Aug. 28, 1951 K. FRANCK 2,566,126

STREET LIGHTING LUMINAIRE

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Fig. 1.

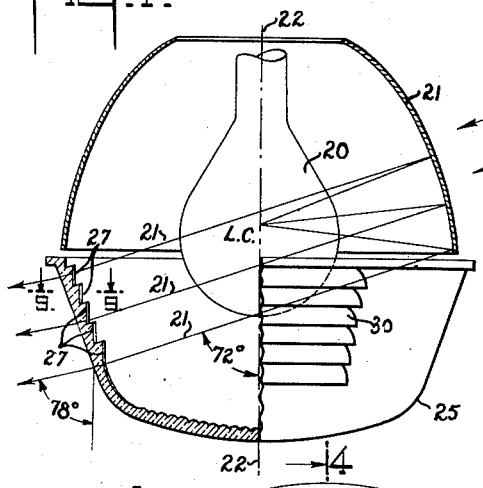


Fig. 3.

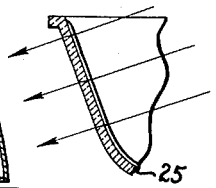


Fig. 4.

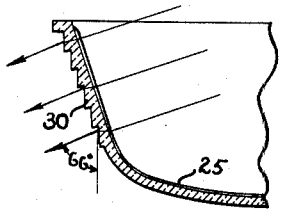


Fig. 5.

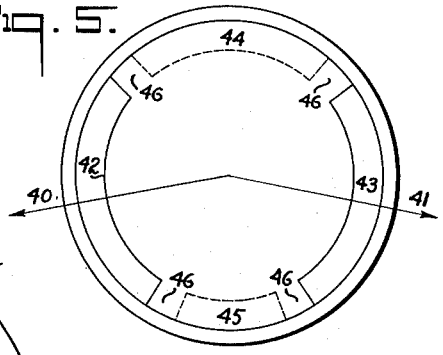


Fig. 2.

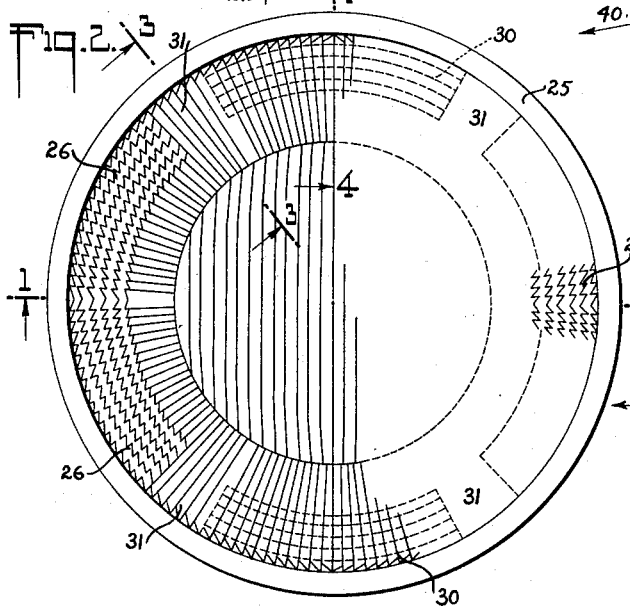


Fig. 6.

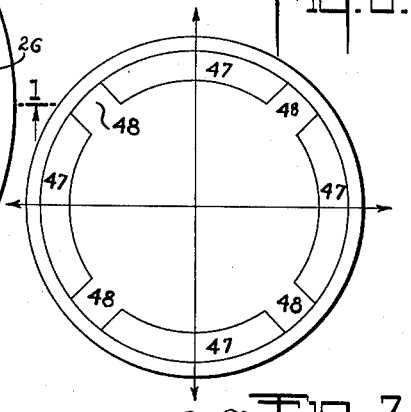


Fig. 8.

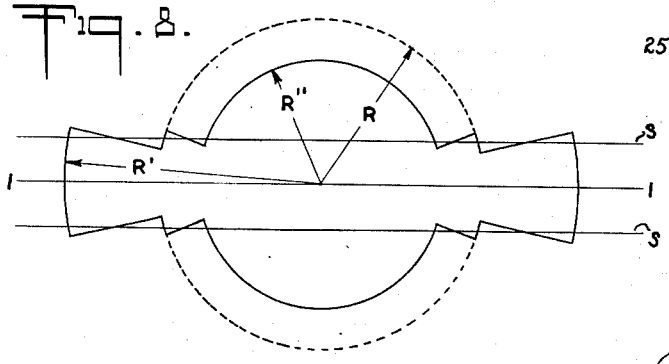
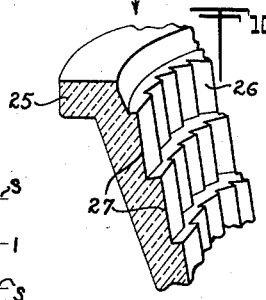


Fig. 7.



