

[54] LUMINAIRE

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[58] Field of Search 240/25, 103 R

[56] **References Cited**

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[57] **ABSTRACT**

Luminaire optical system for providing asymmetric semi-directional light distribution along a one-way highway comprises a concave reflector having a bottom opening inclined toward the direction of travel. The reflector has opposite beam reflecting areas formed of a plurality of vertically extending horizontally adjacent stepped reflecting sections, each section formed of vertically adjacent reflecting surfaces which are parabolic in vertical section with foci at the light center and with axes oriented at different vertical angles for spreading the outgoing light vertically. The reflecting surfaces are formed of horizontally adjacent reflecting surface portions oriented in different horizontal directions for spreading the outgoing light laterally.

8 Claims, 8 Drawing Figures

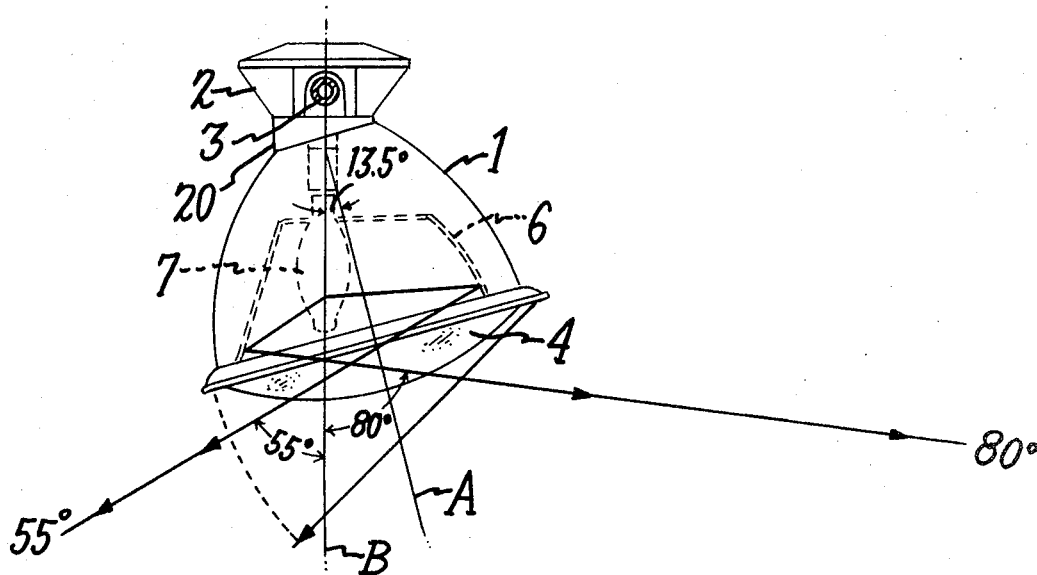


Fig. 1.

