OR 2,327,186

Aug. 17, 1943. C. A. B. HALVORSON 2,327,186

LUMINAIRE

Filed May 26, 1942 3 Sheets-Sheet 1

Fig. 1.

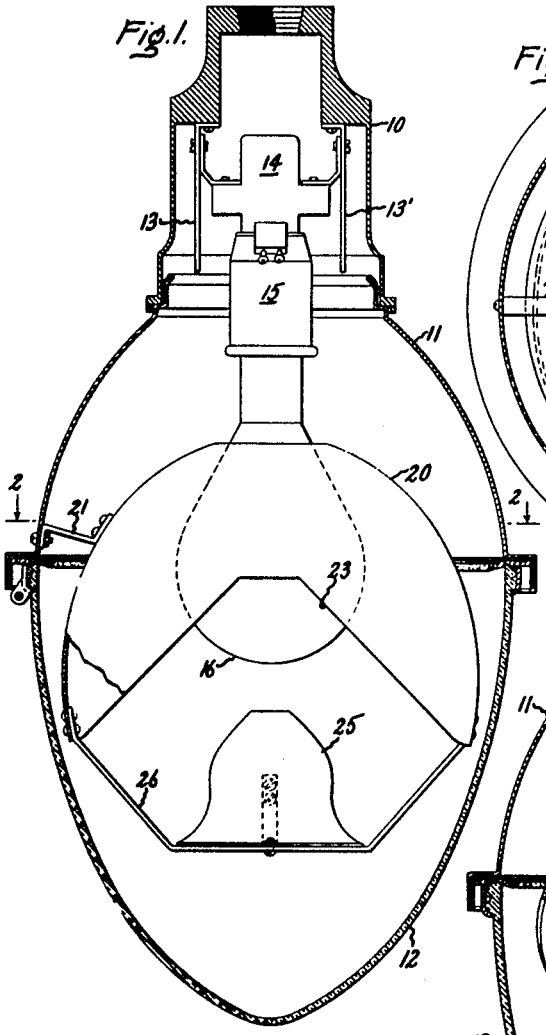


Fig. 2.

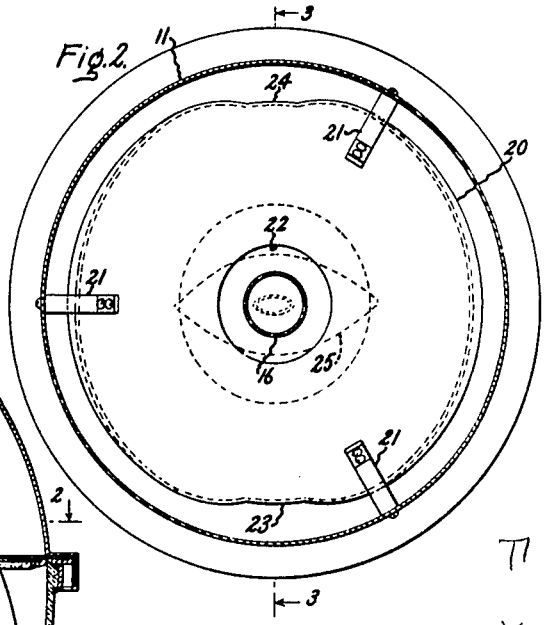
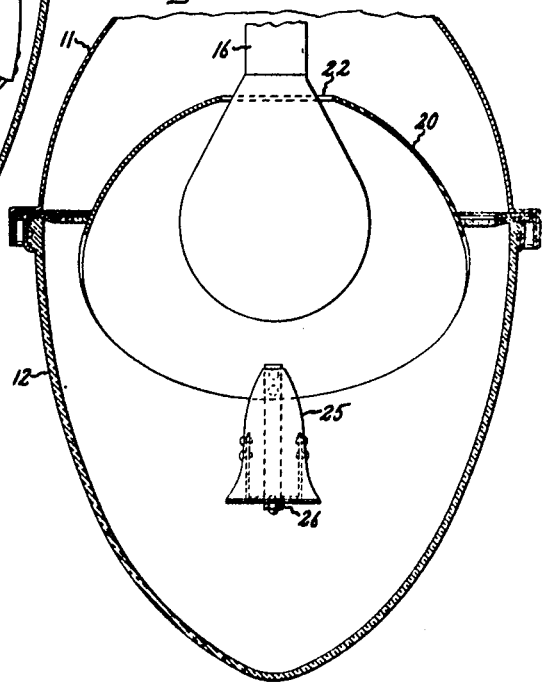


Fig. 3.