INVENTOR
KURT FRANCK

BY John M. Cole.
ATTORNEY

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STREET LIGHTING LUMINAIRE

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Fig. 9.

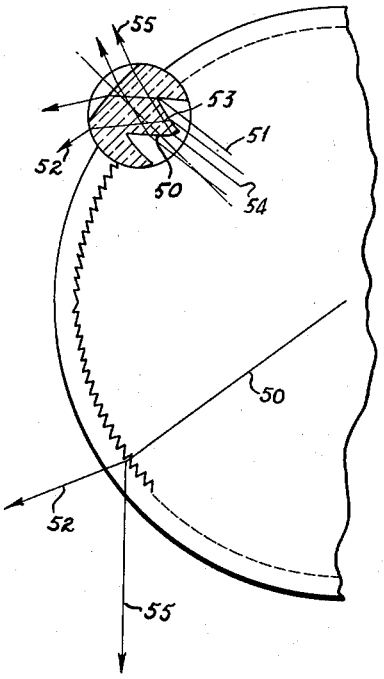


Fig. 10.

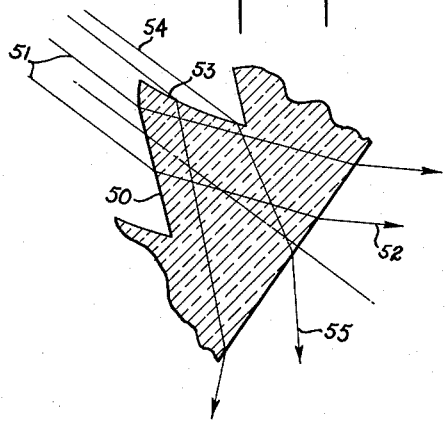


Fig. 11.

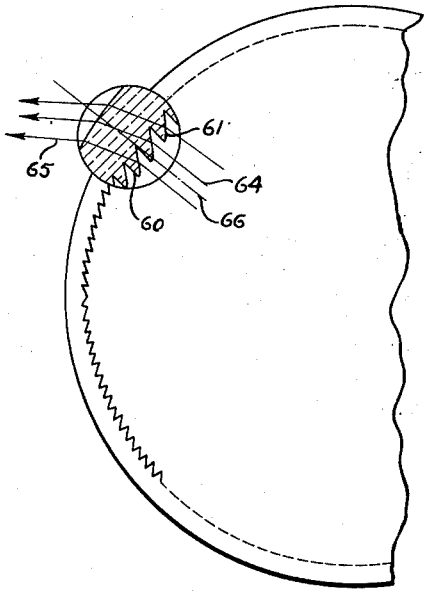
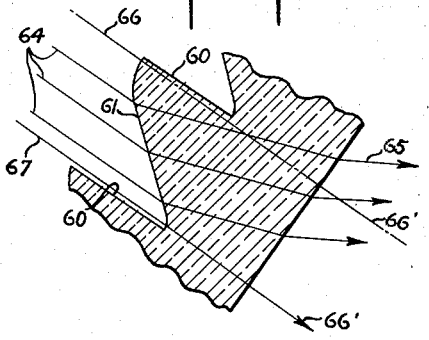


Fig. 12.



INVENTOR
KURT FRANCK
BY John M. Cobb.
ATTORNEY

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UNITED STATES PATENT OFFICE

2,566,126

STREET LIGHTING LUMINAIRE

Kurt Franck, Newark, Ohio, assignor to Holophane Company, Inc., New York, N. Y., a corporation of Delaware

Application August 19, 1947, Serial No. 769,382

10 Claims. (Cl. 240—106)

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The present invention relates to street lighting luminaires and is more particularly directed toward luminaires having provisions for more effectively conforming the light patterns of the luminaires to the patterns of the streets and suitable for increased luminaire spacing along the street.