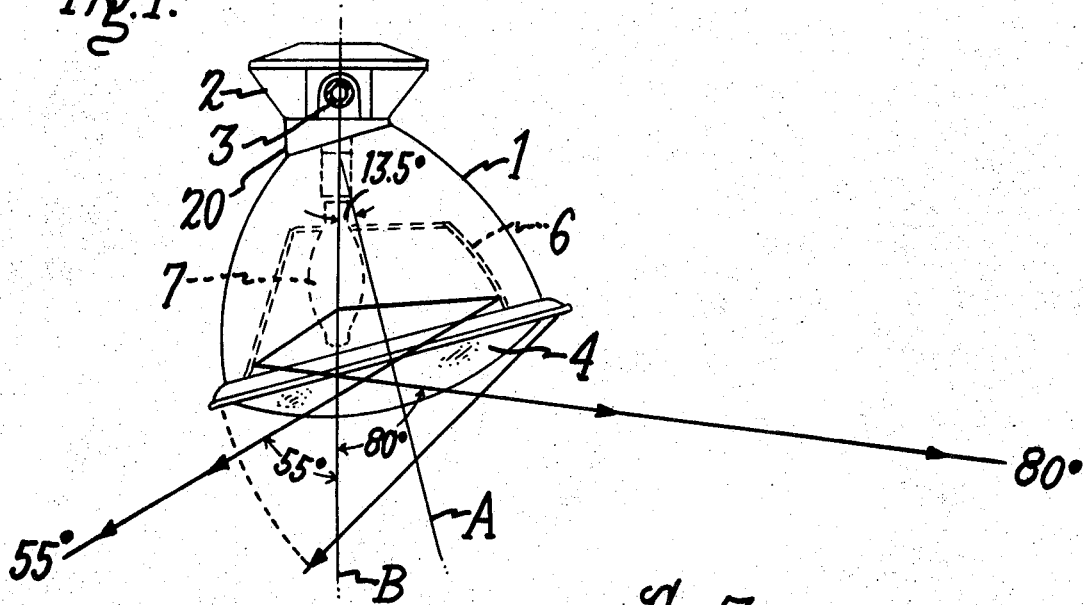


Fig. 2.

