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[54] **LUMINAIRE REFLECTOR COMPRISING ELLIPTICAL AND PARABOLIC SEGMENTS**

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[52] **U.S. Cl.** ....**240/103 R,** 240/25, 240/41.35, 240/51.11

[51] **Int. Cl.** **F21v 7/09**

[58] **Field of Search** ....240/2 B, 7.1 C, 25, 41.35 R, 240/41.35 C, 41.35 E, 41.35 F, 41.37, 44, 44.1, 51.11, 103, 104, 105, 2 W, 2 BV, 73 BI

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[57] **ABSTRACT**

Substantially uniform magnitude of illumination on a plane surface is provided by a concave reflector having a parabolic reflecting surface and an elliptical reflecting surface oriented relative to one another to satisfy the following criteria.

a. the first focal point of the elliptical surface is on the axis of the parabolic surface,
b. the second focal point of the elliptical surface is not within the closure formed by the inner surfaces of the reflecting surfaces and a plane across the outwardly extending edges of the surfaces,
c. the axis of the parabolic surface is from about 45° to about 90° from nadir, and
d. the major axis of the elliptical surface is from about 5° to about 45° from nadir.

Preferred embodiments include the parabolic surface and elliptical surface separated by one or more general reflecting surfaces, and the same combinations of surfaces with a second parabolic reflecting surface or flat reflecting surface adjacent and below the first parabolic surface and a flat reflecting surface adjacent and outside of the elliptical surface. The additional surfaces provide further improvement in control of the reflections.

19 Claims, 7 Drawing Figures

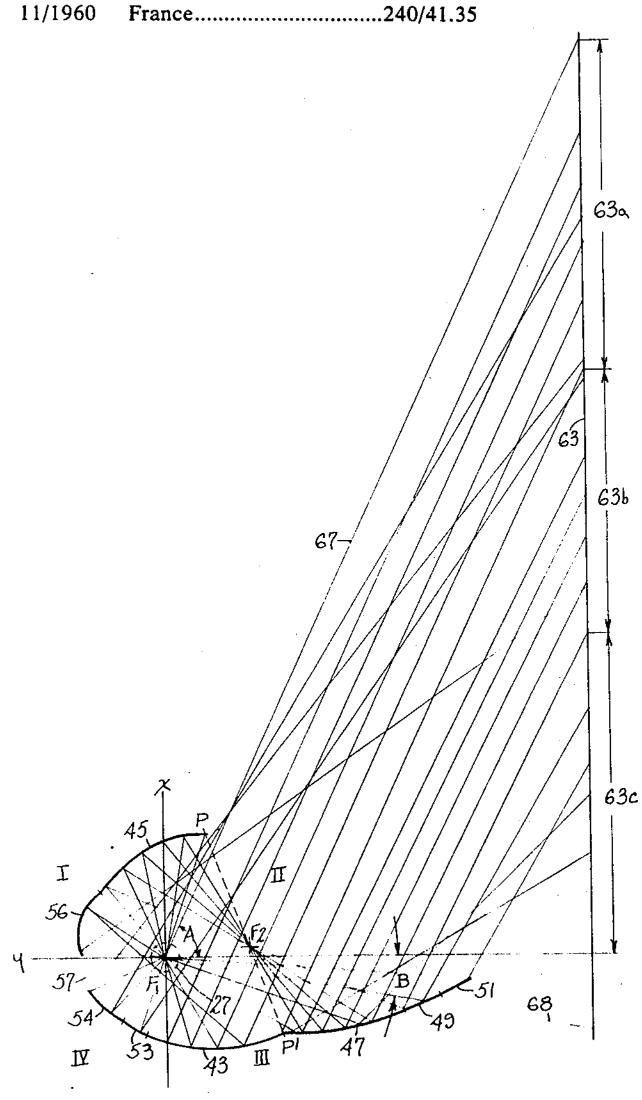


Fig.1.

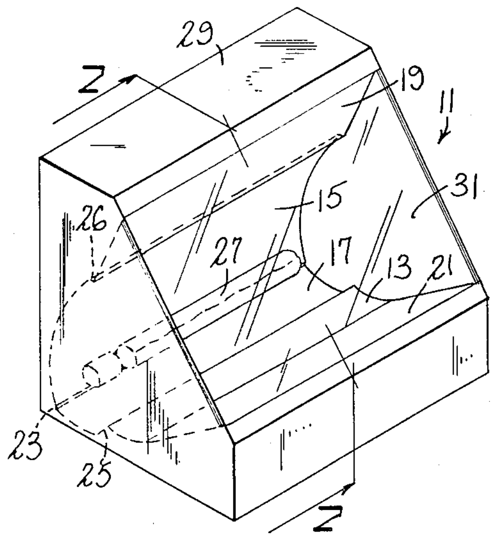


Fig.2.

