

June 15, 1965

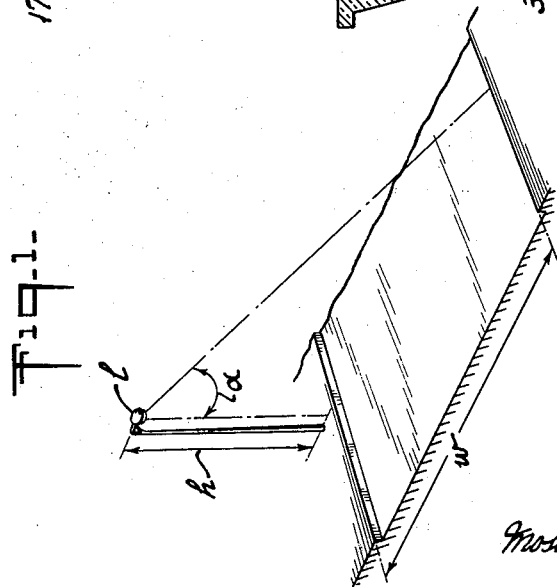
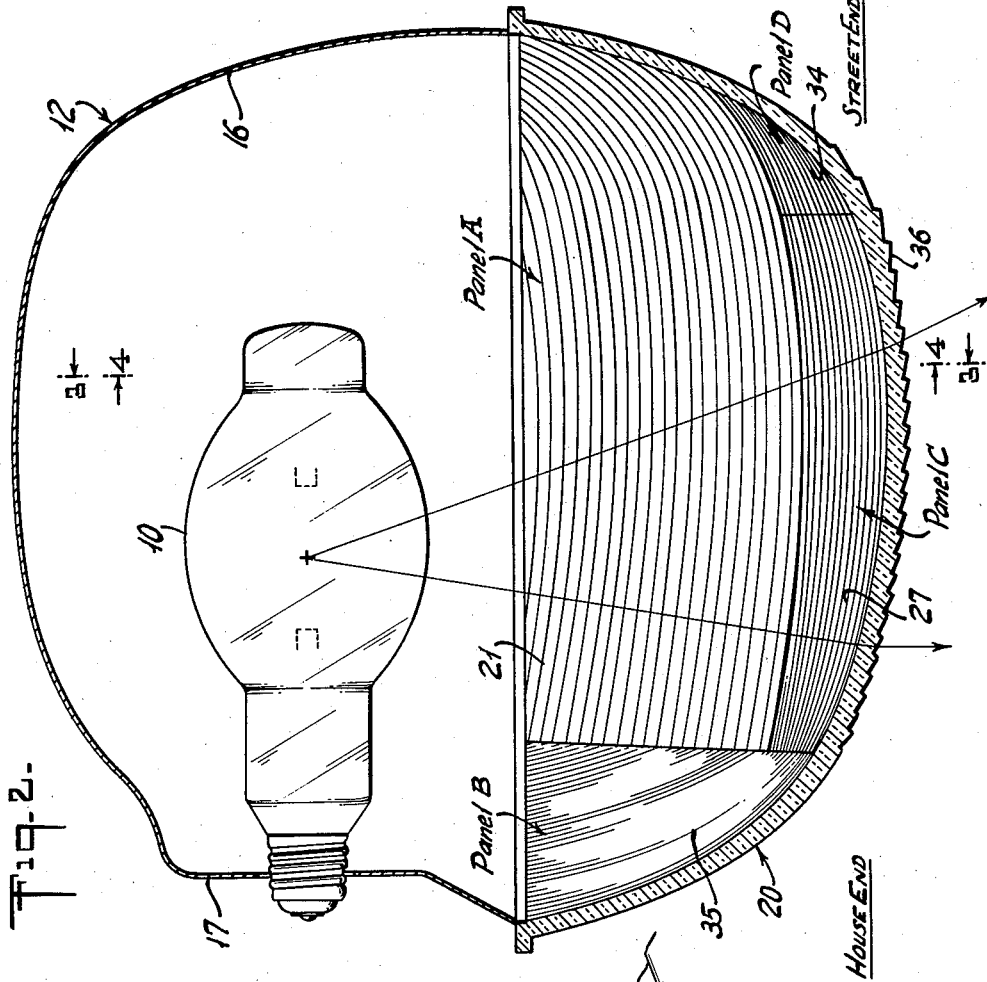
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STREET LIGHTING REFRACTOR

Original Filed Oct. 14, 1957

4 Sheets-Sheet 1



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Fig. 3.