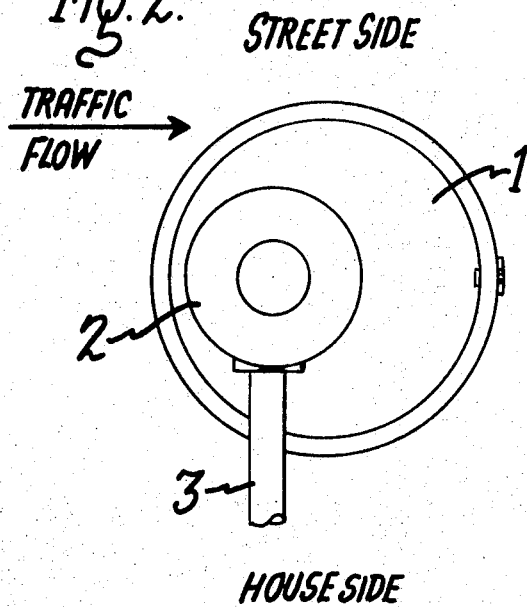
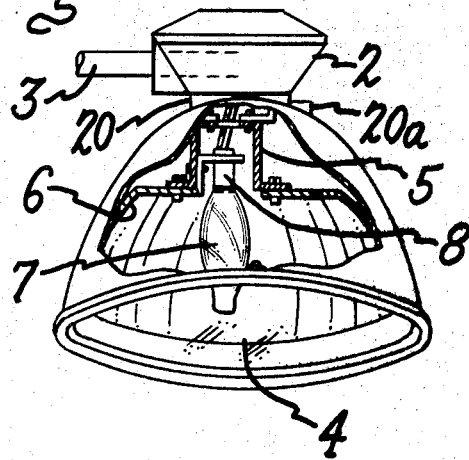
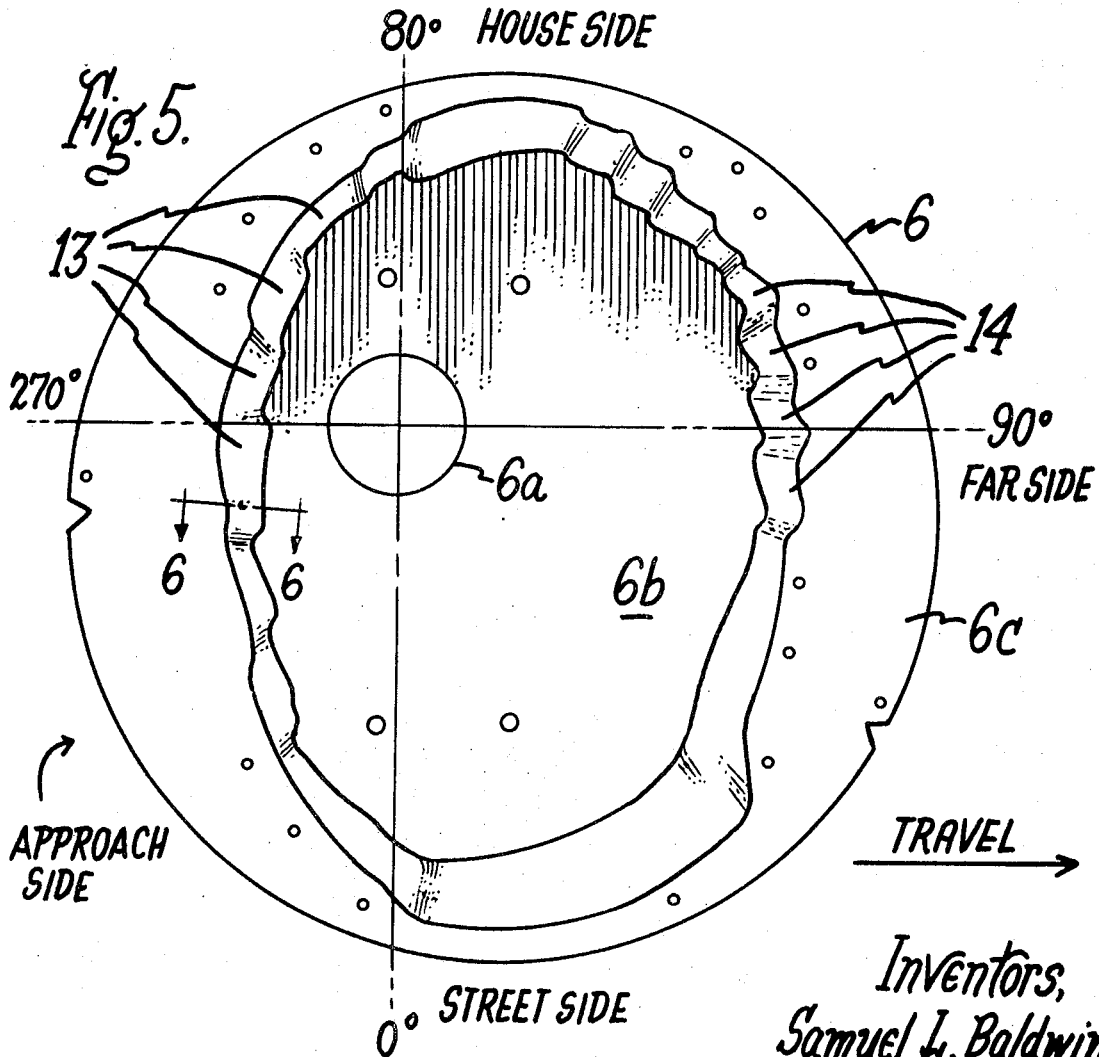
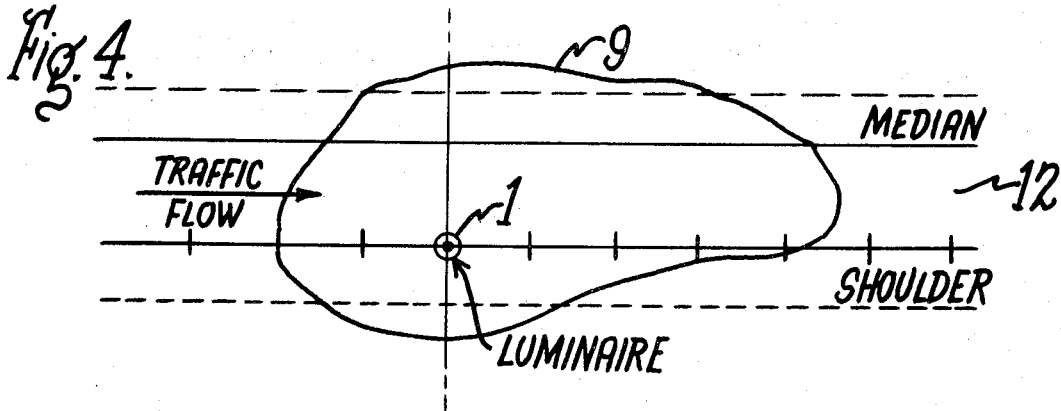


Fig. 3.