T 3 5 0

X 3 5 6 1

Inventor:
Cromwell A.B. Halvorson,
by Harry E. Dunham
His Attorney.

Aug. 17, 1943. C. A. B. HALVORSON 2,327,186

LUMINAIRE

Filed May 26, 1942 3 Sheets-Sheet 2

Fig. 4.

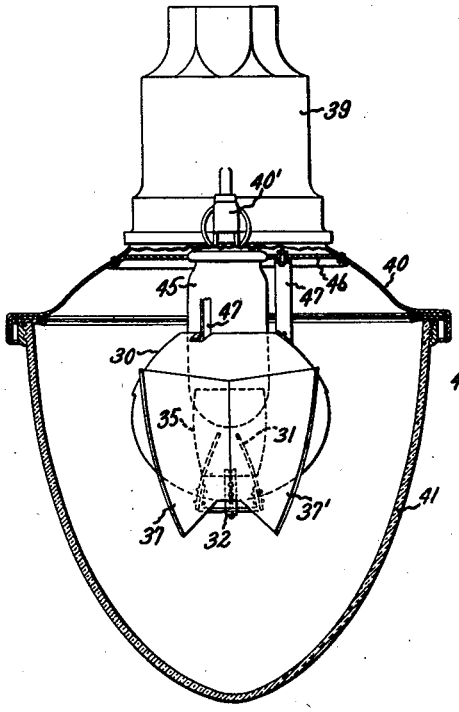


Fig. 5.

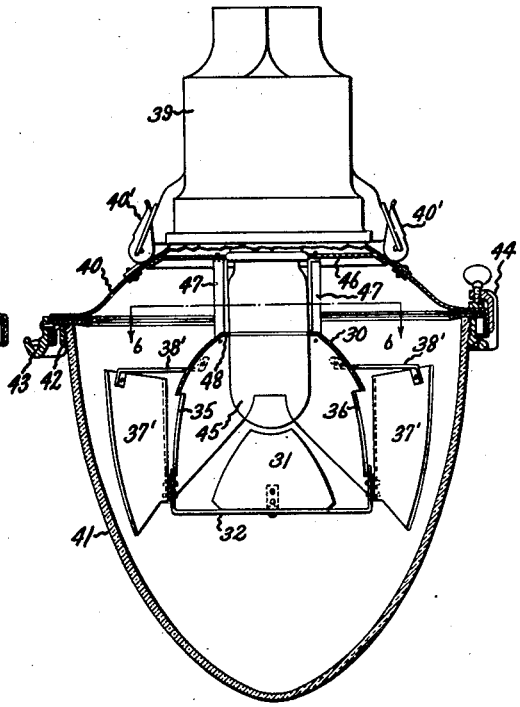
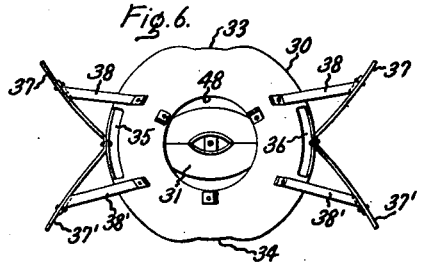


Fig. 6.



Inventor:
Cromwell A. B. Halvorson,
by Harry E. Dunham
His Attorney.

Aug. 17, 1943. C. A. B. HALVORSON 2,327,186

LUMINAIRE

Filed May 26, 1942 3 Sheets-Sheet 3

Fig. 8.