The luminaires of the present invention employ incandescent lamps, usually pendant, and annular refractors to produce light distributions symmetrical about vertical axes with the light at vertical angles insufficiently steep for lighting remote street areas but too steep to be allowed to escape toward houses along the street. The light proceeding from the vertical axis of the luminaire is redirected both laterally and vertically to build up intensity in the desired directions along the street and at higher vertical angles for lighting the more remote street areas. When the luminaires are intended for projecting light beams in two directions only, provisions are made for depressing the light rays which would be emitted at right angles to street direction so that they fall on the ground nearer the mounting of the luminaire instead of on the houses and yards alongside the street. According to the present invention the provisions for depressing the light rays are in the form of prisms formed in the refractor so that it is unnecessary to employ any internal light shields for this purpose.

Other and further objects will appear as the description proceeds.

For purposes of illustrating the present invention the drawings show an embodiment in which the invention may take form together with modifications, it being understood that the drawings are illustrative of the invention rather than limiting the same.

In these drawings:

Figure 1 is a vertical sectional view on line 1—1 of Figure 2 through a luminaire designed for producing light beams in two directions and suitable for center of street mounting.

Figure 2 is a top plan view of the refractor of the luminaire of Figure 1.

Figures 3 and 4 are fragmentary sectional views on the lines 3—3 and 4—4 respectively of Figure 2.

Figure 5 is a diagrammatic plan view of a refractor for side of street mounting.

Figure 6 is a diagrammatic plan view of a refractor for mounting at an intersection.

Figure 7 is an enlarged perspective view illustrating the appearance of certain of the prisms.

Figure 8 is a diagrammatic plan view showing correlation of the light pattern to street pattern.

Figure 9 is an enlarged sectional view on the line 9—9 of Figure 1 illustrating one form of laterally refracting prisms.

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Figure 10 is an enlarged sectional view of the prisms of Figure 9.

Figures 11 and 12 are views similar to Figures 9 and 10 illustrating a modified form of laterally refracting prism.

In the drawings, an incandescent street lighting lamp is indicated at 20. It is housed in annular specular reflector 21 of parabolic profile with its lower edge mounted slightly below the light center LC of the lamp and designed to project light rays 21 across the vertical axis 22 of the luminaire at uniform angles above the nadir. The preferred range is from 70° to 75°. In the particular instance shown this angle is 72°.

If these rays were allowed to proceed they would fall within a circle having a radius R as indicated in Fig. 8. At an angle of 72° from the nadir the radius of such a circle would be 3.07× the mounting height of the luminaire. This spread of light is insufficient to permit wide spacing of the luminaires and when such a luminaire is mounted over the center of the roadway or street, indicated by the lines S—S, of Fig. 8, most of the light would be wasted to the sides of the street.

In order to control the reflected light and modify its distribution both vertically and horizontally the reflected light as well as the downwardly emitted direct light is intercepted by the refractor bowl 25. To deviate the light rays away from the sides of the street and toward the center of the street the inner surface of the side wall of the refracting bowl is provided with a series of vertical or radial laterally refracting prisms indicated generally by the reference character 26. The inner active surface of these prisms designated at 26 is oblique to the radial plane through the axis and oblique to the reflected light rays so that when the light enters, it suffers lateral and vertical deviation. The prism surfaces 26 in radial planes slope relative to the opposed outer surface so that further deviation in vertical planes takes place when the light is emitted. These prisms are symmetrical with respect to the plane 1—1, having variable refracting power and are generally designed to bend the radially directed rays toward the plane 1—1.

The region of the side wall of the refracting bowl on which the reflected rays impinge and approximately but preferably less than 45° of each side of the plane 1—1 is provided with light elevating prisms 27 shown more clearly in Figs. 1 and 7. These light elevating prisms have uniform refracting power and act to deviate the light from the angle of 72° above the nadir to preferably about 78° above the nadir. Where the light elevating prisms and the laterally deviating prisms occupy the same area of the refractor wall the laterally deviating prisms 26 are superimposed

on the light elevating prisms as more clearly shown in Fig. 7.

The effect of these crossed prisms is to deviate light toward the center of the street and elevate the light so that it now reaches the street surface at a distance indicated by the radius R' (Figure 8) which on the same scale would be 4.70× the mounting height. Hence since the light controlled by these crossed prisms, i. e., the dominant light output which can be usefully employed for lighting the street surface, is at the higher angle from the nadir, the luminaires may be much more widely spaced without increasing the mounting height and will give illumination midway between the luminaires.