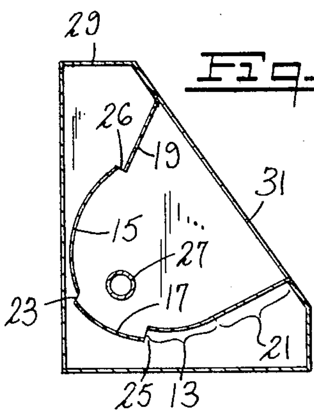
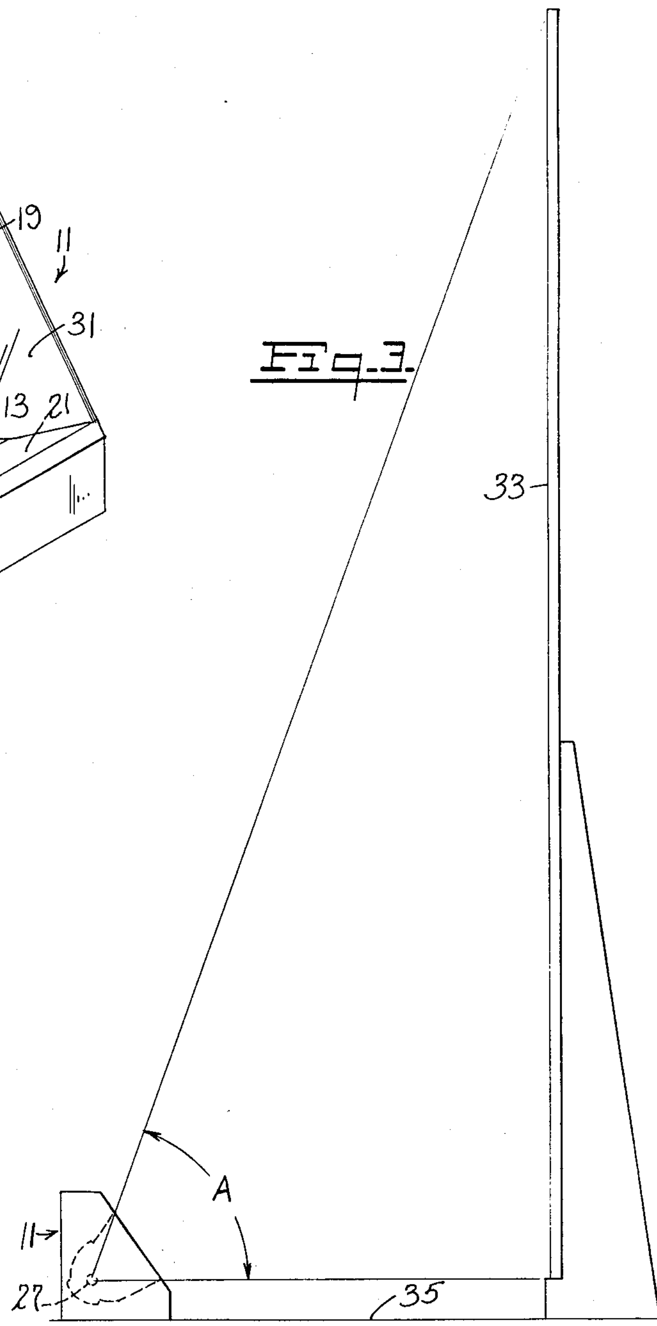


Fig.3.



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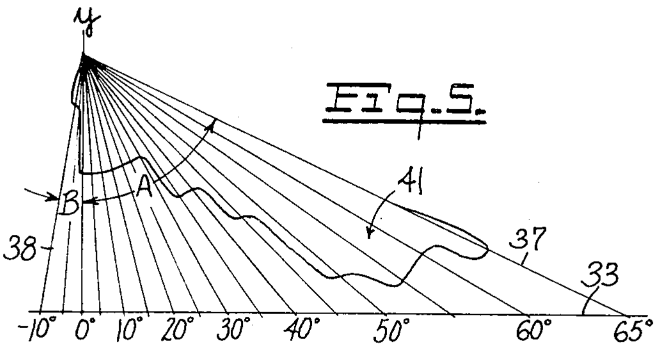
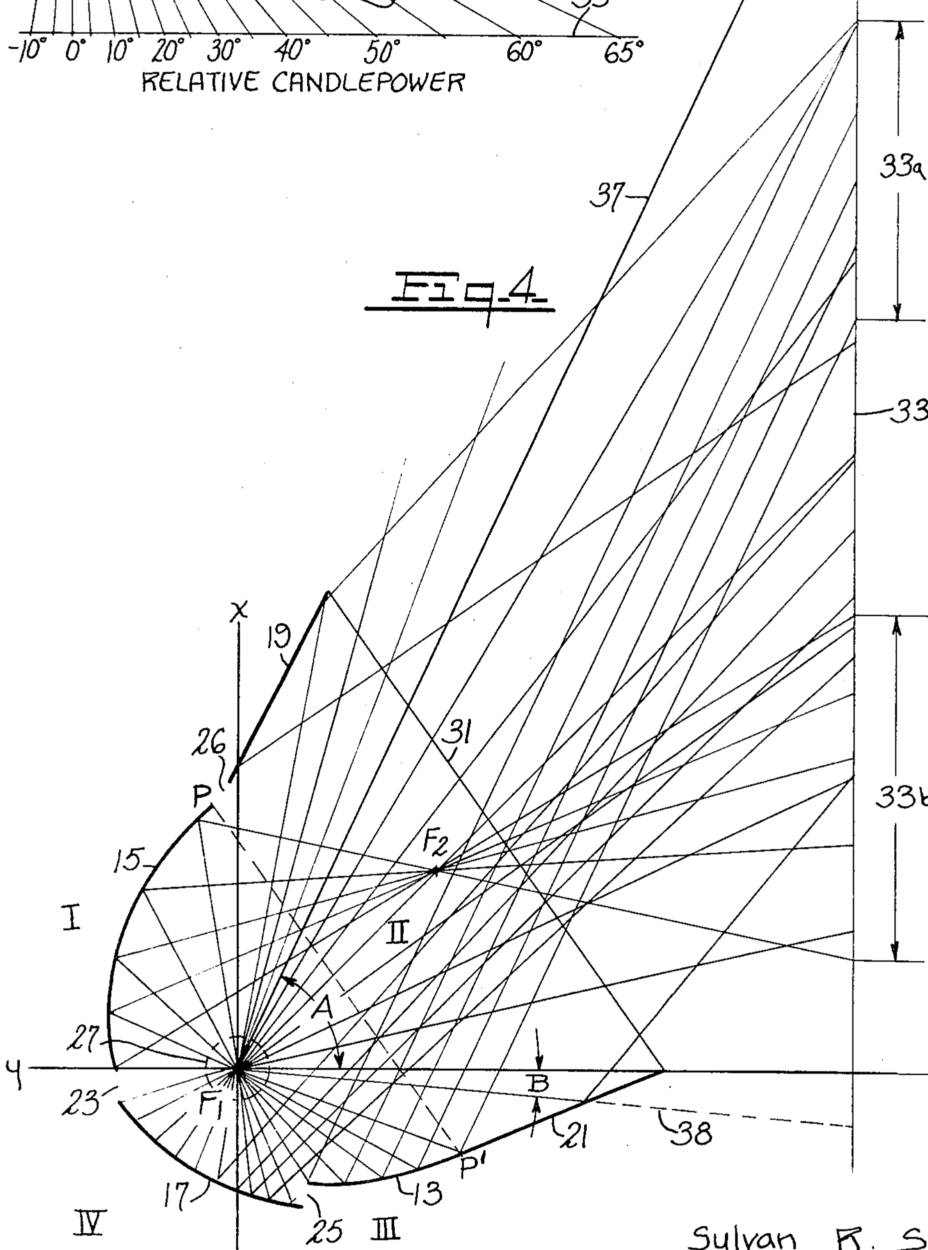


