Dec. 8, 1942. T. W. ROLPH 2,304,208

LUMINAIRE FOR BLACKOUT LIGHTING

Filed Feb. 11, 1942

Fig. 1.

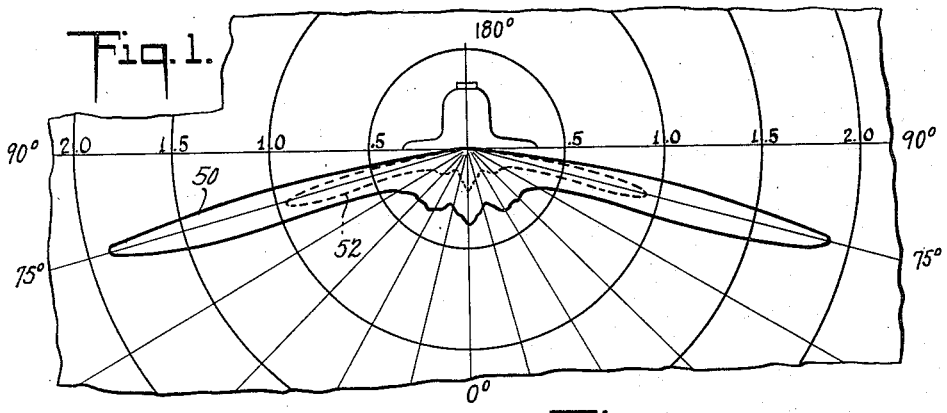


Fig. 5.

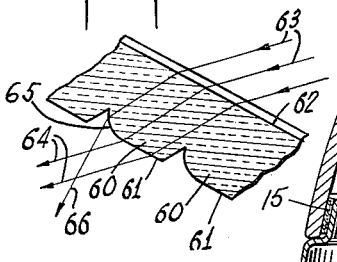


Fig. 2.

Fig. 6.

Fig. 4.

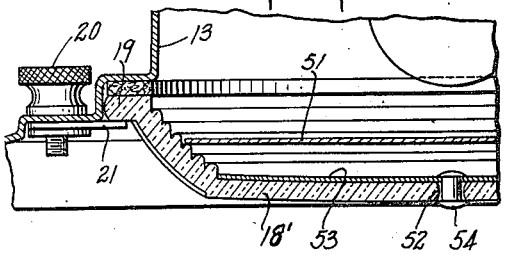
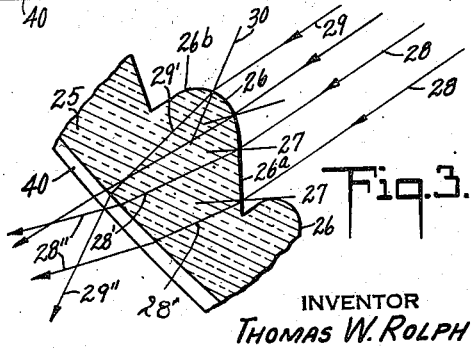


Fig. 3.



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Patented Dec. 8, 1942 2,304,208

UNITED STATES PATENT OFFICE

2,304,208

LUMINAIRE FOR BLACKOUT LIGHTING

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Application February 11, 1942, Serial No. 430,409

6 Claims. (Cl. 240—25)

The present invention relates to luminaries for outdoor blackout lighting on streets, highways and yard areas.

According to the present invention the luminaire employs a small substantially point light source, such as a low wattage incandescent lamp, and this lamp is received in an enclosure having a small optical window through which the quantity of luminous flux to be directed on to the road or street surface is allowed to pass, all other flux being absorbed within the enclosure.

According to the present invention this small amount of light flux is redistributed and transmitted into directions where the large or remote areas can receive light of the very low intensity desired.

The invention contemplates that the window through which the light escapes may be placed somewhat below the horizontal plane through the light source and at a very large angle from the nadir so that only redirected light may fall on street or yard surfaces close to the luminaire.

According to the present invention suitable means are provided whereby the light which would pass through the window is directionally transmitted and spread from the nadir up to an angle below the horizontal which is suitable for lighting the area required according to the mounting height of the luminaire, for example, 75°, and in addition the intensity of the transmitted light is increased from a minimum in the region of nadir to the maximum in the highest angle of transmitted light. This directional transmission and control of distribution can best be accomplished by prismatic ribbing on a transparent medium, such as clear glass. The ribbing may be on the inside or the outside of the glass.

