May 11, 1943. T. W. ROLPH 2,318,716

LUMINAIRE

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Fig. 1.

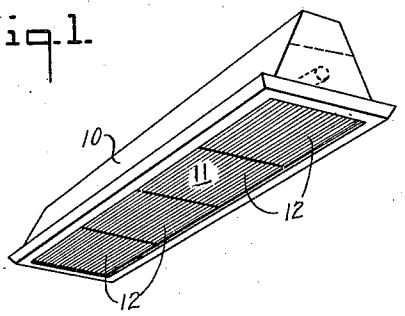


Fig. 2.

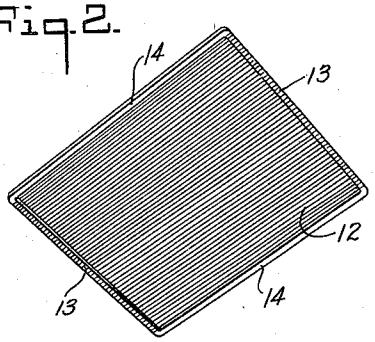


Fig. 3.

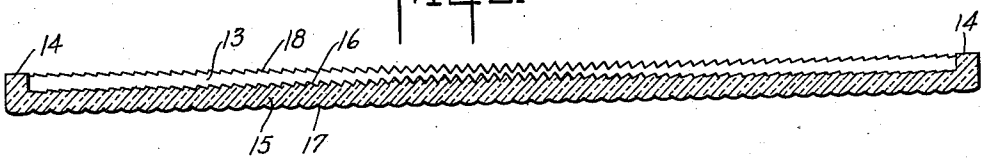


Fig. 4.

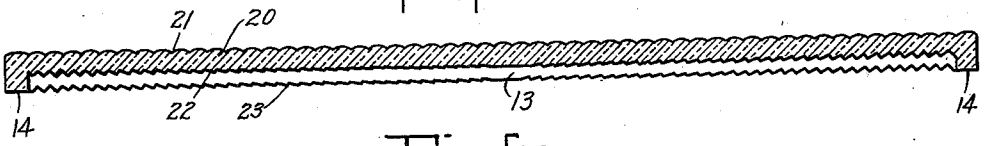
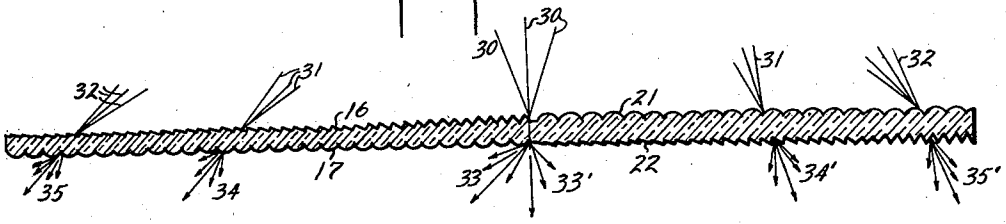


Fig. 6a.



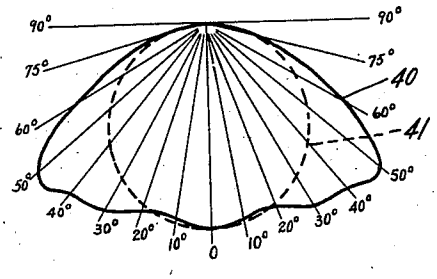


Fig. 7

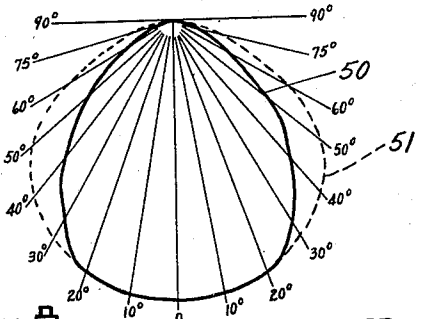


Fig. 8.

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Fig. 5.

