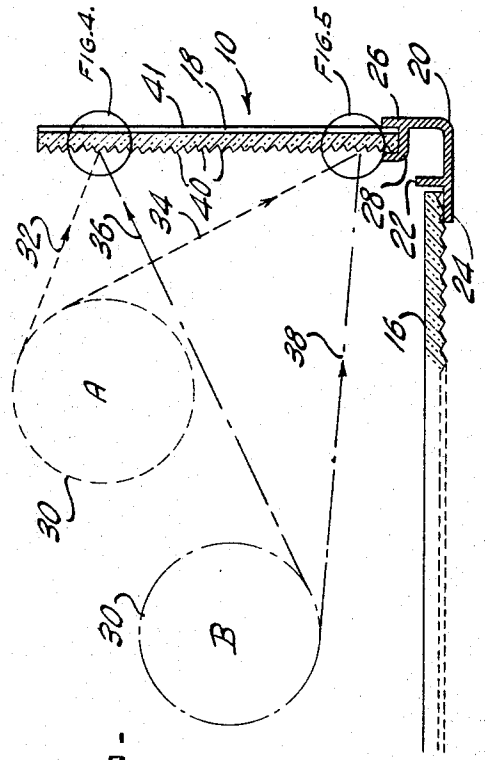


FIG. 3.

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United States Patent Office 3,275,825
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3,275,825

REFRACTOR

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Filed Feb. 20, 1964, Ser. No. 346,218
5 Claims. (Cl. 240—106)

The present invention relates in general to luminaires and in particular to a new and useful prismatic side panel lens for use with linear light sources enclosed within the luminaire.

When employing luminaires with fluorescent or other linear light sources in which side panel lenses are utilized, the side panels may present annoying glare-zones to a viewer. In such cases, it may be desired to position the light sources within a generally rectangular luminaire in a number of positions relative to the side panels. Thus, another problem arises in providing side panel refractors which will accommodate light sources in any position within the confines of the luminaire, and still provide glare free illumination regardless of the position of the light source.

Accordingly, it is an object of this invention to provide improved light transmitting side panels in luminaires having linear light sources, which panels will distribute light in an efficient and uniform glare free manner regardless of how the light source or sources are positioned.

The present invention is particularly applicable to luminaires which require side panel lenses, separate from a bottom lens, and provide a series of identical horizontal prisms which control the vertical distribution of light emanating from one or more linear light sources located within the luminaire. The prism design produces a glare free zone within predetermined critical angles.

The novel design of the prisms also takes into account the possibility of varying the position of the light source or sources within the luminaire so that such positioning will not alter the desired distribution of the light refracted through the side panel.

Furthermore, the present invention enables substantial savings in cost because the side panels permit a universatility of lamp placement within the practical limits of ceiling luminaire construction. Additionally, the side panels of the invention may be employed in any luminaire regardless of size while still retaining the desired glare free zone. In fact, the lens panel may be cut to a desired height less than its original dimensions and still provide the same distribution of light.

For a better understanding of the invention, its advantages and specific objects obtained by its use, reference is made to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

In the drawings:

FIG. 1 is a diagrammatic view of a luminaire of the present invention shown in relation to a viewer from the floor below.

FIG. 2 is a cross section of the luminaire of FIG. 1;

FIG. 3 is a sectional view of a portion of the luminaire of the invention but showing a variation of light source positioning;

FIG. 4 is a magnified sectional view of the encircled portion of the side panel lens of FIG. 3; and

FIG. 5 is a magnified sectional view of the encircled portion of the side panel lens indicated in FIG. 3.

Referring in detail to the drawings, wherein similar reference numerals identify corresponding parts throughout the several views, **10** represents a generally rectangular luminaire. As illustrated in FIG. 1, an observer **12** in the fifty to ninety-five degree glare zone will not be subjected to the effects of usual side wall brightness because the particular design of the prismatic side panel of this

invention serves to substantially eliminate glare in that zone, as described more fully below. Also, the present design provides a substantial, well distributed ceiling component to reduce the contrast between luminaire and ceiling.