The accompanying drawing shows, for purposes of illustrating the present invention, an embodiment in which the invention may take form, together with modifications of certain parts, it being understood that the drawing is illustrative of the invention rather than limiting the same.

In the drawing:

Figure 1 shows a photometric curve of the blackout lighting luminaire;

Figure 2 is a vertical sectional view with parts in elevation;

Figure 3 is a fragmentary sectional view of the prismatic member taken at a larger scale than Figure 2;

Figure 4 is a fragmentary sectional view similar to Figure 2 showing a slightly modified form of construction; and

Figures 5 and 6 are fragmentary views similar to Figure 3 showing external prismatic ribbings.

The luminaire shown in Figure 2 has a cap 10 by which the luminaire may be secured to a suitable support. This cap carries a lamp socket 11 and a small incandescent lamp bulb 12, for example, a 6 watt lamp and having its light center at L. C. The cap also carries a metal shell 13 secured in place by screws 14, the joint being made weathertight by a gasket 15. The shell 13 is painted black inside and has a shoulder portion 16 and a downwardly and outwardly extending screen or skirt 17.

A shallow crystal glass dish 18 has a flange 19 and may be secured in place below the flange 16 by a thumb screw 20 and clip 21 and retainer lugs (not shown). The depth of this dish is no greater than the depth of the skirt 17 so that no light whatever can be emitted by the luminaire above the horizontal. The bottom of the dish 18 is rendered opaque, for example, by black enamel indicated at 22. This extends out, as illustrated in the drawing slightly beyond the line 23 through L. C., which is 45° to the nadir. The cover shell 13 extends well below the line 24 through L. C. which is 75° above the nadir.

The dish 18 has a downwardly and inwardly sloping outer surface 25 and on the inner surface is provided with a number of prismatic ribs 26. These ribs, as shown more clearly in Figure 3, have a lower portion 26*a* which for practical purposes in vertical section is straight. The ribbings also have an upper portion 26*b* which is convex, as will be clear from Figure 3. The lower surfaces 26*a* of the prismatic ribbings accept a predetermined portion of the direct light from the source, and these surfaces are sloped so that their normals 27 are below the incident light rays 28. These light rays are bent upwardly in the glass, as indicated at 28', and are again bent upwardly in air, as indicated at 28'', so as to be emitted at the desired angle, say 75°, above the nadir.

Owing to the curvature of the surface of the upper portion of the prismatic ribbings the angle of incidence of the light from the source lessens until it becomes zero, and then the normal 30 to the surface is above a light ray such as ray 29. The upper portion of the prismatic ribbing therefore refracts light downwardly, as indicated at 29', and this is again refracted down by the lower surface 25 of the prism, as indicated at 29''. Rays, such as 29'', and scattered light reach down to nadir and hence it is apparent that the prismatic ribbing will distribute light all the way

from nadir out to the maximum angle such as rays 28''. The contours of all the prismatic ribbings function similarly and each ribbing is designed to secure the desired light distribution throughout the entire angle through which it operates.

In order to secure lateral diffusion without altering the distribution in vertical planes the glass dish may be provided with radial flutes, indicated at 40.

In the illustration in the drawing six prismatic ribs are employed, and these will accept a predetermined zone of direct light with a known total flux and will redistribute this flux according to the optical design provided by the ribbings. The redistribution of this flux is illustrated by the full line curve 50 of Figure 1 wherein it will be seen that the maximum candlepower is at 75° above the nadir and the candlepower falls off into the region of nadir in substantially the same manner as the distribution of a typical street lighting luminaire designed for usual street lighting. The maximum intensity is approximately 1.9 candlepower, while within 60° of nadir the maximum is substantially less than .5 candlepower.

Should one desire to use a larger light source, or should it be found that less intensities are desired than provided by the six prisms illustrated, it is possible to cut down the output in known steps by covering the lower ribs with black enamel or by placing an opaque plate, such as illustrated at 51, in Figure 4, on top of the proper prism to cut down the light intensity in the desired percentage. Where a flat opaque disc is placed on top of the third prism from the bottom so that only one-half of the prisms can function and one-half all the light output be had, the distribution remains symmetrical in a curve such, for example, as shown at 52 in Figure 5. Where it is desired to reduce the output in certain horizontal angles only, the enameling or plate 51 may be altered accordingly.