In order to improve the shielding of the refractors of Figs. 1 and 2 in directions at right angles to the main beams the outer surface of the refractor wall is provided with light depressing prisms 30. These prisms occupy a region of such angle as to leave four zones 31 between the light depressing prisms and the light elevating prisms in which lateral deviation only takes place. The light depressing prisms 30 act to lower the light rays, as indicated more clearly in Fig. 4 from angles of 72° from the nadir to angles of 66° from the nadir so that in the region occupied by these prisms the light falls on the ground at distances corresponding with radius R'' of Fig. 8, or at a distance of 2.24× the mounting height. This lowering of the light rays provides effective shielding of the luminaire on the house side. In the region between the light depressing and light elevating prisms the vertical angle is not substantially altered so that there is a transition zone of intermediate spread. The full lines of Fig. 8 indicate the light pattern produced by the refractor.

In this discussion no effort has been made to show photometric values or to deal with the change in vertical angle which results from the lateral refraction.

Where the luminaire is intended for side of street mounting instead of center of street mounting, and beams in two general directions such as 40 and 41 (Fig. 5) are desired, the median planes through the laterally refracting prisms are located in the directions of 40 and 41, the laterally refracting prisms are made symmetrical with respect to these planes and the light elevating prisms extend equal angular distances each side of these planes as indicated at 42 and 43. The light depressing prisms on the house side occupy a wider angle than those on the street side as indicated diagrammatically by the dotted line areas 44 and 45. Intermediate the light elevating and light depressing prisms the regions 46 are occupied by laterally deviating prisms only.

Where the luminaire is intended for mounting at an intersection and beams in four directions are desired, the light elevating prisms are arranged in four segments indicated at 47 of Fig. 6 and separated by spaces 48 occupied by laterally deviating prisms only.

For purposes of effecting lateral deviation of light for street lighting refractors commonly employ a form of laterally refracting prisms illustrated in Dorey Patent No. 1,596,006 of August 17, 1926, and laterally deviating prisms formed according to the teaching of this patent may be employed in the refractors of Figs. 1 to 7, inclusive. The action of such prisms is more fully shown in Figs. 9 and 10, and for purposes of illustration prisms located approximately 35° from the median plane 1—1 are selected. Each of these prisms has a dominant active surface 50 which receives most of the light indicated by rays such as 51 and refracts this light so that it is emitted generally parallel with the median plane as indicated at 52. These prisms have risers 53 which are nominally inactive surfaces but do receive a small amonnt of light such as illustrated by the rays 54 and refract them across the principal rays so that they are emitted as back refracted rays 55. These rays proceed, it will be noted, in the direction in which light shielding is caused by annular prisms 30, and are at high angles above the nadir on account of the light elevating prisms.

These back refractions therefore tend to impair the shielding and while prisms such as shown in Figs. 9 and 10 may be used where such impairment of shielding is not important, it is preferable where more complete shielding is demanded, to employ in the region where both great lateral deviation and elevation take place prisms adapted to prevent such back refractions. The prisms shown in Figs. 11 and 12 are adapted to prevent back refractions such as just discussed. In these prisms the risers 60 are in radial planes so as to present no projected area for the light rays to impinge upon. Here the active surfaces 61 of the prisms are connected with the inactive surfaces by curves 62 and 63. With this type of prisms all of the light rays fall on an active surface or one of the curved surfaces. Rays such as 64, 64, 64, are refracted and emitted into the desired direction as shown at 65. Rays such as 66 and 67 go directly through as indicated at 66' and 66' so that no light is emitted in a backward direction. Such prisms have a cutoff so that no light would be emitted corresponding with rays 55 of Figures 9 and 10. These special prisms are therefore valuable in regions where back refractions are not desired. If desired all the laterally refracting prisms may be of this type.

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 forms shown are but a few 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 refractor for acting on light rays proceeding away from a vertical axis at angles of approximately 70° from the nadir, said refractor having vertical laterally deviating prisms occupying two generally opposite quadrants of a band-like zone and acting to concentrate light falling thereon into two beams generally opposite one another, and having in the major portion of said two quadrants internal, annular horizontal, light elevating prisms whereby the light passing through both the oblique surfaces of the superposed vertical and the annular elevating prisms is concentrated into higher angles from the nadir, and the light in the end portions of the two quadrants is deviated only by the lateral prisms.

2. A refractor as claimed in claim 1, having two similar symmetrical quadrants between the first mentioned quadrants.

3. A refractor for acting on light rays proceeding away from a vertical axis at angles of approximately 70° from the nadir, said refractor having vertical, laterally deviating prisms extending through substantially 90° each side of two median vertical planes and acting to concentrate light falling thereon into two beams generally opposite one another, the external surface of the refractor remote from said median planes having

annular light depressing prisms, the internal surface of the refractor adjacent said planes having annular light elevating prisms crossing the lateral deviating prisms and partaking of their obliquity, there being intermediate spaces between the internal and external annular prisms occupied by laterally deviating prisms only.