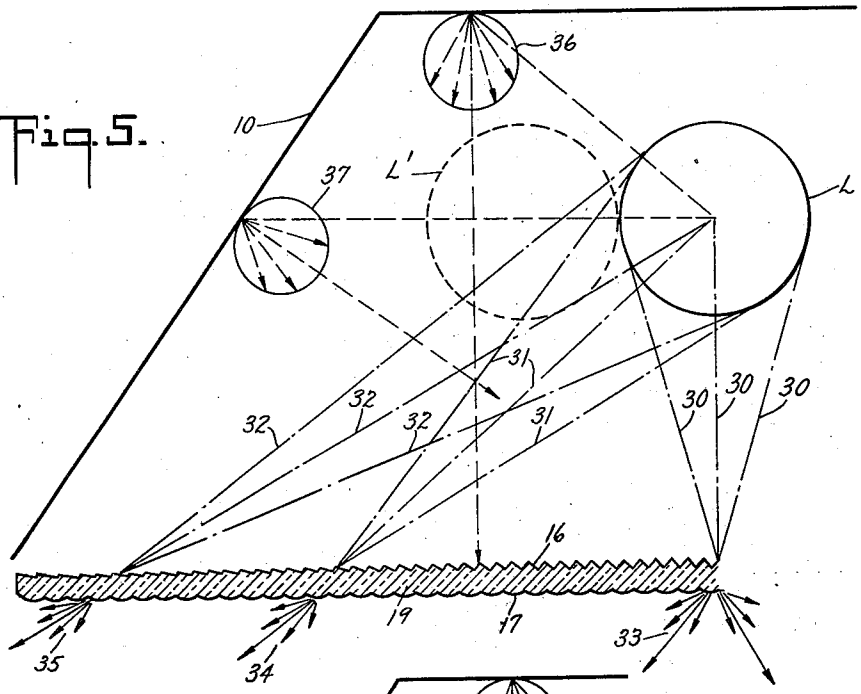
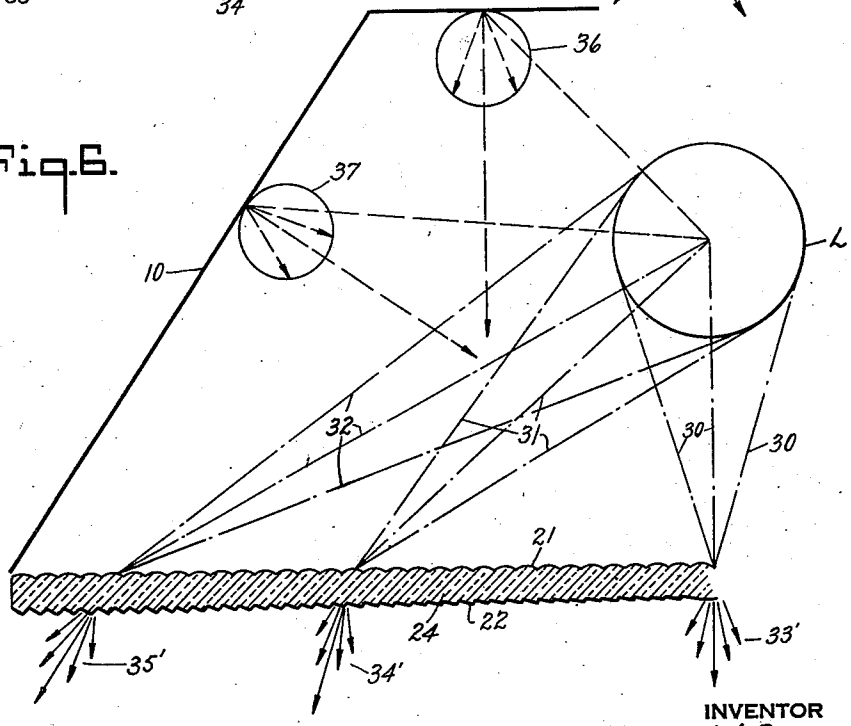


Fig. 6.



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UNITED STATES PATENT OFFICE

2,318,716

LUMINAIRE

Thomas W. Rolph, Newark, Ohio, assignor to Holophane Company, Inc., New York, N. Y., a corporation of Delaware

Application July 5, 1941, Serial No. 401,089

6 Claims. (Cl. 240—93)

The present invention relates to luminaires, and is more particularly directed toward direct lighting luminaires employing one or more long light sources and having a prismatic light transmitter for controlling the transmission of the direct and reflected light so that it has altered (i. e. increased or lessened) divergence and controlled diffusion in transverse planes.