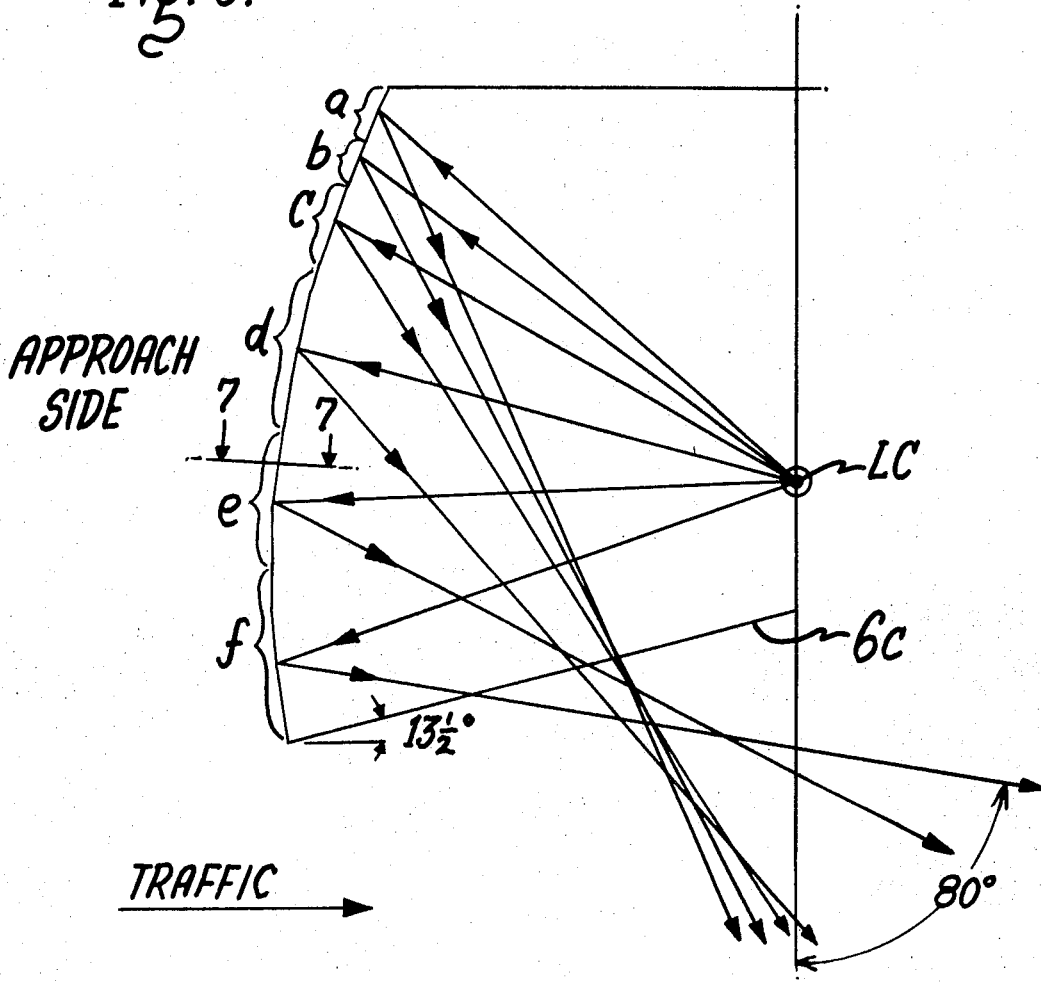


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Fig. 6.