Fig. 5.

Fig. 4



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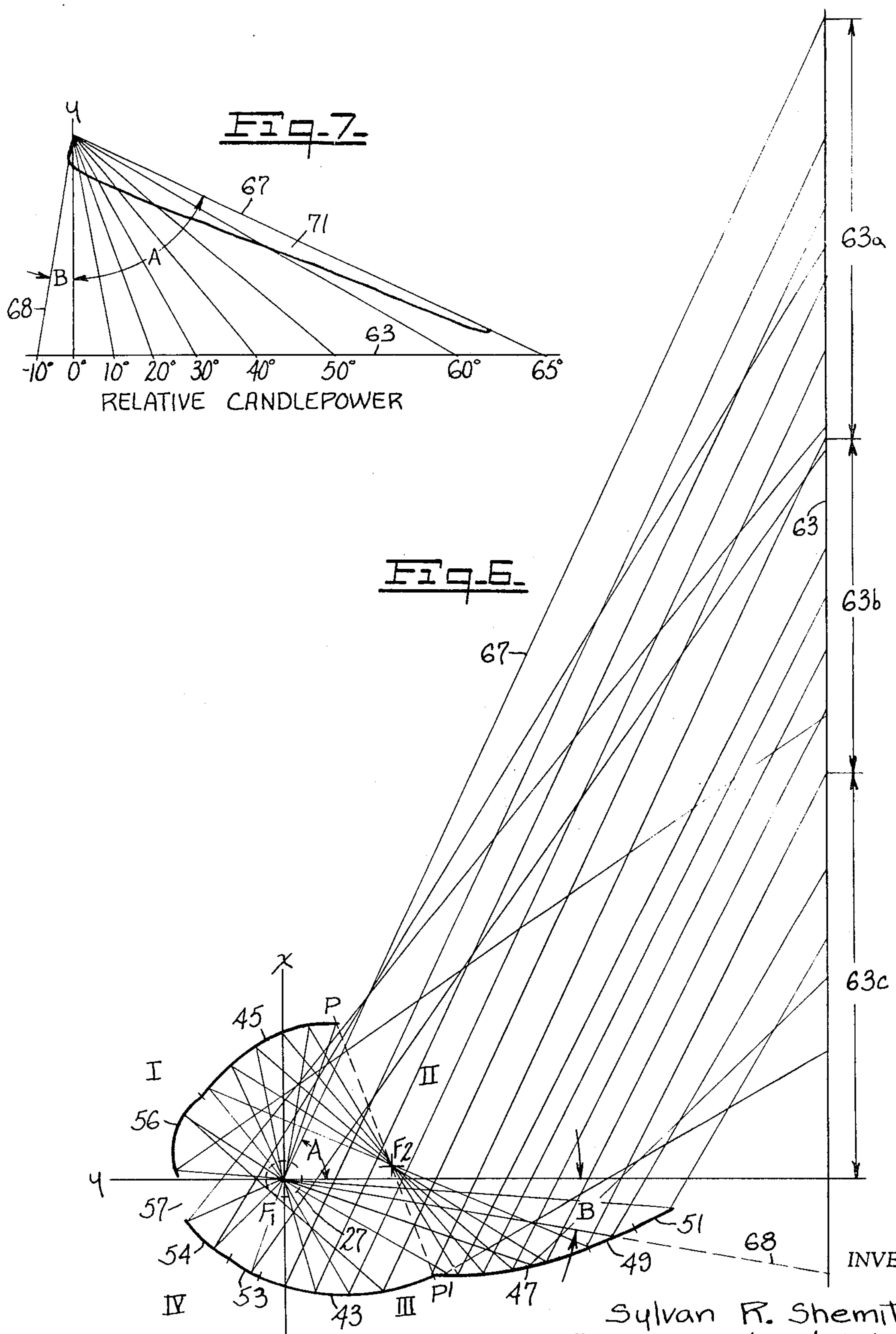

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LUMINAIRE REFLECTOR COMPRISING ELLIPTICAL AND PARABOLIC SEGMENTS

BACKGROUND OF THE DISCLOSURE

This invention relates to concave reflectors and luminaires for use in asymmetric light distribution.

