

June 17, 1947.

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2,422,378

LOW LEVEL REFLECTOR

Filed Nov. 22, 1943

2 Sheets-Sheet 1

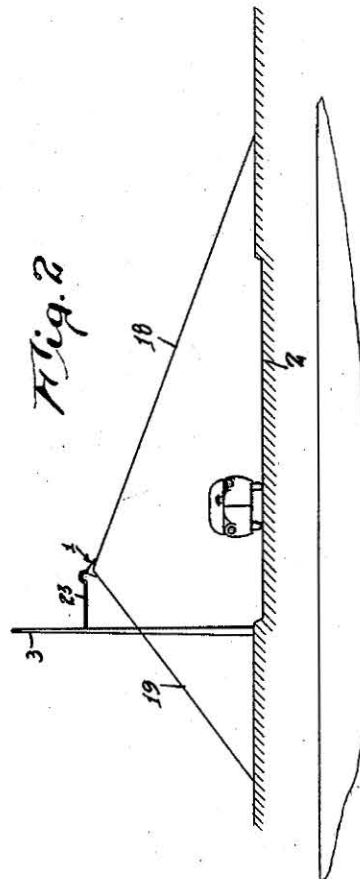
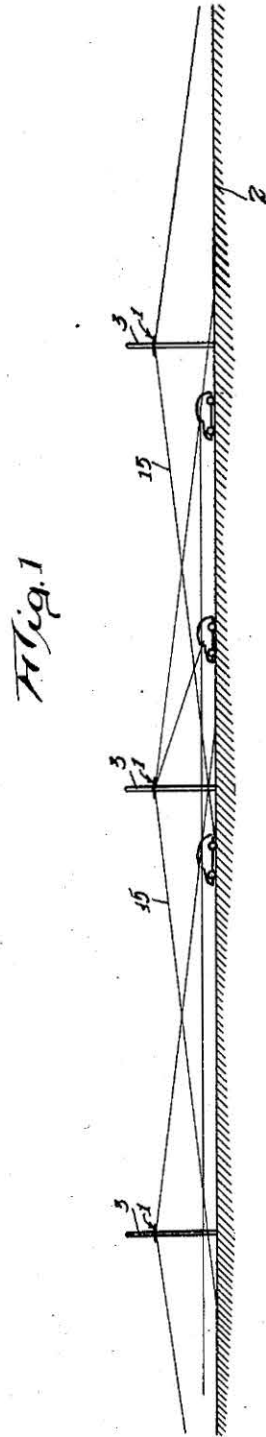