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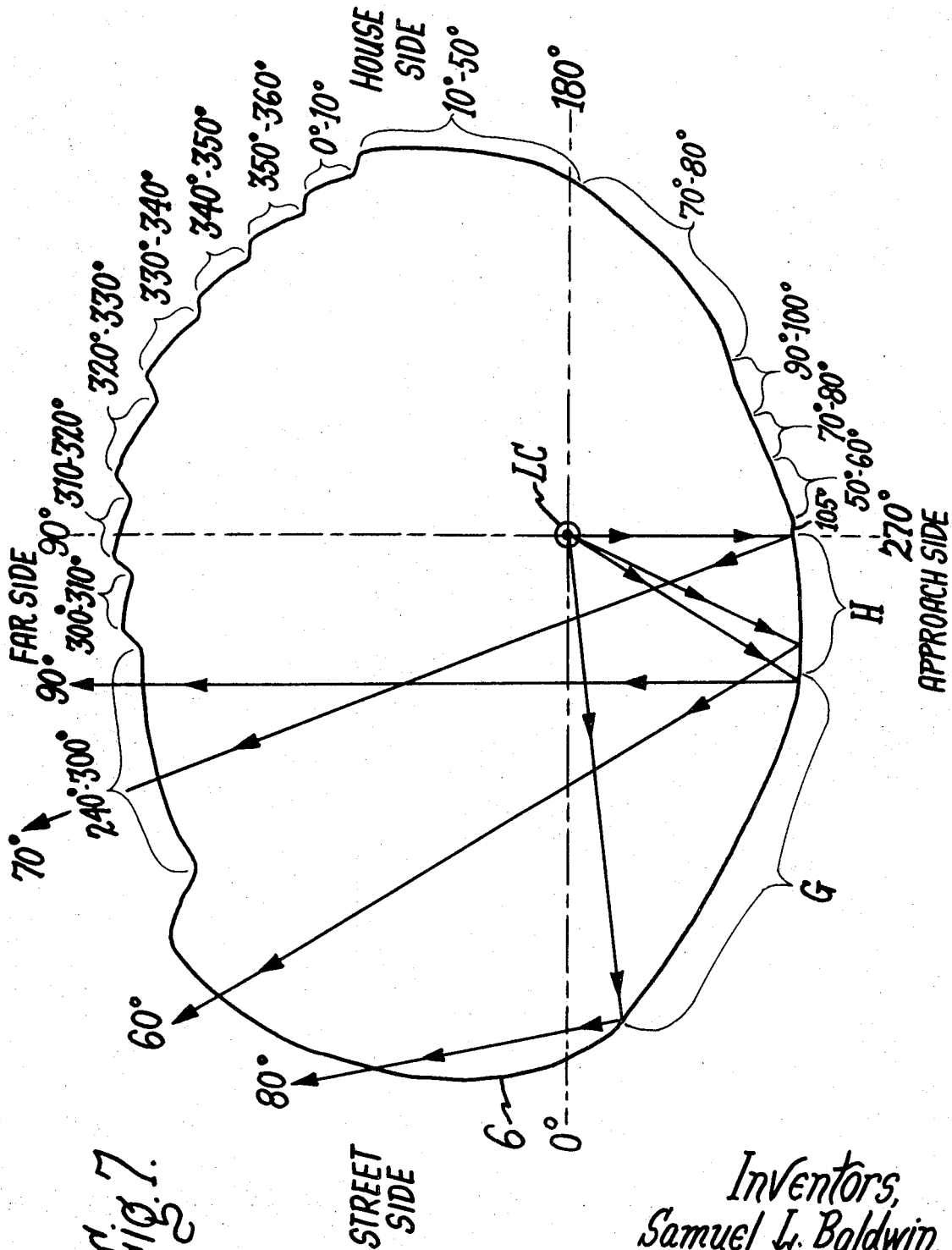
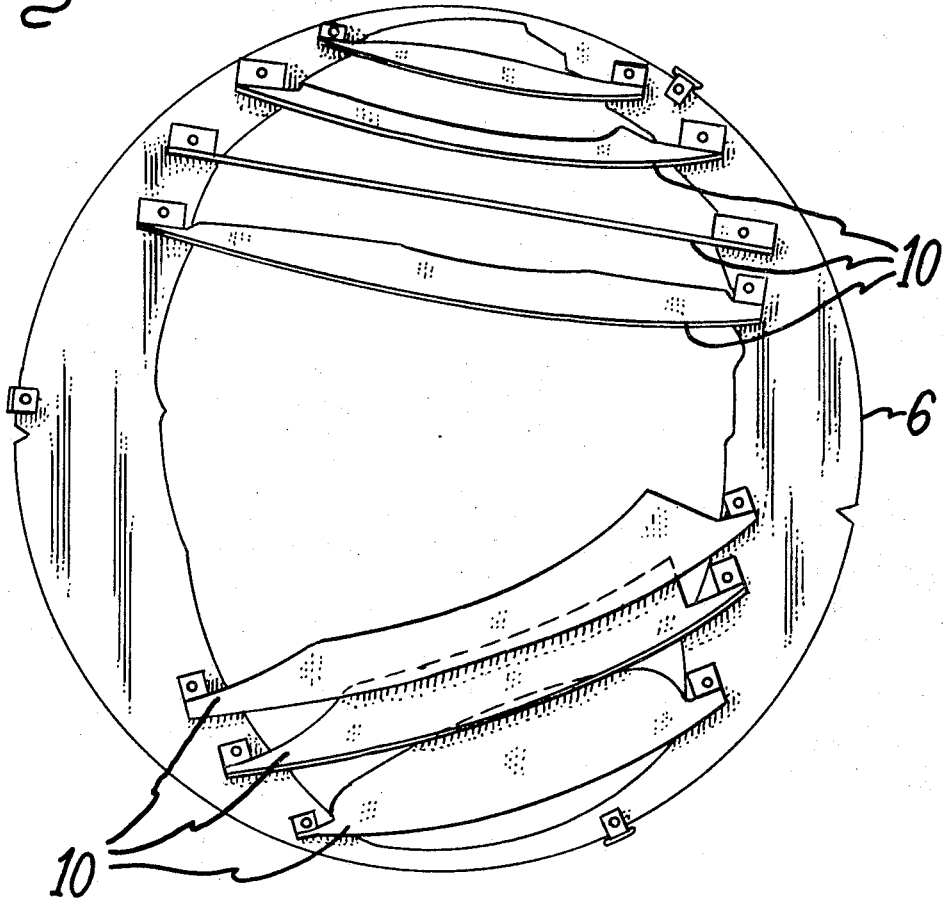