Where the ordinary incandescent lamp is the source of light it has heretofore been common to obtain the desired extensive, intensive or focusing types of distribution by appropriate reflectors and refractors singly or in combination, and such distributions have been applied in the design of incandescent lighting installations.

The fluorescent lamp, owing to its long bulky shape, its diffuse light scattering properties, and its opacity, has made it impossible to follow the prior methods in the design of luminaires to provide any of these distributions in a downwardly open type direct lighting unit. The open type of unit, unless deep, exposes the lamps. It has very uneven brightness over its visible area with possible glaring reflections of the source and emits direct light through an angle determined by its aperture which often is in the glare zone.

A closure in the form of a simple Fresnel type lens plate may be used below a reflector to obtain a concentrating or focusing distribution and will have reasonably uniform brightness when viewed across the axis, along the axis or diagonally. The application of prisms to closures below reflectors for the purpose of spreading the light and producing an extensive distribution, or for the purpose of reducing its divergence to provide an intensive distribution, was found to be unsatisfactory from an appearance standpoint. The lamps and fixture interior were insufficiently obscured, and brightness very uneven.

The present invention contemplates providing these closures with longitudinally extending diffusing flutes opposite the prisms, with a definite flute-prism size relationship, so that the light must pass through both refracting surfaces and the direct light be deviated controlled amounts by each, and this is true whether the prisms, or the flutes, are on the light incident side. The prisms and flutes are of different widths, the ratio being preferably a mixed number (such as 1⅔, making the proportions 5 to 3) for with such a mixed number ratio it is impossible for any group of prisms exactly to equal the width of the opposite flutes, or vice versa.

While the present invention may be, and preferably is embodied in constructions having specular reflectors for predetermined light control in conjunction with the cooperative prismatic and fluted transmitter to produce the highest efficiency and most accurate light control, yet it may be embodied at sacrifice of efficiency and precision in constructions where the reflector is diffuse or spread and departs substantially from such precise contour so long as the reflector form is one which directs enough scattered light onto the entire plate surface to cause it to light up without excess contrasts in brightness.

Where redistribution of direct light alone is desired, for example, in fixtures delivering a portion of the light upwardly, the plates may be used, but will not light up as evenly as where a downwardly acting reflector is used.

The accompanying drawings show, for purposes of illustrating the present invention, two embodiments in which the invention may take form, it being understood that the drawings are illustrative of the invention rather than limiting the same.

In these drawings:

Figure 1 is a perspective view illustrating a fluorescent lighting fixture embodying the present invention;

Figure 2 is a perspective view of a prismatic plate for use in such fixture;

Figures 3 and 4 are transverse cross sectional views through two different forms of plate for use in such fixtures, Figure 3 showing a plate for obtaining an extensive distribution and Figure 4 a plate for obtaining an intensive distribution;

Figures 5 and 6 are cross sectional views at an enlarged scale through the plates and illustrating typical positions for light source and reflecting housing, Figure 5 illustrating the use of the extensive plate in the fixture, and Figure 6 the intensive plate in the fixture;

Figure 6*a* illustrates an asymmetric plate;

Figures 7 and 8 are typical light distribution curves for the extensive and intensive units, respectively.

The luminaire illustrated in Figure 1 has a long reflecting housing or box 10 of suitable size to house the lamps and auxiliaries and where exposed may have any desired external ornamental appearance desired. The mouth of this reflector is closed by a prismatic and ribbed cover indicated generally at 11. Where the cover employs pressed glass it is preferable to make it in a number of identical plates, four of which are indicated in Figure 1. One of these cover plates is indicated in Figure 2 at an enlarged scale. The

plates may conveniently be 12" long and about 11" wide. Each is typically a piece of flat glass, but it may be curved or made in two pieces. When plates of this nature are made of pressed glass it is customary on account of the restrictions of the method of manufacture to provide the plates with end flanges indicated at 13, 13 and side flanges indicated at 14, 14.