Fig. 2a

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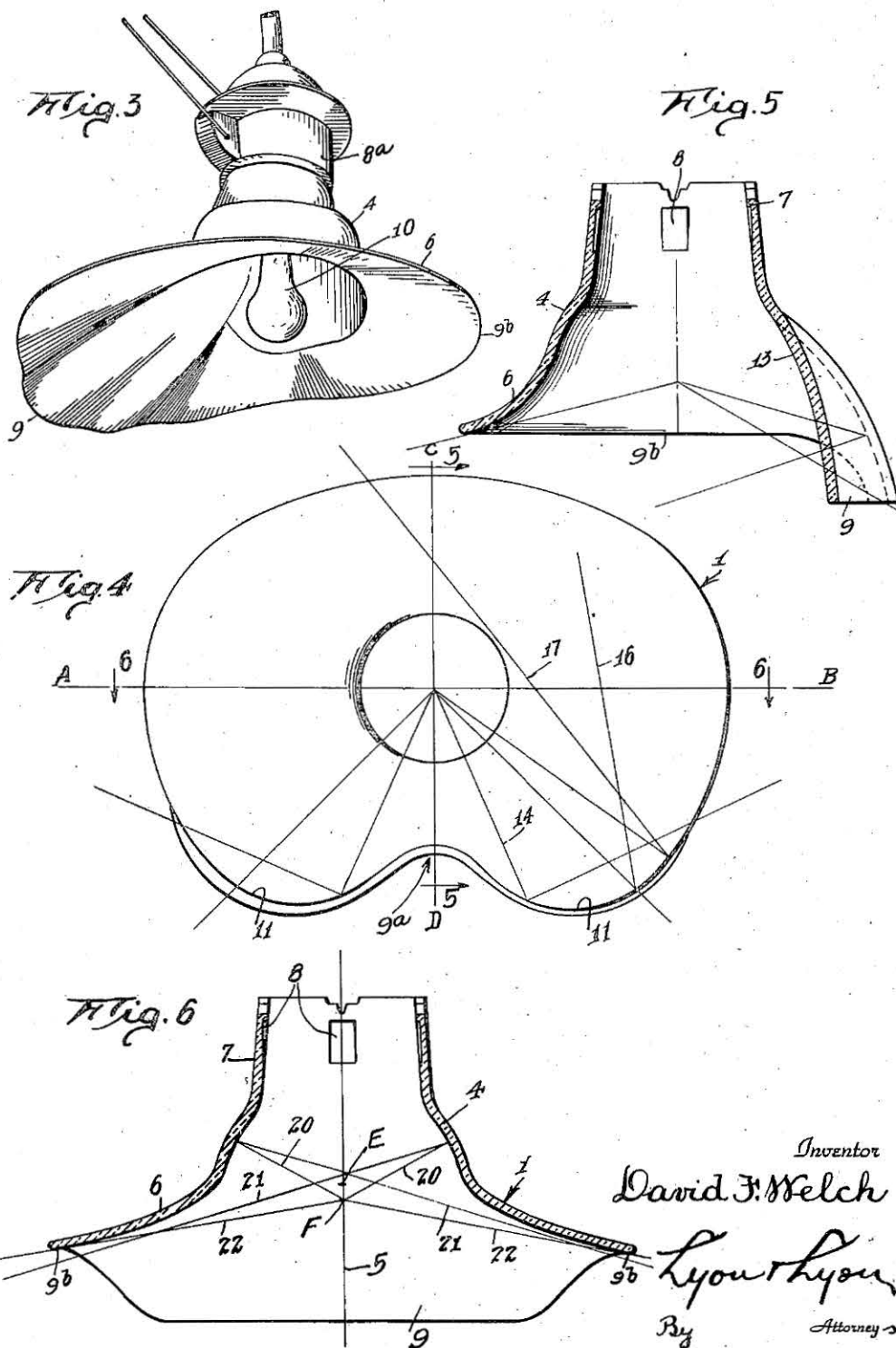
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LOW-LEVEL REFLECTOR

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3 Claims. (Cl. 240-103)

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This invention relates to the lighting of highways. In accordance with the prevailing practice in lighting streets or highways, overhead lights are provided spaced equidistant along the highway or street, and reflectors are employed above the lights to reflect and disperse the light in a substantially circular spot below the light. This method is wasteful of light, and does not effect a substantially uniform distribution of the light along the roadway.

One of the objects of the present invention is to provide a reflector of special construction, particularly adapted for lighting a street or highway, the general purpose being to distribute the light rays over the area to be illuminated by utilizing upward rays and rays ordinarily reflected directly down to illuminate relatively distant areas that are usually inadequately illuminated, but where a higher degree of visibility is desirable.

Another object of the invention is to provide a reflector of improved form, which is so constructed that if located toward one side of a street or roadway, it will operate to reflect the light in such a way that a light beam will be cast down onto the roadway so as to illuminate its width and adjacent sidewalks; and at the same time, casting beams of light longitudinally of the roadway; also to accomplish these objects without permitting any rays of light to pass in a substantially horizontal direction from the lamp.

Another object of the invention is to provide an improved reflector capable of being used on equidistant light poles, and which will operate to give a substantially uniform intensity of light between the poles, at the same time illuminating effectively the full width of the roadway or street.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient low level reflector.

A preferred embodiment of the invention is described in the following specification, while the scope of the invention is pointed out in the appended claims.

In the drawings:

Fig. 1 is a diagrammatic view illustrating a series of light poles and lights having reflectors embodying this invention, and illustrating the general direction of rays that are reflected longitudinally of the roadway and down onto the same.

Fig. 2 is also a diagrammatic view, and is a vertical section taken transversely to the road-

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way in the vicinity of a lamp post; and illustrating the direction of the reflected rays that are cast down onto the roadway in order to illuminate its full width.

5 Fig. 2a is a diagrammatic view in which the ordinates of the area indicate approximately the intensity of illumination of a transverse area under a light having a reflector embodying my invention.