Fig. 7.

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Fig. 8.



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LUMINAIRE

The present invention relates to roadway lighting luminaires and more particularly to luminaires for lighting one-way highways.

It is an object of the invention to provide a roadway lighting luminaire of the above type which produces semi-directional light distribution on a one-way street or highway with the major portion of the light projected in the direction of travel.

Another object of the invention is to provide a roadway lighting luminaire of the above type which is designed for mounting at the side of the roadway.

Still another object of the invention is to provide a luminaire of the above type having a reflector for distributing the light as intended without the need for a refractor for controlling the distribution of the light rays.

A further object of the invention is to provide a reflector for a luminaire of the described type having asymmetric form with stepped reflecting surfaces oriented to produce a uniformly lighted, generally oblong pattern on the roadway, with a major portion of the light projected in the direction of travel on a one-way highway.

Other objects and advantages will become apparent from the following description and the appended claims.

With the above objects in view, the present invention in one of its aspects relates to a luminaire comprising a concave reflector having a rim defining a bottom opening and having a light center therein, a light source arranged at the light center, the reflector being formed of a plurality of vertically adjacent reflecting surfaces which are parabolic in vertical section and have their foci at the light center, the reflecting surfaces being differently oriented for reflecting incident light from the light source downwardly and outwardly of the reflector at varying vertical angles for spreading the light vertically in regions beyond the luminaire for lighting different predetermined portions of the roadway surface at different distances from the luminaire, the reflecting surfaces being arranged in horizontally adjacent vertically extending stepped sections, the reflecting surfaces in the respective stepped sections being of concave curvature in horizontal section for respectively spreading the light incident thereon in different predetermined ranges of lateral angles for lighting different predetermined portions of the roadway surface on opposite sides of the luminaire.

The invention will be better understood from the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an elevational view of the rear of a highway luminaire constructed and arranged in accordance with the invention, as seen from the side of the highway on which the luminaire is mounted;

FIG. 2 is a top plan view of the FIG. 1 luminaire;

FIG. 3 is a side view, partly broken away, of the FIG. 1 luminaire as viewed from the far side of the luminaire, i.e., the side opposite the traffic approach side;

FIG. 4 is a diagrammatic view of a typical light distribution pattern produced by a luminaire constructed in accordance with the invention;

FIG. 5 shows a reflector constructed in accordance with the invention as viewed from the bottom thereof;

FIG. 6 is a view in vertical section of a portion of the FIG. 5 reflector taken generally along the lines 6 — 6

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in FIG. 5 and showing vertical re-direction of light rays originating at the light center;

FIG. 7 is a view in horizontal section of the FIG. 5 reflector taken generally in a plane passing through the light center, as indicated by line 7 — 7 in FIG. 6, and showing lateral re-direction of light rays originating at the light center; and

FIG. 8 is a view of the FIG. 5 reflector showing the provision of light shields thereon.