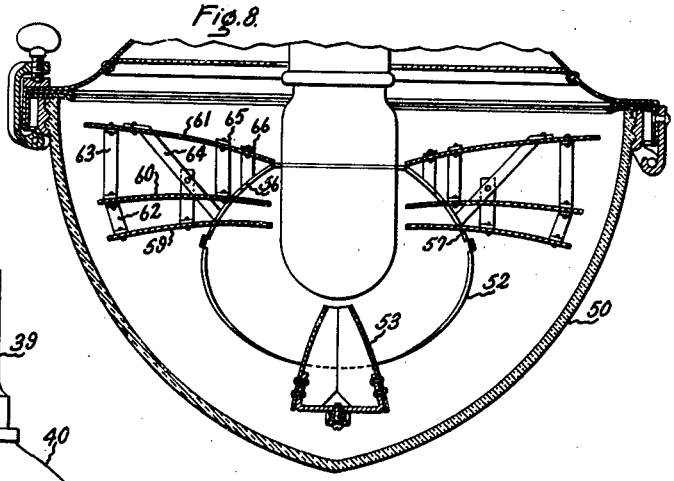


Fig. 7.

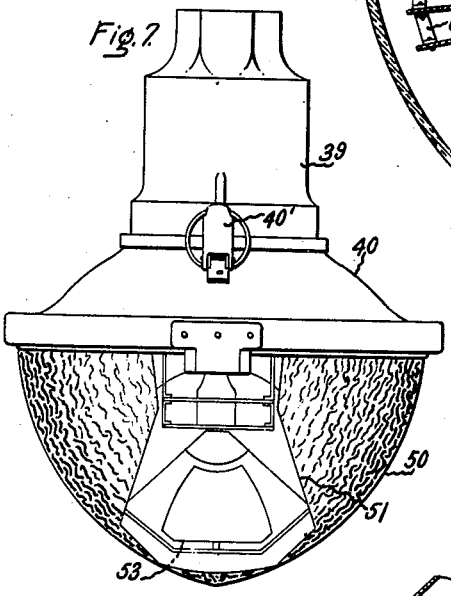


Fig. 9.

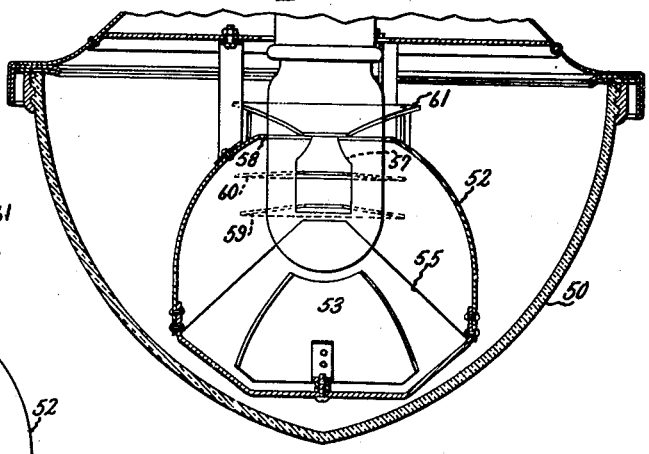
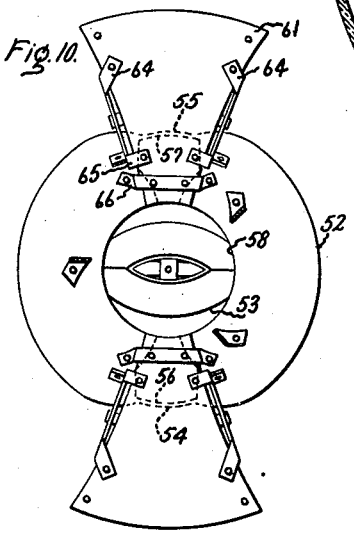


Fig. 10.



Inventor:
Cromwell A. B. Halvorson,
by Harry E. Dunham
His Attorney.

Patented Aug. 17, 1943

2,327,186

UNITED STATES PATENT OFFICE

2,327,186

LUMINAIRE

Cromwell A. B. Halvorson, Lynn, Mass., assignor to General Electric Company, a corporation of New York

Application May 26, 1942, Serial No. 444,535

9 Claims. (Cl. 240—25)

My invention relates to luminaires and more particularly to luminaires for use in lighting streets and highways.

One object of my invention is to provide an improved reflector system for highway luminaires for confining the light produced in the luminaire to the highway surface.

Another object of my invention is to provide a reflector system, as an integral unit, possible of installation in standard luminaires.