It is known from the inverse square law with its cosine correction, $E=(I/d^2)\cos\theta$, defining the magnitude of illumination E at a point on a plane, that equality of the illumination at all points on the plane theoretically requires that a luminaire provide thirteen times more candlepower at a point approximately 2.15 times mounting height away on the plane to be illuminated than is provided at nadir. Despite this understanding of an essential requirement for controlled, uniform illumination, attempts to design luminaires to approach these results have not been entirely successful. A primary reason for the lack of success has been inability to control both the direct and reflected emanations from a light source so as to substantially eliminate light losses caused by subtraction of light rays, by reflection of light rays back to the light source, and by stray reflections. When a large proportion of the light rays are reflected back to the source, the problem is complicated by excessive heat production within the source.

In addition to constant magnitude of illumination along the plane, it is preferred that sharp cutoff of rays on each side of the plane to be illuminated be provided in order to conserve and concentrate the light flux.

Another requirement is the reduction of discomfort glare and disability veiling glare when the observer is within or without the zone of illumination. Reduction of glare is especially important, for example, when the luminaire is to be employed for the illumination of airport aprons and vehicular or pedestrian walkways. Designs, however, which have reduced glare have done so by means of visors, baffles, or absorbers placed within or external to the closure of the luminaire, but to the detriment of continuously even illumination and with greater expense of manufacture.

Coupled with the foregoing requirements is the need for a luminaire which can be preset, or which is later adjustable, in order to provide a portion of the illumination of constant magnitude to an extension of the plane to be illuminated in the direction opposite to the major portion of the plane being illuminated, that is, into the zone encompassed by negative degrees from nadir, e.g., −10° from nadir. For example, it is sometimes important to be able to illumine two planes which are separated by a normal to the light source where one of the planes is substantially longer than the other. This situation is illustrated by a street light placed elevated on a support between a sidewalk and a street, the latter having substantially greater width than the former. Ideally, in this circumstance, the luminaire should illuminate with the same magnitude of illumination the full width of the street as well as the narrower width of the sidewalk but without wasting light by illuminating areas outside of the sidewalk and street. Thus, not only should the luminaire be capable of illuminating both the street and sidewalk without glare, but the luminaire should also provide a sharp cutoff of the illumination at the outer boundaries of the sidewalk and street. This capability permits a luminaire to be mounted on a short projection or arm, as from a pole or from the side of a structure, since the luminaire can light the zone on the negative side of nadir, that is, the shorter portion of the horizontal plane as well as the longer portion of the horizontal plane.

SUMMARY OF THE INVENTION

Accordingly, an object of the invention is to provide a new and improved concave reflector or luminaire which is capable of illuminating a surface with substantially constant magnitude through an asymmetric distribution.

A further object is to provide a new and improved reflector and luminaire capable of controlling the direction of emanations from the light source so as to substantially eliminate light losses.

A still further object is to provide a concave reflector and luminaire for asymmetric light distribution, which is capable of sharply cutting off the illumination on each end of the plane to be illuminated.

Another object is to provide a new and improved concave reflector capable of reducing glare in the eyes of an observer positioned within or without the zone of illumination.

An additional object is to provide a new and improved reflector and luminaire which may be adapted to encompass selected portions of the zones on each side of nadir when forming an asymmetric pattern of illumination.

Still other objects, features and advantages of the invention will in part be obvious and will in part be apparent from the specification.

In brief outline, it has been discovered that when properly oriented relative to each other, a reflecting surface which is parabolic in section and a reflecting surface which is elliptical in section in combination provide a concave reflector substantially satisfying the foregoing objectives. Conditions which define the orientation of the two essential reflecting surfaces of the invention are as follows:

a. the first focal point of the elliptical surface is on the axis of the parabolic surface,

b. the second focal point of the elliptical surface is not within the closure formed by the reflecting surfaces and a plane across the outwardly extending edges of the surfaces,

c. the axis of the parabolic surface is from about 45° to about 90° from nadir, and

d. the major axis of the elliptical surface is from about 5° to about 45° from nadir.

When substantially all of the first reflections from the elliptical surface are not reflected into the −10° to +65° zone from nadir, additional reflecting means adjacent the outer rim of the parabolic surface for reflecting these reflections into the −10° to +65° zone from nadir, are employed.