10 Fig. 3 is a perspective of a lamp and reflector embodying my invention.

Fig. 4 is a bottom plan of a reflector embodying my invention, and showing its contour.

15 Fig. 5 is a vertical section taken about on the line 5-5 of Fig. 4, but showing the reflector in an upright position instead of in an inverted position as shown in Fig. 4.

20 Fig. 6 is a vertical section taken about on the line 6-6 of Fig. 4, but showing the reflector in its upright position.

Before proceeding to a more detailed description of the invention, it should be stated that this reflector is particularly adapted for operating at a location to one side of a street or roadway, and it has a special form adapting it to reflect the rays of light from the lamp associated with the reflector, so that the full width of the roadway will be illuminated in the vicinity of the lamp, while a considerable number of rays will be reflected in a general longitudinal direction along the roadway. To this end the reflector is characterized by its form with relation to two axes, one of which extends substantially parallel with the roadway, and the other of which is the axis of symmetry for the reflector, extends transversely to, and preferably substantially at right angles to the direction in which the roadway extends.

Referring to Fig. 4, the line A, B, indicates an axis or axial plane of the reflector 1, which may be considered the main axis for the reason that it extends longitudinally with respect to the roadway 2 on which the lamps and reflectors may be mounted on equidistant spaced lamp poles 3 (see Fig. 1).

45 However, the reflector 1 is preferably not symmetrical with respect to the plane A, B, but is symmetrical with respect to a transverse axial plane C, D. This axial plane or axis C, D, preferably extends substantially at right angles to the plane A, B. The reflector preferably includes a body portion 4 which may be of approximate spheroidal form or paraboloidal with respect to the vertical central axis 5 which is a true geometric axis of this part of the reflector; and be-

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low the body portion 4, the reflector is formed with a downwardly and outwardly extending apron 6. The reflector is formed with an upwardly extending neck portion 7 which may be cylindrical or slightly conical, and provided with means such as sockets 8 on the inner face of its wall, for facilitating its attachment to a supporting collar or lamp casing 8a which supports an electric lamp 10 on the vertical axis of the reflector, and so that the center of illumination from the lamp will be disposed at a point such as the point F (see Fig. 6) which should be located slightly below the center of curvature E for the approximate spheroidal body portion 4. The reason for this will appear hereinafter in connection with the lines indicating the manner in which the reflected rays will pass from the reflector after being reflected by the body portion 4, and so that they will pass generally up and down the roadway. On the side of the reflector that is located toward the lamp pole 3, that is to say, on the side disposed away from the roadway, the apron 6 is offset inwardly and downwardly so that it presents a downwardly projecting extension or lip 9 that extends a considerable distance below the normal edge 9b (Fig. 5) for the remainder of the reflector, and at this point a pair of inwardly facing concave reflecting surfaces 11 are formed (see Fig. 4); and this lip 9 extends inwardly on the transverse axis C, D, considerably so that the concave reflecting surfaces 11 approach the central axis 5 of the reflector adjacent this axis, forming a rounded re-entrant angle 9a.

The reflector is preferably made of opaque glass, porcelain or other vitrified material, or the reflector may be made out of metal. The inner surface is provided with an integral or applied coating 13 of enamel or similar reflecting material. The function of the reflecting surfaces 11, is to reflect rays such as the rays indicated by the light lines 14, in the general direction in which the roadway extends, and in this way a beam is projected from each lamp up and down the roadway, the upper edges of which beams are indicated by the lines 15 in Fig. 1. The poles 3 are spaced so that these lines 15 will impinge upon the roadway somewhere within the vicinity of the next adjacent pole. But in addition to the longitudinally reflected beams that are projected up and down the roadway, the outer portions of the convex reflecting surfaces 11 which are remote from the axis C, D, will operate to reflect a considerable quantity of light as indicated by the light lines 16 and 17 which indicate the direction of rays or beams of light that will pass at right angles to the axis A, B, and transverse to the roadway. This will give resultant transverse beams giving a floodlight effect extending from each lamp; and the upper edges of these transverse reflected rays are indicated by the lines 18 and 19 in Fig. 2.