For a better understanding of my invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

In the accompanying drawings, Fig. 1 is a cross-sectional elevation of my improved reflector system supported within a common form of highway luminaire; Fig. 2 is a sectional view taken along line 2—2 of Fig. 1 and looking in the direction of the arrows; Fig. 3 is a sectional view looking in the direction of arrows 3—3 in Fig. 2; Figs. 4 and 5 are sectional vertical elevations taken at right angles to each other of a modified form of my reflector system, also installed in a common form of luminaire; Fig. 6 is a plan view looking in the direction of arrows 6—6 of Fig. 5; Fig. 7 is a vertical elevation of a luminaire provided with a second modification of my reflector system; Fig. 8 is an enlarged sectional vertical elevation of the reflector system of Fig. 7; Fig. 9 is a sectional vertical elevation of the reflector system of Fig. 7 taken at right angles to the sectional view of Fig. 8; and Fig. 10 is a plan view of the reflector system illustrated in Figs. 7, 8 and 9.

Referring to the drawings in detail, Figs. 1, 2 and 3 disclose a luminaire comprising a hood 10, a conoid-shaped reflector housing 11 and a globe 12. The hood 10 supports, upon a pair of brackets 13, 13', a receptacle 14, a socket 15 and a lamp 16. This type of luminaire is commonly used for highway lighting. The housing 11 has heretofore been made of sheet metal provided with an inner reflecting surface so that the light projected toward it from the light source was reflected in a cone-shaped beam which illuminated a circular area. The disadvantage of such distribution from a conoidal reflector is that, since the highway is a continuous narrow surface, a large portion of the light from the conical beam projected by such a reflector is projected, unless otherwise deflected, off the highway surface and in many instances is projected upon dwellings along the highway. This is objectionable besides being a total loss as far as lighting the highway surface is concerned.

In accordance with my invention I provide an ellipsoidal reflector 20 supported within the housing 11 and close to the lamp 16 by suitable brackets 21 attached to the housing 11, so that its axis is vertical to the surface which is to be lighted, and so that the focal point of the reflector coincides with the center of the light source of lamp 16. The lamp projects into the reflector 20 through an axial opening 22. The surface of the ellipsoidal reflector surrounds the upper half of the light source, being extended below the plane of its focus and almost to the plane of its conjugate focus to form an opening having a width so proportioned to the width of a highway over which the reflector is to be suspended that the base width of the beam of direct light projected through the opening will correspond to the width of the highway. In order that this luminaire may cover a substantial length of the highway I widen the beam of direct light along one axis by providing two diametrically opposite notches 23, 24 in the reflector edge. These notches are tapered and are cut off to resemble a truncated cone. The depth thereof is such that the angular width of the beam is approximately 160°, a 10° below horizontal cutoff being provided to reduce glare to a practical value. The tapered sides of these notches confine the light to a narrow beam the base of which is equal to the width of the highway. The total opening in this ellipsoidal reflector, as above described, provides a fan-shaped beam of direct light which is directed only to the highway surface when the reflector is suspended over the highway and is properly alined therewith.

That portion of the light flux which is intercepted by the ellipsoidal reflector surface is reflected and concentrated at the conjugate focal point in accordance with the well-known reflection characteristics of ellipsoids. In the illustrated reflector 20 this conjugate focal point is approximately in the plane of the reflector opening and in order to redirect the light which is concentrated at this point into the direct-light beam projecting through the reflector opening, including the notches 23 and 24, I provide a secondary reflector 25 having its reflection surfaces centered about this focal point. This secondary reflector 25 may be supported below the light source 16 by a stirrup bracket 26 attached to the reflector 20, as illustrated, or by any other suitable means.

The secondary reflector **25** is generally cone shaped having an elliptical base, its surface being developed to direct the light projected from the ellipsoid predominantly in two directions and in two beams directed to coincide with the fan-shaped beam of direct light projected by the luminaire. This cone surface is further developed so that the reflected light is projected mainly to the outer region of the beam of direct light. Since that region of the beam is projected to highway surface areas farthest from the luminaire and the light intensity on these areas is therefore relatively low, it is desirable to add the reflected light to this portion of the direct light beam to build up that light intensity.

This secondary reflector also intercepts a solid angle of direct light which is projected in its direction from the light source. This light is subtracted from the area directly below the luminaire where the highway surface is nearest the luminaire and therefore most intensely illuminated, and is scattered throughout the beam to illuminate surfaces farther from the luminaire. This redistribution of light flux, therefore, tends to even out the light intensity on the surface area illuminated by a single luminaire.