With respect to criterion (d), the orientation of the elliptical surface, such that its major axis is less than 35° from nadir, will cause reflections from the elliptical surface to illuminate areas on the negative side of nadir. When the elliptical surface is so oriented, it may then be useful or necessary to recapture its reflections and reflect them into the zone on the 0° to 65° side of nadir. This is achieved by the additional reflecting means, as explained below.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

DETAILED DESCRIPTION

With reference to the drawings:

FIG. 1 is a perspective, partially fragmentary, view of a concave reflector of the invention;

FIG. 2 is an elevational section along line 2—2 of FIG. 1;

FIG. 3 is a diagrammatic elevational view of a reflector of the invention positioned to provide asymmetric light distribution on a vertical plane;

FIG. 4 is a diagrammatic view of the reflections from a reflector of the invention;

FIG. 5 is a photometric curve (relative candlepower) in a vertical plane through a reflector and luminaire of the invention;

FIG. 6 is a diagrammatic view of the reflections from another reflector of the invention; and

FIG. 7 is a photometric curve (relative candlepower) in a vertical plane through the reflector and luminaire of FIG. 6.

In the embodiment of the invention illustrated in FIGS. 1 to 4, a concave reflector **11** essentially comprises a reflecting surface **13** which is parabolic in section, and a reflecting surface **15** which is elliptical in section. Reflectors **13** and **15** are shown separated by a reflecting surface **17** which, in section, is a general curve. Adjacent the outside rim of the elliptical surface 15 is a flat reflecting surface 19, forming a straight line in section. Below and on the outside rim of parabolic surface 13 is a second flat reflecting surface 21, forming a straight line in section. Reflecting surface 17 is shown slightly outside of surfaces 13 and 15 so as to form vents 23 and 25 therebetween. A light source 27 is placed at the first focal point F_1 of the elliptical surface. Reflector 11 may be enclosed in a housing such as 29 and fixed therein by means such as struts, rivets, bolts, or the like (not shown), behind a protective window or lens such as glass 31.

FIG. 3 illustrates the reflector 11 in position on horizontal surface 35 for illumination of a vertical plane 33 such as a billboard. It should be understood that the plane 33 might also represent a horizontal surface, reflector 11 then being positioned above the horizontal surface, preferably on a vertical support member, now represented by 35, for illumination of the surface. In either position, the reflector of the invention provides substantially constant magnitude of illumination over the plane 33 in the 0° to 65° zone from nadir, shown as angle A. The maximum practical extent of angle A is 65°, although it may be varied to more or less than 65° by selecting additional reflecting surfaces for use with the parabolic and elliptical surfaces or by rotating or tilting the surfaces.

The direction of reflections from the individual surfaces and operation of the reflector 11 as a whole is evident from a consideration of FIGS. 4 and 5. With reference to FIG. 4, it will be noted that the two essential reflecting components 13 and 15 are defined as to their curvature and relative orientation in space by the following criteria:

a. the first focal point of the elliptical surface is on the axis of the parabolic surface, and preferably coincides with the focal point of the parabolic surface,

b. the second focal point of the elliptical surface is not within the closure formed by the reflecting surfaces and a plane across the outwardly extending edges of the surfaces,

c. the axis of the parabolic surface is from about 45° to about 90° from nadir, preferably about 65° as shown in FIG. 4, and

d. the major axis of the elliptical surface is from about 5° to about 45° from nadir, preferably about 45° as shown in FIG. 4.

The closure referred to in (b) is line PP′ in FIG. 4. It will be noted that the second focal point F_2 is below line PP′ and therefore outside of the closure. With reference to criterion (c), it will be noted that line 37 is on the axis of parabolic surface 13, and line 37 passes through the first focal point F_1 of elliptical surface 15. Illuminations from surfaces 13 and 15 are indicated on plane 33 as sectors 33*a* and 33*b* respectively. While surfaces 13 and 15 may be positioned such that some overlap occurs on plane 33 between their reflections, it is preferred that surfaces be chosen and oriented so as to avoid overlap, as illustrated.

While it is possible to rely only upon the combination of a parabolic reflecting surface 13 and an elliptical reflecting surface 15, in order to provide illumination of the desired characteristics on plane 33, it is preferred to employ in conjunction with the two essential surfaces at least a general reflecting surface 17 for the purpose of reinforcing the reflections from the two essential surfaces, avoiding reflections back to the light source, and for filling in the areas between the reflections from the surfaces on the plane to be illuminated, as shown in FIG. 4 with respect to reflections along the entire length of plane 33, including 33*a* and 33*b*. General reflecting surface 17 may take any suitable form, such as a flat surface, spherical, parabolic, or general surface.

As the auxiliary reflecting means, especially for reflecting direct emanations into the useful zone as well as for redirecting stray reflections from the other surfaces, there may be employed reflecting surfaces such as flat surfaces 19 and 21 as shown in FIG. 4. An additional function of these auxiliary surfaces 19 and 21 is to enhance the sharp cutoff of the reflections onto plane 33 at predetermined angles. For example, as shown in FIG. 4, reflecting surface 21 provides sharp cutoff of direct emanations from source 27 so that illumination on plane 33 begins at 0° from nadir. However, as indicated by discontinuous line 38, subtended by angle B, illumination in a negative direction from nadir may be provided by employing a reflecting surface 21 which does not cut across or touch the normal (*y* axis) to plane 33.

In FIG. 4, the major axis F_1 F_2 of the elliptical surface 15 is about 45° from nadir. With this orientation, substantially all of the reflections from elliptical surface 15 are on plane 33 in the 0° to 65° zone from nadir. However, as will be evident from FIGS. 6 and 7, should the major axis of the elliptical surface be oriented such that reflections therefrom are not directed into the zone defined by −10° to +65° from nadir, an auxiliary reflecting surface may be employed in order to redirect these reflections into the −10° to +65° zone.