Where an extensive light distribution is desired the plates may be conveniently made as indicated at 15 in Figure 3 and at 19 in Figure 5. The upper surface of the plate is provided with a series of narrow, parallel, longitudinally extending prismatic ribs 16. These ribs, as will be clear from Figures 3 and 5, are steeper near the center of the plate than near the side edges. The lower surface of the plates 15 and 19 are provided with a plurality of narrow, longitudinally extending flutes 17. The width of the flutes, as shown in Figures 3 and 5, differs from the width of the prisms and in these drawings the ratio is about 5 to 3. This ratio may be obtained by employing prismatic ribs .10" wide and diffusing flutes .17" wide. The flutes may be convex or concave and should not be deep enough to disturb to a serious degree the light control obtained by the prisms. Excellent results are had when flutes approximately $\frac{3}{16}$ of an inch wide and $\frac{1}{32}$ of an inch high or deep are used. By having the flutes of different width than the prisms there is less likelihood of a flute and an opposed prism terminating opposite one another as one proceeds across the plate, and this may be completely avoided where the ratio is such that neither width is an exact multiple of the other, for then one always obtains a mixed number when dividing the larger width by the lesser. While the flutes are shown larger than the prisms, they may be smaller, provided the incommensurable relationship is retained.

The flanges 13 at the ends of the pressed glass plate 15 are provided with short prismatic ribs 18 of the same contour as the prismatic ribs 16 so that the light control is uniform the entire length of the plate. These plates are normally supported from their side edges with the ends of the plate in abutting relation and not covered by mullions, and hence the provision of the prisms on the flanges serve to maintain the same light distribution clear to the end of the plate. Such prismatic flanges may be applied to prismatic pressed glass plates intended for end to end assembly.

Where the prismatic and fluted formation is to be applied to rolled glass instead of pressed glass, a sheet of glass may be made long enough for the entire fixture and the flanges omitted, as shown at 19 in Figure 5.

When the plate 15 or rolled sheet 19 is employed as a closure for a direct lighting fixture having a reflector of any suitable contour, such as indicated at 10, it receives from a centrally located lamp L direct light rays, such as indicated by the dot and dash-lines 30, 31 and 32. In all cases each point on the upper surface of the light transmitter receives direct light from the source through widely varying angles on account of the size of the source. The direct light is refracted by the prismatic ribs and transmitted to the flute and the flute breaks up the rays and scatters them somewhat as indicated in the dot-and-dash lines 33, 34, 35 below the glass. Direct light rays from the lamp L strike the top and sides of the reflector and are diffusely reflected as indicated by the dotted circles 36 and 37. This reflected light strikes the upper surface of the plate at various angles and is refracted and diffused and a large part will be emitted in the same general downward direction as the controlled direct light. The flutes provided on the inner surface of the plate give a certain degree of spread to the transmitted controlled light. This in itself will tend to provide a better lighted appearance of the plate crosswise, but ordinary flutes of customary size will not give sufficient diffusion in lighter effect and will give a rather dead and monotonous appearance to the lighted plate. The present invention seeks to overcome this monotonous effect by providing flutes of a markedly different size from the prisms and yet not an even multiple of the prism size. Thus every prism has back of it a section of a flute quite different from the section back of the adjacent prism and even different from the section back of any prism in the immediate neighborhood. The result is a degree of diffusion of light which provides a well lighted surface appearance and provides also a tendency toward a scintillating or shimmering effect. This effect, provided in directions crosswise of the light source together with the natural diffusion lengthwise provided by the length of the source gives an attractive lighted appearance to any luminaire having a long light source and provided with such a light transmitting prismatic cover. The interior of the fixture is completely obscured and one sees a very uniformly lighted luminous surface extending over the entire width and length of the fixture and this is characterized by the absence of bright streaks showing that no light has leaked through without diffusion.

In Figure 7 the typical distribution curve across the fixture axis is indicated at 40 and the curve along the fixture axis at 41. It will be noted that this distribution is one which spreads the light substantial distances away from the nadir so that parallel fixtures may be spaced substantial distances apart, for example, twice the mounting height and obtain uniform horizontal illumination and excellent vertical illumination.

Where the same reflector and the lens are intended to be used with two 40 watt lamps a lamp position is indicated by the dotted circle L' of Figure 5, there being another similar lamp on the opposite side of the fixture. Tests have shown that the curves of Figure 7 are practically the same shape differing only in intensities, when the fixture is used with a single lamp or with two lamps. With the two lamp construction the brightness of the cover plates is slightly increased.