According to the invention, the luminaire includes a horizontal bottom lens **16**, vertical side panel lenses **18**, and a reflector plate **19**. Side panel lenses **18** are separated from the bottom lens **16** by right angle supports **20** supported in the housing by conventional means, not shown. Right angle supports **20** include stops **22** and ledges **24** on which bottom lens **16** rests. Bottom lens **16** may be secured to right angle supports **20** by fitting the lens snugly between opposing stops **22**, or by any other suitable means. The upright leg **26** of right angle support **20** includes right angle side panel lens support **28** projecting inwardly of the leg and integrally formed therewith. Support **28** serves to hold the side panel lenses securely in place. The side panel lens may be secured to support **28** by fitting the lens snugly therein, or by affixing the lens to the support by any other suitable means. A plurality of fluorescent lamps **30** are secured within the luminaire by any suitable means (not shown).

Each lens **18** includes a plurailty of identical horizontal light splitting prisms **40**, which are asymmetric relative to a horizontal plane through the apices of the prisms, with the upper active surfaces **42** having a steeper slope than the lower active surfaces **44**. Prisms **40** are positioned over the entire inner surface of side panel lens **18** in a contingent relationship, and provide substantially reduced glare from the side panel lens in a predetermined zone, which, for example, may extend from fifty to ninety-five degrees. The zone of reduced glare may be adjusted by utilizing prisms of different refractive power. Vertical cut-off prisms **41**, suitably positioned on the outer surface of lens **18**, provide for horizontal diffusion of the light.

To make a thorough analysis of the effect of the side panels on different lamp positions, it is only necessary to consider the extreme rays emanating from such positions upon the extreme portions of the side panel lens, that is, the upper and lowermost sections of the lens.

Turning now to FIG. 3, there are shown possible positions A and B of lamp **30**, relative to side panel **18**. The two positions are merely illustrative and any lamp position may be employed, or any practical member of lamps utilized within the scope of the invention. In lamp positions illustrated, extreme rays **32, 34, 36** and **38** are shown emanating from the lamps and impinging upon the upper and lower portions of side panel lens **18**.

FIGS. 4 and 5 illustrate in detail the effect of the top and bottom side panel prisms, respectively, on rays emanating from the lamps within the luminaire. For purposes of explanation, parallel light rays will be identified by the same numeral, but with respective identifying letters A and B.

In FIG. 4, ray **32A** impinges upon the upper surface **42** of prism **40** in the upper portion of the panel and is refracted downwardly as ray **32A1**, emerging downwardly from the lens near the vertical as ray **32A2**. As the light incident upon upper surface **42** impinges on the panel at higher vertical angles relative to nadir it will be refracted downwardly but at higher angles than ray **32A2**. The highest ray which can strike the top surface **42** is grazing light, illustrated as ray **33**. Ray **33** is refracted downwardly through the lens as **33(1)** and emerges as ray **33(2)**, the angle of which can be set by the slope of upper surface **42** at a desired maximum. Thus, the angle of the upper surfaces of the prisms is designed so that all of the rays impinging thereon emerge from the lens at angles beneath the desired glare free zone (e.g. less than fifty degrees).

When ray 32B enters the lower surfaces 44 of prisms 40 at the upper portion of the panel, it is refracted upwardly as ray 32B1, and emerges from the lens as ray 32B2. As the rays on lower surfaces 44 impinge at higher vertical angles, the rays are refracted higher than ray 32B1 as illustrated by ray 36–36(1)–36(2): conversely, any light entering the bottom surface at angles lower than ray 32B will emerge at angles lower than ray 32B(2) with the limiting or grazing ray 35, the lowest angle accepted by the surface 44, being refracted upwardly as ray 35(1) and emerging from the lens as ray 35(2). The lower surface 44 is set at an angle to prevent limiting ray 35(2) from emerging from lens 18 at lower than the desired angle, in this case, not less than ninety-five degrees with respect to the vertical.

Any ray higher than ray 35 will be refracted above the glare free zone limit. For example, extreme rays from lamp position B, such as ray 36, enter the lower surface 44 and are refracted as ray 36(1), ultimately emerging as ray 36(2) at an angle above ninety-five degrees.

The section of side panel lens 18 depicted in FIG. 5 is from the bottom portion of the lens. The extreme rays from the two possible lamp positions A and B incident upon this portion of the lens can be analyzed in a manner similar to the above. Rays 34 and 38, as shown in FIG. 3, may be considered in a plurality of incident angles relative to the upper and lower surfaces of prisms 40 in this lower portion of lens 18.