FIG. 5 shows the approximate relative candlepower distribution provided by the embodiment of FIGS. 1–4 onto plane 33. As is well known, the resulting "half bat wing" shaped curve indicates substantially even distribution of illumination on plane 33, that is, illumination of substantially constant magnitude. It will further be noted that some distribution of the illumination is shown in the region to the left of nadir, in the zone encompassed by angle B. The extent of this distribution is governed by the relative orientation of the parabolic and elliptical surfaces of the reflector as well as by the extent to which auxiliary reflecting surfaces, such as surface 21, are employed. It should be evident, however, that the major proportion of the illumination is into the region to the right of nadir when the major axis of the elliptical surface is about 35° or more from nadir, and therefore the resulting photometric curve would still approximate the curve of FIG. 5. The magnitude of the area 41 will depend on the output of light source 27, but the shape of the curve will be constant for the same reflector and same light source position.

A preferred arrangement of reflecting surfaces of the reflector and luminaire of the invention relative to plane 33 may be described on the compass shown in FIG. 4 in which the first focal point F_1 of the elliptical surface is placed at the origin, this also being the placement of the light source. The *x* and *y* axes thus define four quadrants I, II, III, and IV. Taking the *y* axis to the left of F_1 in FIG. 4 as north, the preferred positions of the reflecting surfaces of FIG. 4 may be defined as follows:

1. Parabolic surface 13 is closer to plane 33 than is elliptical surface 15.
2. The second focal point F_2 is outside the closure perimeter PP′, and F_1 and the focal point of parabolic surface 13 coincide.
3. The parabolic surface 13 in section extends from 197.5° to 237.5°.
4. The elliptical surface 15 in section extends from 0° to 83.5°.
5. The general surface 17 in section extends from 242.5° to 342.5°.
6. The lower flat surface 21 in section extends from 180° to 197.5°.
7. The upper flat surface 19 in section extends from 88.5° to 100.5°.
8. The ventilation slots 23, 25 and 26 occur at 350°, 240° and 85°, respectively.
9. The axis 37 of parabolic surface 13 is in the range 90° to 135° (90° to 45° from nadir) preferably 115° to 120° (65° to 60° from nadir), and passes through F_1.
10. The major axis F_1 F_2 of elliptical surface 15 is at 135° (45° from nadir).

The elliptical surface 15 in section may be extended past 83.5° to 103.5° to provide maximum reflection of light in a left and down direction with respect to plane 33. When so extended, the lower flat reflecting surface 21 may start at 181.5° rather than at 180°.

FIG. 6 shows a particularly preferred embodiment of reflectors and luminaires of the invention. With reference thereto, the essential reflecting surfaces are a reflecting surface 43 parabolic in section and a reflecting surface 45 elliptical in section. With respect to the relative orientations of these two surfaces, it will be noted with reference to FIG. 6 that the four criteria set forth above are fully satisfied. Particularly, it will be noted that the second focal point F_2 of elliptical surface **45** is on but not within the closure PP′ of the reflector. Further, it will be noted that the axis of parabolic surface **43**, represented by line **67**, passes through the first focal point F_1 of elliptical surface **45** and the light source **27** is placed at the first focal point F_1 of elliptical surface **45**. Preferably, as shown, F_1 and the focal point of parabolic surface **43** coincide.

In the orientation of surfaces **43** and **45** of FIG. **6** it will be noted that the light rays reflected from elliptical surface **45**, after passing through second focal point F_2, are directed to quadrant III of the compass defined by F_1 as origin and the *y* axis to the left as north. In order to redirect these reflections into the 0° to 65° zone from nadir, an auxiliary reflecting surface **47**, parabolic in section, is employed. While surface **47** preferably is parabolic, it will be evident that other surfaces such as a flat reflecting surface, a general reflecting surface, or other surfaces, may be employed.

With reference to FIG. **6**, it will be noted that the reflections from parabolic surface **43** illuminate the sector **63***a* on plane **63** and the re-reflected rays from elliptical surface **45** illumine the sector **63***b* on plane **63** with substantially no overlap between the reflections. In order to reinforce these illuminations and to control the direct emanations from light source **27**, general reflecting surfaces **53**, **54** and **56** are mounted adjacent to and above reflecting surfaces **43** and **45**, relative to surface **63**. These general surfaces also serve to illuminate sectors on plane **63** not illuminated by surfaces **43** and **45**, such as sector **63***c*. As so constituted, a reflector of FIG. **6** would also illuminate a small region to the left of nadir bounded by discontinuous line **68**. However, for some applications, it may be preferred to provide a sharp cutoff at 0° nadir or at a position on the positive side of nadir. For this purpose one or more flat reflecting surfaces or baffles, shown in section as straight lines **49** and **51**, may be employed.

In the embodiment of FIG. **6**, a ventilating slot **57** is provided as a convenience between surfaces **54** and **56**, although it should be understood that the slot may be provided at any point on the reflector in the vicinity of light source **27** in order to prevent overheating. It will be evident that reflecting surfaces **53**, **54** and **56** may be eliminated and the two essential reflecting surfaces **43** and **45** extended to close the resulting gap, or a vent **57** may be maintained between surfaces **43** and **45**.