Referring now to the drawings, and particularly to FIG. 1, there is shown an asymmetric semi-directional luminaire which is adapted to be mounted at the side of a one-way highway for direction a major portion of the light emanating therefrom in the direction of travel and distributing the light on the highway generally in a pattern as depicted in FIG. 4. The illustrated luminaire comprises a dome-shaped main housing 1 secured at its top to slipfitter housing 2 which is removably clamped to a support arm 3, which in a typical installation extends horizontally toward the street from a pole located at the side of a one-way highway and mounting the luminaire at a height of about 50 feet above the roadway. Main housing 1, which has a circular opening at its bottom, is attached to housing 2 by means of intermediate support 20 so that its axis A is inclined toward the direction of traffic flow at an angle preferably of about 13° to the vertical. Support 20 is provided with spaced projections 20a serving as a sighting device to aid in alignment of the luminaire with the roadway. The bottom opening of housing 1 is closed by a light transmitting closure 4 hingedly connected to the rim of housing 1 so that it can be swung downwardly to provide access to the interior of the housing. Mounted within main housing 1 by suitable means such as bracket 5 (see FIG. 3) is reflector 6 which has an asymmetric form (see FIGS. 5 and 7) and has an aperture 6a for accommodating the stem of lamp 7, which is removably mounted at its base in lampholder 8 and extends downwardly (see FIG. 1) into the interior of reflector 6 along vertical axis B of opening 6a. Lamp 7 is typically of gaseous discharge type, such as a mercury vapor lamp, and is electrically connected at lampholder 8 in conventional manner to electrical ballast operating components (not shown). Lamp 7 is arranged asymmetrically within reflector 6 extending along vertical axis B so as to be closer to the approach side of the reflector than to the far side and has its light center LC located a substantial distance upwardly from the bottom of reflector 6, as seen in FIGS. 6 and 7. As shown in FIG. 6, the rim of reflector 6, like that of housing 1, is about 13° to the horizontal.

As indicated in FIG. 1, the optical arrangement of the described luminaire is such that, typically, the main light beam reflected from the far side of reflector 6 toward the traffic approach side is cut off at an angle of about 55° to the vertical, while the other main light beam reflected from the opposite side of reflector 6 along the direction of traffic flow is cut off at an angle of about 80° to the vertical. As a result of this arrangement and the structure of the reflecting surfaces of reflector 6 and other features described more fully below, a generally oblong pattern 9 of light distribution is provided on roadway 12 for projecting light substantially farther along the downstream side of the luminaire than the approach side, as shown in the diagram of FIG. 4. In general, about two-thirds of the total light output is directed downstream and one-third directed upstream.

As seen in FIG. 5, which is a view looking into the interior of reflector 6 through its bottom opening, the reflector has a top wall 6b adapted to be connected to the upper portion of main housing 1 and a bottom flange 6c which is adapted to fit within the rim of main housing 1. As will be seen from the position of lamp receiving opening 6a, the lamp in the assembly is located closer to the house side of the reflector 6 than the street side and closer to the approach side than to the far side. The distribution of light from the main beams referred to above which emanate from opposite sides of reflector 6 is controlled by the vertically extending, horizontally adjacent stepped reflecting surfaces 13, 14 shown in FIG. 5. As seen in FIG. 6, which shows a vertical section as taken along the lines 6-6 of FIG. 5, through one of the stepped reflecting surfaces 13 (which directs the light rays at about 85° lateral angle), the reflecting surface is constituted by a plurality of vertically adjacent portions a-f of parabolic contour in vertical section having their foci at the light center LC but with axes downwardly directed at different vertical angles, such that the vertical angles increase from the upper to the lower parabolic portions. As a result, the light rays emanating from the reflecting surface are spread vertically so that the light beam is distributed in an elongated pattern along the length of the roadway. The other stepped reflecting surfaces on both sides of the reflector are composed of generally similar combinations of vertically adjacent parabolic portions and will therefore similarly vertically spread the light rays incident thereon, except that the cutoff angle for rays reflected from the far side of the reflector will be less than that reflected from the approach side of the reflector as previously explained. The main beam reflecting surfaces are constructed in the form of differently oriented stepped sections 13, 14 as shown in order to provide for the necessary lateral distribution of light emanating from the luminaire, while enabling manufacture of the reflector within practical limits of size and shape.