A considerable amount of reflection occurs from the inner or concave surface of the inner or body portion 4 of the lamp. The manner of reflecting these light rays at this point is indicated by the lines 20 and 21, in which the lines 20 indicate the rays before reflection, and the lines 21 indicate the rays after reflection. These reflected rays 21 will pass down under the edges 9b of the apron, so that they will pass up and down the roadway, instead of being concentrated directly below the reflector, and in addition to this, there is a considerable quantity of direct rays passing from the point of illumination F, the

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upper edge of which rays or beams are indicated by the lines 22 in Fig. 6.

The effect of this reflector is to give a generally uniform distribution of light as to intensity, and this is accomplished without the lights producing a glare in the eyes of persons passing along the roadway. At the same time, the construction of the reflector substantially cuts off any rays passing in a horizontal direction from the point of illumination. The inclination or angle of the apron 6 is preferably about 15° below the horizontal line; in other words, the elements of this apron make an angle of approximately 15° with a horizontal plane. In attaching the reflectors 1 to their supporting arms 23 on the poles, they may be mounted in a slightly tilted position such as indicated in Fig. 2. In other words, the "vertical" axis 5 of the reflector may be in a truly vertical position, or it may be tilted more or less in a normal plane extending transverse to the direction of the roadway. This of course, would depend upon special requirements in any particular situation.

While this reflector will operate very effectively in any situation where a roadway or court is to be lighted from the side, it is particularly advantageous in dim-out areas where it is desirable to prevent any rays of light from passing upwardly from the source of illumination; or where it is also desirable to prevent concentrations or highly illuminated areas which would tend to increase the reflection from lighted areas onto the clouds, or in such a way as would enable silhouettes of ships to be seen from the sea along a coast.

Although I have shown and described a particular embodiment of my invention, it is understood that I do not wish to be limited to the details herein set forth, but include in the scope of my invention the constructions, combinations, and arrangements as set forth in the appended claims.

What I claim is:

1. A reflector for highway illumination, comprising: an inverted bowl, the upper portion thereof being partially spheroid for effecting substantially uniform distribution of reflected light from a source of light located approximately at its center; a skirt depending from said partial spheroid; three sides of said skirt flaring outwardly to points below the center of said spheroid with curvatures reversed to that of said spheroid and defining in part a three-quarter cone with concave sides and an apex at the center of said spheroid; the remaining side of said skirt continuing the curvature of said spheroid but at a greater arc and projecting below said first-mentioned sides; said remaining side including a re-entrant portion whereby the bowl is essentially kidney-shaped in plan and defining reflecting surfaces for directing rays from the center of said spheroid in obtusely divergent directions from each other.

2. A reflector for highway illumination adapted to be mounted at one side of a highway and confine its illumination to the near and far sides of the highway and along the length thereof, said reflector comprising: a bowl substantially spheroidal in form and having means for suspension from an electric fixture whereby a source of light may occupy the center of said spheroid; an integral flared skirt curving outwardly and downwardly from said bowl, the portions of said skirt directed toward the far side of the highway and along the length of the highway flaring outwardly

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and downwardly at relatively obtuse angles to define an edge located below the center of said spheroid, and the remaining portion of the skirt facing the near side of the highway continuing downwardly and approaching the vertical, the center of this portion being folded inwardly to form a re-entrant region above and below the level of the flared skirt the sides of which reflect light from said center of the spheroid in the direction of the length of the highway.

3. A highway reflector, comprising: a central substantially hemispherical bowl; a skirt continuing from said bowl, substantially three quarters of said skirt flaring outwardly with a curvature reversed to that of said bowl and the fourth side continuing in the direction of curvature of said bowl but at a greater radius, said fourth side having a vertical channel in its external surface to form a re-entrant internal reflecting surface, the entire skirt extending below the center of said bowl and said fourth side and its re-entrant

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portion depending below the remaining three sides.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
270,339	Ritchie	Jan. 9, 1883
1,189,231	Benjamin	July 4, 1916
1,515,897	Walser	Nov. 18, 1926
1,894,227	Saaf	Jan. 10, 1933
2,266,190	Giese	Dec. 16, 1941

FOREIGN PATENTS

Number	Country	Date
398,966	Great Britain	1933
203,669	Germany	1908
429,668	France	1911