FIG. **7** illustrates photometrically the approximate relative candlepower distribution provided by a reflector and luminaire as illustrated in FIG. **6**. "Relative candlepower" and the angles A and B have the same meaning as in FIG. **5**. It will be evident from the shape of the curve that the ideal light distribution for uniform illumination has been substantially achieved within the zone encompassed by about 0° to about +65° from nadir, the perfect curve being a straight line paralleling the bottom line of the curve. Similar to FIG. **5**, the shape of the curve will be constant for identical reflectors and when the light source remains in the same position. However, the magnitude of the area **71** will vary with the output of light source **27**.

The particularly preferred reflecting surfaces illustrated in FIG. **6**, and their orientation relative to one another and to plane **63** are defined with reference to a compass oriented as in FIG. **4** as follows:

1. Parabolic surface **43** is closer to plane **63** than is elliptical surface **45**.

2. Parabolic surface **43** extends from 212.5° to 287.5°.

3. Elliptical surface **45** extends from 44° to 110°, but may be limited as to its outer rim at 90°.

4. The lower parabolic surface **47** extends from 192.5° to 212.5°.

5. General reflecting surface **53** extends from 287.5° to 307.5°.

6. General reflecting surface **54** extends from 307.5° to 337.5°.

7. Ventilation slot **57** extends from 337.5° to 2.5°.

8. General reflecting surface **56** extends from 2.5° to 44°.

9. Flat reflecting surface **49** extends from 187.5° to 192.5°.

10. Flat reflecting surface **51** extends from 185° to 187.5°.

11. The axis **67** of parabolic surface **43** passes through F_1 and is in the range of 90° to 135° (90° to 45° from nadir), preferably 115° to 120° (65° to 60° from nadir), and F_1 coincides with the focal point of parabolic surface **43**.

12. The axis of parabolic reflecting surface **47** is about 2° to 10° greater than the axis of parabolic reflecting surface **43**.

13. The major axis F_1 F_2 of elliptical surface **45** is at 173.5° (6.5° from nadir).

14. The axis of parabolic surface **47** passes through the second focal point F_2 of elliptical surface **45**.

A special benefit achieved by the reflector of FIG. **6** is the provision of substantially absolute cutoff of direct lamp light emanations at about 70° from nadir without the use of an auxiliary surface, such as surface **19** in FIG. **4**, and without the use of baffles or visors.

It will be evident from consideration of the embodiments of the invention represented by FIGS. **4** and **6** that the invention provides controlled asymmetric light distribution to produce substantially constant illumination on a plane preferably encompassing the zone within −10° to +65° from nadir, the extent of the cutoff being controllable by the use of auxiliary reflectors or baffles. In addition the invention provides means for reducing glare in regions adjacent or in the zone of illumination. The invention further provides sharp cutoff to the extent desired on either side of nadir.

The reflecting surfaces of the invention may be constructed of any suitable reflecting material, such as glass (coated or uncoated), aluminum, stainless steel, and the like, whether in sheet, molded, or cast form. While it is preferred to employ an elongated substantially linear light source, the invention is operative with substantially point sources of light or linear light sources. Likewise, the reflecting surfaces may be parabolic or elliptical in only one plane as illustrated, or may be surfaces of revolution, or assemblies of the reflectors may be oriented to oppose each other (with crossing of beams), or assemblies may be oriented back-to-back or around a circle shining their beams outward. The choice of dimension, plane or arrangement primarily depends on the type of light source, expense of manufacture, and esthetic considerations. The preferred embodiments employ surfaces which are parabolic and elliptical in section, in conjunction with an elongated light source such as a gaseous discharge lamp (e.g., mercury vapor, ceramic discharge, metal halide, fluorescent sources, and the like), or a tungsten halogen lamp (e.g., quartz iodine, and the like).

To the basic combinations of the reflecting surfaces of the invention may be added visors, baffles and lenses of various types in order to provide special effects. For example, it may be desirable to close the reflector of the invention with a spread lens in order to spread the illumination to the right and left of the reflector as well as in a forward and downward direction.

It should be evident that the reflectors and luminaires of the invention are economical in their construction and versatile in their application and thus provide substantial improvements over presently existing reflectors and luminaires.

The environments of use of the reflectors and luminaires of the invention are virtually unlimited. Thus, they may be employed on vertical supports to illumine roadways, pedestrian passages and walks, parking lots, the exteriors and interiors of buildings, or they may be placed on horizontal surfaces for the purpose of illuminating vertical planes, as in the illumination of billboards, interior walls, and the floodlighting of airport aprons, display areas, and the like. In any of such positions, they may be turned upward to illuminate ceilings, canopies, and the like.

With respect to the illumination provided by luminaires which distribute light symmetrically, the relative candlepower curve would indicate that there is candlepower "above" the line of maximum candlepower (which line is 65° above nadir in FIGS. **5** and **7**). In other words, the curve would be approximately a mirror image above the center of the beam as below the center of the beam. It can be readily seen that, if such luminaires were used to obtain substantially constant magnitude of illumination on a plane, with the luminaire's maximum candlepower being aimed out toward the far side of the illuminated area, there would be considerable spill light (stray light) that would pass high above the area, which spill light would cause discomfort glare and disability veiling glare, or which would represent wasted light, or energy. The reflectors and luminaires of the invention avoid these problems.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. In a concave reflector, the combination of:

1. a first reflecting surface parabolic in section,
2. a second reflecting surface elliptical in section, said surfaces being positioned relative to each other such that:
   a. the first focal point of said elliptical surface is on the axis of said parabolic surface,
   b. the second focal point of said elliptical surface is not within the closure formed by said reflecting surfaces and a plane across the outwardly extending edges of said surfaces,
   c. the axis of said parabolic surface is from about 45° to about 90° from nadir, and
   d. the major axis of said elliptical surface is from about 5° to about 45° from nadir, and
3. means adjacent the outer rim of said first reflecting surface, for reflecting first reflections from said elliptical surface, when substantially all of said first reflections are not reflected into the −10° to +65° zone from nadir, into said zone;

whereby, when a light source is placed at said first focal point, light is reflected from said concave reflector in an asymmetric pattern to produce substantially constant magnitude of illumination on a plane and to reduce discomfort glare and disability veiling glare.