In Figs. 4, 5 and 6 I have illustrated a modification of my reflector system. The ellipsoidal reflector **30** is in this case similar to the reflector **20** but its surface is extended below the conjugate focal plane and the secondary reflector **31** is supported by a stirrup bracket **32** so that it is wholly above the plane of the reflector edge. This secondary reflector in this modification reflects the light flux received from the ellipsoidal surface into the beam of direct light projecting through the notches **33** and **34** in the reflector edge.

The reflector **30** is also provided with rectangular openings, windows **35** and **36**, placed diametrically opposite to each other upon an axis at right angles to the axis of the notches **33** and **34**. The light projecting through these windows **33** and **34** is redirected by a pair of cylindrical reflectors **37** and **37'** supported at each window by suitable brackets **38**, **38'** at one end and attached to the reflector at the other end with their line of intersection parallel to the axis of the ellipsoidal reflector. The curvature of the cylindrical reflector surfaces is such that this light is reflected at right angles into the main light beam. The advantage gained by this addition of the cylindrical reflector surfaces is that the surface area from which light is projected by the luminaire is increased, thereby decreasing the unit area intensity and correspondingly reducing the glare from this luminaire. A somewhat greater efficiency is also obtained in that the light projected by the cylindrical reflectors is added to the main beam after impinging upon only one reflector surface. The light projected from the secondary reflector **31** is light that is mainly received from the surface of the ellipsoidal reflector.

The luminaire of Figs. 4, 5 and 6 is a standard type comprising a hood **39**, a housing **40** latched to the hood by suitable latches **40'**, a deep globe **41** attached to the housing by a ring **42** attached to the globe, hinged to the housing at **43** and fastened thereto by a suitable latch **44**. The light source is a lamp **45** mounted in a socket (not shown) along the axis of the hood and housing. The reflector system is suspended from a partition **46** by brackets **47** so that the lamp projects into the ellipsoidal reflector **30** through an axial opening **48** at the upper end and the light center within the lamp coincides with the focus of the reflector.

In Figs. 7, 8, 9 and 10 I have illustrated another modification of my reflector system. The luminaire herein illustrated is the same as that of Figs. 4 and 5 except that a shallow globe **50** is used having a stippled surface interrupted by a clear zone **51** through which the narrow fan-shaped beam projects without diffusion.

The reflector system in this modification includes an ellipsoidal reflector **52** and an auxiliary reflector **53** at the conjugate focus. Notches **54** and **55** are provided, these being similar to the notches in the ellipsoidal reflectors **20** and **30** of Figs. 1 and 4. In addition thereto windows **56** and **57** are provided above the notches and projecting down from the axial opening at the top. These windows are generally rectangular, a tapered slot being provided at the top to connect the window with the axial opening **58** through which the lamp projects into the ellipsoidal reflector.

The light projecting through these windows is redirected by cylindrical reflectors. A group of three reflectors **59**, **60**, **61** is shown at each window. The curvature of these reflectors is parabolic and they are triangularly shaped to coincide with the angular beam spread between the light center and the edge of the windows. The lower two reflectors **59** and **60** project into the reflector through the windows and are spaced relatively closely to each other. The third reflector **61** is spaced farther away and limits the upwardly projected light. These reflectors are spaced and supported by suitable braces **62**, **63**, **64**, **65** and **66** to distribute the light from the windows into the upper portion of the fan-shaped beam projected by the light source through the opening in the ellipsoidal reflector and by the auxiliary reflector at the conjugate focus of the ellipsoidal reflector.

The advantage of this modification is that the cylindrical, wing-shaped, reflectors exercise a more accurate control over light distribution at the edges of the main beam making it possible to raise the light intensity at the remote sections of the illuminated area of the highway.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a reflector system, the combination of an ellipsoidal reflector having a pair of diametrically opposite notches in its edge to define light beams projecting from the light source at the focus of the reflector, and a secondary reflector mounted about the conjugate focal point of said ellipsoidal reflector arranged to project light reflected from said ellipsoidal reflector into the light beams projecting through said notches in the ellipsoidal reflector.