As seen in the horizontal section shown in FIG. 7 taken at the plane passing approximately through light center LC, i.e., approximately along lines 7-7 in FIG. 6, the respective stepped reflecting sections are so formed in horizontal contour as to spread the light in controlled manner within a predetermined range of lateral angles, so that the light is projected from the luminaire uniformly into the desired lateral zone of the distribution pattern. Thus, for example, light incident on portion G of the horizontal section from light center LC is spread laterally by portion G between lateral angles of 80° - 90°, while adjacent horizontal portion H spreads the light laterally between lateral angles of 60° and 70°, the angles being with reference to 0° at the street side and 90° at the far side of the luminaire, as shown in FIG. 7. Others of the stepped reflecting sections of reflector 6 typically spread the light laterally within the ranges indicated in FIG. 7. To provide such results, the reflecting surface of each stepped section is formed of smoothly merging horizontally adjacent facets of varying widths which are individually oriented in horizontal direction as to produce the required amount of light within the lateral spread of light rays by each such section as described.

The described reflector structure itself provides the essential light control for producing the desired distribution of light on the roadway, and accordingly light

refracting glassware such as conventionally employed in street lighting luminaires for controlling light distribution is dispensed with. However, in a usual case, a transparent closure 4 covering the bottom of the luminaire is preferably employed as shown in order to protect the interior of the optical system. Where desirable, the glass cover 4 may be somewhat stippled to blend the light beams projected from the individual stepped reflecting sections to improve the uniformity of the light pattern.

In the modification shown in FIG. 8, louvers or light shields 10 are placed across the bottom of the reflector opening on the street and house sides thereof to provide any desired additional cutoff of direct light which might otherwise be projected to unwanted areas in the vicinity of the luminaire.

While the present invention has been described with reference to particular embodiments thereof, it will be understood that numerous modifications may be made by those skilled in the art without actually departing from the scope of the invention. Therefore, the appended claims are intended to cover all such equivalent variations as come within the true spirit and scope of the invention.

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

1. A luminaire comprising, in combination, a concave reflector having a rim defining a bottom opening and having a light center therein, a light source arranged at said light center, said reflector being formed of a plurality of vertically adjacent reflecting surfaces which are parabolic in vertical section and have their foci at said light center, said surfaces being differently oriented for reflecting incident light from said light source downwardly and outwardly of said reflector at varying vertical angles for spreading the light vertically in regions beyond the luminaire for lighting different pre-determined portions of the roadway surface at different distances from the luminaire, said reflecting surfaces being arranged in horizontally adjacent vertically extending stepped sections, the reflecting surfaces in the respective stepped sections being of concave curvature in horizontal section for respectively spreading the light incident thereon in different pre-determined ranges of lateral angles for lighting different pre-determined laterally displaced portions of the roadway surface on opposite sides of said luminaire.

2. A luminaire as defined in claim 1, said luminaire being adapted to be mounted at the side of a one-way roadway whereby said reflector has a traffic approach side and an opposite far side, each side being formed with a plurality of said stepped reflecting surfaces, said light center being located on a vertical axis extending asymmetrically relative to said reflector sides, said reflector rim lying in a plane at a substantial angle to said vertical axis with the axis of said bottom opening inclined toward the direction of traffic flow.

3. A luminaire as defined in claim 2, said parabolic vertically adjacent reflecting surfaces having axes downwardly sloping respectively at vertical angles increasing from upper to lower reflecting surfaces.

4. A luminaire as defined in claim 3, said light center being arranged closer to said approach side of said reflector than to far side thereof.

5. A luminaire as defined in claim 4, said reflector having a house side intermediate said approach side and said far side and a street side opposite said house

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side, said light center being arranged closer to said house side than to said street side.

6. A luminaire as defined in claim 5, the bottom of the approach side of said reflector being lower than the bottom of the far side of said reflector, whereby the maximum vertical angle of light rays reflected outwardly by said far side is substantially smaller than that of light rays reflected outwardly by said approach side.

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7. A luminaire as defined in claim 6, including a housing containing said reflector and having a bottom opening, and a light transmitting closure closing said bottom opening of said housing.

8. A luminaire as defined in claim 7, including spaced light shield members extending across said reflector bottom opening at said house and street sides thereof.

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