2. A concave reflector as in claim **1** wherein reflecting means (3) is a parabolic surface the axis of which passes through the second focal point of said elliptical surface.

3. A concave reflector as in claim **2** including at least one flat reflecting surface adjacent the outer rim of said reflecting means (3), so disposed as to reflect into the zone encompassed by −10° to +65° from nadir.

4. A concave reflector as in claim **2** wherein, on a compass having as its origin the first focal point of said second reflecting surface, said first reflecting surface in section extends from 212° to about 288°, said second reflecting surface in section extends from about 44° to about 110°, and said reflecting means (3) in section extends from about 192° to about 212°.

5. A concave reflector as in claim **4** including three general reflecting surfaces disposed between said first and second reflecting surfaces, one of said general reflecting surfaces in section extending from about 287° to about 308°, the second of said general reflecting surfaces in section extending from about 308° to about 338°, and the third general reflecting surface in section extending from about 2° to about 44°, the space between the second and third general reflecting surfaces being a ventilation slot.

6. A concave reflector as in claim **5** including at least one flat reflecting surface in section extending from about 187° to about 192°.

7. A concave reflector as in claim **1** including a general reflecting surface disposed between said first and second reflecting surfaces so as to reflect into the zone encompassed by −10° to +65° from nadir.

8. A concave reflector as in claim **7** wherein, on a compass having as its origin the first focal point of said second reflecting surface, said first reflecting surface in section extends from about 197° to about 238°, said second reflecting surface in section extends from about 0° to about 84°, and said general reflecting surface in section extends from about 242° to about 343°.

9. A concave reflector as in claim **1** wherein reflecting means (3) is a first flat reflecting surface.

10. A concave reflector as in claim **1** including a flat reflecting surface adjacent the outer rim of said second reflecting surface, so disposed as to reflect into the zone encompassed by −10° to +65° from nadir.

11. A concave reflector as in claim **1** wherein reflecting means (3) is a parabolic surface, the axis of which passes through the second focal point of said elliptical surface, said concave reflector further including at least one general reflecting surface disposed between said first and second reflecting surfaces so as to reflect into the zone encompassed by −10° to +65° from nadir.

12. The concave reflector of claim **11** wherein the general reflecting surface is in three portions separated by a ventilation slot between two of said portions.

13. A concave reflector as in claim **1** wherein reflecting means (3) is a first flat reflecting surface, said first flat reflecting surface in section extending from about 180° to about 198°, said concave reflector further including a second flat reflecting surface adjacent the outer rim of said second reflecting surface, said second flat reflecting surface in section extending from about 88° to about 101°.

14. In a luminaire, the combination of: a concave reflector as in claim **1**, a housing for said reflector, means for supporting said reflector in said housing, and a light source placed at said first focal point of said elliptical surface.

15. A concave reflector as in claim **1** wherein said reflecting means (3) is a first flat reflecting surface; said concave reflector further including a general reflecting surface between said first and second reflecting surfaces, and a second flat reflecting surface adjacent the outer rim of said second reflecting surface, said general reflecting surface and said second flat reflecting surface each being positioned so as to reflect into the zone encompassed by −10° to +65° from nadir.

16. A concave reflector as in claim **15** wherein, on a compass having as its origin the first focal point of said second reflecting surface:

said first reflecting surface in section extends from about 197° to about 238°;

said second reflecting surface in section extends from about 0° to about 84°;

said first flat reflecting surface in section extends from about 180° to about 198°;

said second flat reflecting surface in section extends from about 88° to about 101°; and

said general reflecting surface in section extends from about 242° to about 343°.

17. A concave reflector as in claim **1** wherein said reflecting means (3) is a parabolic surface the axis of which passes through the second focal point of said second reflecting surface; said concave reflector further including at least one general reflecting surface between said first and second reflecting surfaces, and at least one flat reflecting surface adjacent the outer rim of said reflecting means (3), said general reflecting surface and said flat reflecting surface each being positioned so as to reflect into the zone encompassed by −10° to +65° from nadir.

18. A concave reflector as in claim **17** wherein the general reflecting surface is in three portions separated by a ventilation slot between two of said portions.

19. A concave reflector as in claim 17 wherein, on a compass having as its origin the first focal point of said second reflecting surface:

said first reflecting surface in section extends from about 212° to about 288°;

said second reflecting surface in section extends from about 44° to about 110°;

said reflecting means (3) in section extends from about 192° to about 212°;

said general reflecting surface is in three portions, one of said portions in section extending from about 287° to about 308°, the second in section extending from about 308° to about 338° and the third in section extending from about 2° to about 44°, the space between the second and third portions being a ventilation slot; and

said flat reflecting surface is in two portions, together in section extending from about 185° to about 192°.

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