Ray 38A enters the lower prism surface 44 and is refracted through the lens as ray 38A1 emerging as ray 38A2 outside of the desired glare-free zone (i.e. above ninety-five degrees). As the light incident on lower surface 44 impinges at lower vertical angles than ray 38A it is refracted and emerges at lower angles than ray 38A2 until the rays arrive at the greatest angle of incidence upon surface 44, as illustrated by grazing ray 37. Ray 37 is refracted upwardly as ray 37(1) and emerges in an upward direction as ray 37(2) at an angle corresponding to the upper limit of the desired glare-free zone. Rays incident upon the lower surface of the prism at a higher angle than ray 38A will be refracted through the lens to emerge at an angle above ray 38A2, well above the glare-free zone limit.

Ray 38B, which enters the upper surfaces 42 of the lower prisms, is refracted downwardly as ray 38B1 in the lens, and again refracted downwardly as it emerges from the lens as ray 38B2. As in the case of the upper prisms, light impinging on the upper surfaces of the lower prisms at higher angles than that of ray 38B cannot emerge from the lens at an angle greater than fifty degrees, although this limit is not normally approached in the case of the lower prisms, since they are not usually subjected to upwardly directed or high angled light.

Ray 46 represents the lowest ray which can enter the upper surface of any prism 40 and be refracted through the lens. Ray 46 is refracted as ray 46A in the lens and emerges at zero degrees vertical as ray 46B. All rays which are lower than ray 46 and impinge upon an upper surface will be internally reflected. Thus, extreme ray 34, lower than ray 46, passes through the lens as ray 34(1) but does not emerge from the lens, and instead, is internally reflected as ray 34(2). Hence, the highest ray incident upon the upper surface of the prisms emerges from the lower portion of the lens considerably below fifty degrees vertical, and the lowest ray incident upon the lower surface of the prisms emerge at ninety-five degrees vertical, thereby producing a glare free zone between fifty and ninety-five degrees.

Thus, a prismatic side panel lens has been provided for luminaires with an inside surface covered by a plurality of identical horizontal prisms. The highest ray incident upon the upper surface of the prisms, and subsequently emergent from the lens, is set at an arbitrary maximum value (in this case fifty degrees vertical).

Other rays which enter the upper surface of the prisms are either refracted and emerge at angles lower than fifty degrees, or are reflected internally. The lowest ray incident on the lower surface of the prisms and subsequently emergent from the lens is set at an arbitrary minimum angle (in this case ninety-five degrees vertical). All other rays incident upon the lower surface of the prisms are refracted and emerge from the lens at angles higher than ninety-five degrees. It will be understood of course that the design of prisms 40 may be varied to thereby alter the glare-free zone to accommodate any particular set of circumstances.

Because prisms 40 are identical, the lamps may be placed in any position relative to the side panel lens and still produce the glare-free zone described and explained hereinabove. These positions are limited only by practical considerations in the manufacture of luminaires.

Furthermore, since the prisms are identical, the lens may be cut to any desired width less than its original width and still function satisfactorily. Thus the prismatic design allows considerable variation in lamp placement, making the lamps suitable for use in a wide range of fixtures.

While a preferred embodiment of the invention has been shown and described in detail to illustrate the application of the inventive principles, it should be understood that the invention may be embodied otherwise without departing from such principles.

I have described what I believe to be the best embodiments of my invention. I do not wish, however, to be confined to the embodiments shown, but what I desire to cover by Letters Patent is set forth in the following claims.

What is claimed is:

1. For use in a luminaire including at least one linear light source, a refractor comprising at least one substantially vertical side panel, said side panel having a series of substantially identical horizontal prisms lying parallel to said light source at the surface of said side panel nearest said light source, said prisms each comprising an upper and a lower light receiving surface asymmetrically disposed on either side of a horizontal plane through the apex of said prism, said upper surface constituting means for re-directing incident light thereon at angles lower than a predetermined range of angles from nadir, and said lower surface constituting means for re-directing incident light thereon at angles greater than said range of angles, the area defined within said range of angles defining a glare free zone of light.

2. The refractor of claim 1 wherein all light incident on said upper surface emerges at an angle less than 50° from nadir and all light emerging from said lower surface emerges at an angle greater than 95° from nadir.

3. The refractor of claim 1 wherein said series of identical prisms cover the entire length and height of said side panel, said prisms being disposed in contiguous relationship.

4. The luminaire of claim 1 wherein said light source is placed in any substantially horizontal plane along a substantially vertical plane substantially parallel to said side panel.

5. The refractor of claim 1 wherein said surfaces constitute said means regardless of the height of the linear light source relative to said vertical panel.

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