In the form illustrated in Figure 4 the glass dish 18' has a central aperture 52 and the opaque baffle is in the form of a metal disc 53 secured to the bottom of the dish by a rivet 54.

In the arrangements shown in Figures 5 and 6 similar light distributions may be obtained. The ribbings 60 of Figure 5 have lower portions 61 parallel to the upper surface 62 so that rays such as 63 emerge at 64 without change in angle to the nadir, and an upper curved portion 65 which deviates rays downwardly as indicated at 66. The ribbings 70 of Figure 6 have lower portions 71 sloped to the upper surface 72 so that rays such as 73 emerge at higher angles than the incident light, and an upper curved portion 75 which deviates rays downwardly as indicated at 76. In these forms, it will be understood, that the screening will be brought down to a depth such as to cut off all light above the horizontal.

In each case the emergent light is indicated as being at 75° from the nadir, this being a typical angle of maximum for street and yard lighting.

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 form shown is but one 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 blackout lighting unit, comprising a substantially point light source, an enclosure for the source which save for an annular window below the horizontal plane through the source and substantially above the nadir is opaque and absorbs substantially all the light falling on it, and a refractor occupying the annular window to intercept the light passing to the window from the light source and having a prismatic profile for directionally transmitting the intercepted light outwardly from the window and controlling its distribution in vertical planes.

2. A lighting unit such as claimed in claim 1, wherein each prism of the prismatic profile includes light elevating surfaces of the necessary angles to raise a portion of the light falling thereon into regions screened by the portion of the inclosure above the window and light depressing surfaces of the necessary angles to lower a portion of the light falling thereon into regions screened by the portion of the inclosure below the window.

3. A lighting unit such as claimed in claim 1, wherein each prism of the prismatic profile includes light elevating surfaces of the necessary angles to raise a portion of the light falling thereon into regions screened by the portion of the inclosure above the window and light depressing surfaces of the necessary angles to lower a portion of the light falling thereon into regions screened by the portion of the inclosure below the window, and wherein the light elevating surfaces of the prism are below the light depressing surfaces thereof.

4. A lighting unit such as claimed in claim 1, wherein each prism of the prismatic profile has light depressing surfaces which deviate a small portion of the light falling on the rib into regions screened by the opaque bottom and other surfaces which directionally transmit a dominant portion of the light falling on the rib below the horizontal at substantially uniform angles above the nadir and into regions beyond those screened by the opaque bottom.

5. A luminaire for blackout street lighting, comprising a pendant lamp socket, an incandescent lamp, an opaque light absorbing housing about the socket and lamp and extending down below the horizontal plane through the filament of the lamp and having a downwardly facing annular seat, a shallow, dish-shaped closure made of transparent material and having a peripheral flange to fit the seat, a substantially flat bottom smaller than the seat and rendered opaque so that only direct light from the source may escape through the side walls, said side walls being ribbed to directionally transmit light with controlled distribution in vertical planes to spread it from the nadir through the region screened against direct light by the opaque bottom so as to illuminate at low intensity areas near the luminaire which would otherwise be without light from the luminaire and up to an angle of substantially 75° from the nadir and increase the intensity of the transmitted light from a minimum in the region of the nadir to a maximum in the region of the highest angle of transmitted light, a skirt member carried by the housing and extending downwardly and outwardly from the seat to a level slightly below that of the bottom of the closure so as to screen the closure member at all angles above the horizontal, and means for detachably securing the closure in place.

6. A luminaire for blackout street lighting, comprising a light source, an opaque light absorbing housing about the source and extending below the horizontal plane through the source

and having a downwardly facing annular seat, a dish-shaped closure made of transparent material and having a peripheral flange to fit the seat and a substantially flat bottom smaller than the seat and rendered opaque so that only direct light from the source may escape through the side walls, said side walls being ribbed to directionally transmit light with controlled distribution in vertical planes to spread it from the nadir through the region screened against direct light by the opaque bottom so as to illuminate at low intensity areas near the luminaire which would otherwise be without light from the luminaire and up to an angle substantially 75° from the nadir and increase the intensity of the transmitted light from a minimum in the region of the nadir to a maximum in the region of the highest angle of transmitted light, a skirt member carried by the housing and extending downwardly and outwardly from the seat to a level substantially in the plane of the bottom of the closure so as to screen the closure at all angles above the horizontal, and means for detachably securing the closure in place.

THOMAS W. ROLPH.