The plate 20 of Figure 4 is provided with flutes 21 on the surface toward the lamp and has a series of parallel prisms 22 on the opposite or lower surface of the glass. The flange is provided with prisms 23 similar to the prisms 22. The ratio of widths of prismatic rib and flute may be the same as that above described and for the same purpose.

Figure 6 shows a rolled plate 24 with flutes 21 and prisms 22 and illustrates the action of the intensive lighting cover in a manner similar to that shown in Figure 5 for the extensive lighting cover. The dot-and-dash lines 30, 31 and 32 indicate the paths of direct light as before, and the dotted lines indicate the paths of the reflected light. The full lines 33', 34' and 35' indicate the direction of the transmitted direct

light which, it will be noted, is less widely spread than in Figure 5.

The distribution obtained from the intensive lighting plate **20** or **24** is illustrated in Figure 8 where the full line curve **50** illustrates the distribution of the luminaire across its axis, and the dotted curve **51** illustrates the distribution of the luminaire along its axis. Luminaires with intensive distribution require much closer spacing to give even horizontal illumination than those having the extensive distribution, and provide less vertical illumination.

The plates shown in Figures 3 to 6, inclusive, are designed for symmetric lighting units. In special instances it is desirable to provide a fixture one side of which has the extensive distribution while the other side has intensive distribution and then the prismatic plates are made asymmetric, one-part carrying the extensive lighting prisms on top with flutes below, and the other part carrying the flutes on top with the intensive lighting prisms below. Such an asymmetric plate is indicated in Figure 6*a* where the same reference characters are applied to the prisms, flutes and light rays.

Since these devices are primarily adapted to provide the desired lighting effect in directions crosswise of a rectilinear source they are particularly applicable to fluorescent lamps in long tubular form, with the prisms and the flutes always running in directions parallel with the length of the source.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claims, I wish it to be understood that the particular forms shown are but a few of these forms, and various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. A direct lighting luminaire employing as a light source a horizontal fluorescent lamp of substantial width and having a horizontal light transmitting cover, the luminaire being adapted for mounting heights which bring the cover into the direct line of view so that it may be in the glare zone, the cover being of the same length as the lamp and of a width several times the width of the lamp and having on one surface a series of longitudinally extending ribs which alter the divergence of the direct light from the source in planes transverse of the source and on an opposed surface a series of longitudinally extending shallow diffusing flutes which introduce throughout the entire transmitted light a minor degree of supplemental divergence in transverse planes whereby the general distributional characteristic determined by the ribs is retained, the ribs and flutes each being of uniform contour longitudinally of the cover, each width being substantially narrower than the source so that from any point of observation within the spread of the transmitted light a multiplicity of ribs and flutes occupying a width greater than the source are delivering light rays from the various portions of the source, the flute and rib bearing a width relationship such that one width is not an integral multiple of the other, whereby opposite each rib there is a fluted section substantially different from the fluted section opposite the adjacent ribs.

2. A luminaire such as claimed in claim 1, having an inverted trough shaped reflector with diffusely reflecting walls whereby scattered light is directed onto the cover.

3. A luminaire such as claimed in claim 1, wherein the ribs and flutes are on a single plate, the ribs being on the side away from the source for decreasing the divergence.

4. A luminaire such as claimed in claim 1, wherein the ribs and flutes are on a single plate, the ribs being on the side toward the source for increasing the divergence.

5. A luminaire such as claimed in claim 1, wherein the flutes are wider than the ribs and of the order of $\frac{3}{16}$ of an inch by $\frac{1}{32}$ of an inch.

6. A luminaire comprising a rectilinear light source of substantial width, and a light redirecting cover parallel with and substantially wider than the source and comprising a plurality of flat rectangular pressed glass plates arranged end to end to form a flat area coextensive with the length of the source, the plates having abutting end flanges forming a part of the exposed light emitting surface of the luminaire, the area of the plates between the flanges having longitudinally extending prisms to alter the divergence of light, the end flanges being provided with prisms extending transversely of the faces thereof and of substantially the same prism formation as the areas adjacent them to similarly alter the divergence of light and give the flanges the same lighted appearance as the body of the cover.

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