4. A refractor for acting on light rays proceeding from a vertical axis at uniform angles to the nadir and having in substantially two generally opposite quadrants of a band-like region internal horizontal light elevating prisms to increase the angle of the emitted light relative to the nadir and in two intermediate regions external horizontal light depressing prisms to bend the light nearer the nadir, and two systems of vertical laterally deviating prisms with active surfaces bending the rays toward median planes through the first mentioned quadrants, the laterally deviating prisms opposite the ends of the light elevating prisms having radial risers to provide inactive surfaces with no projected area in the direction of the incident light rays, whereby no light is refracted across the rays refracted by the active surfaces.

5. The improvement in street lighting luminaires having a pendent concentrated light source, a downwardly acting annular reflector about the light source with its mouth substantially at the level of the source and a contour immediately above the horizontal plane through the source which directs light rays across the luminaire axis at angles of approximately 70° above the nadir in a narrow region below the mouth of the reflector and produces an annular light pattern of uniform spread, which improvement comprises an annular refractor intercepting said beam and having in the zone traversed by the reflected rays two opposite sets of external annular light depressing prisms and two opposite sets of internal, horizontal, annular light elevating prisms angularly separated from one another and two opposite sets of vertical, laterally refracting prisms occupying the entire inner periphery of the refractor, the laterally refracting prisms in the region occupied by the light elevating prisms being superposed on the light elevating prisms so that light incident thereon is elevated and laterally deviated on entry into the refractor, each set of vertical prisms being symmetrical with respect to median planes through the light elevating prisms, whereby the reflected light of uniform angle from nadir is converted into beams of higher angled light opposite one another, and light emitted at right angles to the direction of the high angled beams is laterally deviated and emitted at lower angles.

6. A street lighting luminaire as claimed in claim 5, wherein the laterally refracting prisms opposite the end portions of the elevating prisms have radial risers to accept substantially no direct or reflected light to thereby avoid back refractions into the general direction of the depressed beams.

7. The improvement in street lighting luminaires having a substantially point light source, a downwardly acting specular reflector annular about a vertical axis through the source, the reflector being of parabolic profile with the focus at the light source and axis oblique and reflecting light rays across the vertical axis at a uniform controlled angle above the nadir for producing a light pattern of uniform spread, which improvement comprises a refracting bowl having an annular side wall intercepting the reflected light, said wall having two regions of not over 90° angular width generally opposite one another and provided interiorly with horizontal annular light elevating prisms of uniform refracting power and vertical laterally refracting prisms of variant refracting power superposed thereon so that light incident thereon is elevated and laterally deviated on entry into the refracting bowl, the vertical prisms being symmetrical about a median plane through the elevating prisms for elevating the reflected light in said region and concentrating it into the general direction of the median planes, so as to illuminate street areas in said two directions more remote than would have been reached by the reflected light.

8. A street lighting luminaire as claimed in claim 7, having two opposite regions between the first mentioned regions wherein the refractor wall is provided with external downwardly refracting prisms for depressing light reflected into the second mentioned regions and internal laterally refracting prisms for deviating said light toward said median planes.

9. A street lighting luminaire as claimed in claim 7, wherein the laterally refracting prisms in the outer portions of said regions have radial risers to accept substantially no direct or reflected light to thereby avoid back refractions into directions lateral of the median planes.

10. The improvement in street lighting luminaires having a substantially point light source, a downwardly acting specular reflector annular about a vertical axis through the source, the reflector being of parabolic profile with the focus at the light source and axis oblique and reflecting light rays across the vertical axis at a uniform controlled angle above the nadir for producing a light pattern of intermediate spread, which improvement comprises a refracting bowl having an annular side wall intercepting the reflected light, said side wall having two systems of internal, vertical, laterally refracting prisms of variant refracting power for deviating reflected light toward two median planes extending in generally opposite directions, two series of internal, annular, horizontal light elevating prisms generally opposite one another and two series of external, annular, light depressing prisms generally opposite one another and angularly separated from the internal prisms, the internal prisms where they occupy the same region being superposed to provide surfaces oblique to both the radial planes and to the opposed outer surface and acting to elevate light to spread the light beyond the intermediate spread, the external prisms acting to depress the light to be within said intermediate spread, the spaces separating the annular prisms transmitting the light without substantially altering its vertical angle.

KURT FRANCK.

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