2. In a reflector system arranged on a substantially vertical axis for a highway luminaire, the combination of an ellipsoidal reflector provided with tapered openings projecting upwardly toward the axis of the ellipsoidal reflector from the edge thereof to define beams of direct light projected from the light source at the focus of said ellipsoidal reflector, and a secondary reflector at the conjugate focus of said ellipsoidal reflector, said secondary reflector and said tapered openings in the side of said ellipsoidal reflector cooperating to direct the light produced by a luminaire upon a highway in a narrow fan-shaped beam.

3. In a luminaire, the combination of a light source and a reflector system arranged on a substantially vertical axis including an ellipsoidal reflector surrounding said source and provided with a notched edge the notches defining the upper limits and the width of a light beam projecting from said source, a secondary reflector mounted below the light source and substantially at the conjugate focus of said ellipsoidal reflector comprising reflecting surfaces arranged at an angle to the axis of the reflector and cooperating respectively with the notches in said edge to project the light reflected by said ellipsoidal reflector at least partially through said notches.

4. In a reflector system, the combination of an ellipsoidal reflector having a vertical axis the edge of which projects below its conjugate focal plane, notches in said reflector projecting from said edge to a point above its conjugate focal plane, and an auxiliary reflector mounted on the axis and at said conjugate focal plane and provided with surfaces cooperating with said notches to project light reflected by said ellipsoidal reflector through said notches whereby the direct light beam from a source at the focal point of said ellipsoidal reflector is limited to a predetermined solid angle by the opening in said reflector and the reflected light from the surface of said ellipsoidal reflector is added to selected portions of that beam.

5. In a luminaire including a housing, a globe and a light source enclosed within said housing and globe, the combination of a reflector system arranged on a substantially vertical axis including an ellipsoidal reflector provided with two notches diametrically opposite each other at the edge of said ellipsoidal reflector, an auxiliary reflector substantially at the axis of said light source and above the edge of said ellipsoidal reflector having surfaces arranged to limit the lower edge of a light beam projected through said notches of said ellipsoidal reflector, openings in said ellipsoidal reflector diametrically opposite each other and upon an axis substantially at right angles to the axis of said notches in said ellipsoidal reflector, and cylindrical reflectors arranged to reflect the light projecting therethrough and to add it to the beams projecting through said notches.

6. In a luminaire comprising a housing, a globe and a light source enclosed by said houesing and globe, the combination of a reflector system including a substantially ellipsoidal reflector having a notched edge, a secondary reflector mounted at the conjugate focus of the ellipsoidal reflector provided with surfaces alined respectively with the notches in said reflector edge, said notched edge and said secondary reflector surfaces limiting the respective beams from said light source, openings in said ellipsoidal reflector above said notches, and parabolic cylindrical reflector surfaces supported by and projecting outwardly from said ellipsoidal reflector at said openings to direct light flux projecting through said openings into the main beam projected by said ellipsoidal reflector.

7. In a reflector system for a highway luminaire, the combination of an ellipsoidal reflector having an upper and a lower axial opening, notches projecting from the lower axial opening in said ellipsoidal reflector and shaped to define narrow beams of direct light projecting from a light source at the focal point of said reflector, a secondary reflector mounted at the conjugate focal point of said ellipsoidal reflector and arranged to cooperate with said notches to project light reflected by said ellipsoidal reflector into the beam defined by the notches in said ellipsoidal reflector, notches projecting from the upper axial opening in said ellipsoidal reflector, and cylindrical reflectors cooperating with said last mentioned notches to direct light into the defined beam of direct light projected through said first mentioned notches.

8. In a reflector system, the combination of a conoidal reflector provided with a focal point and a conjugate focal point and having notches spaced from each other in its edge to define light beams projecting from the light source at the focal point of the reflector, and a secondary reflector mounted about the conjugate focal point of said conoidal reflector arranged to project light reflected from said conoidal reflector into the light beams projected through said notches in the conoidal reflector.

9. In a reflector system, the combination of a concave reflector provided with a focal point and a conjugate focal point and provided with notches projecting from its edge towards its focal plane, and a secondary reflector mounted about the said conjugate focal point having its surface developed to project light reflected from said concave reflector into the light beams projecting through said notches from a light source mounted at the said focal point.

CROMWELL A. B. HALVORSON.