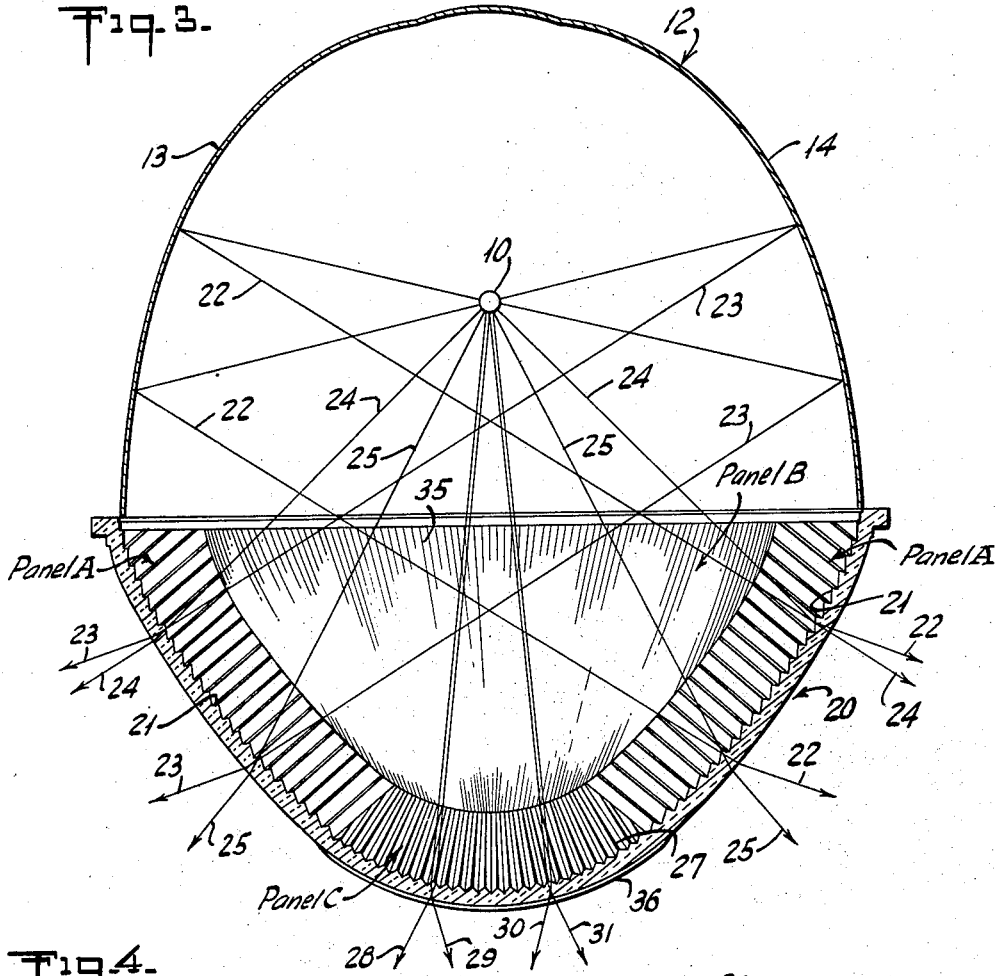
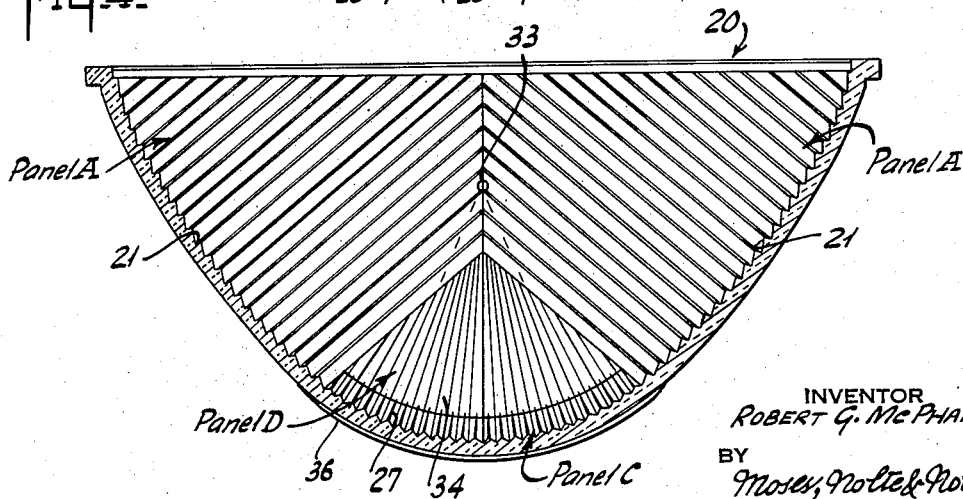


Fig. 4.



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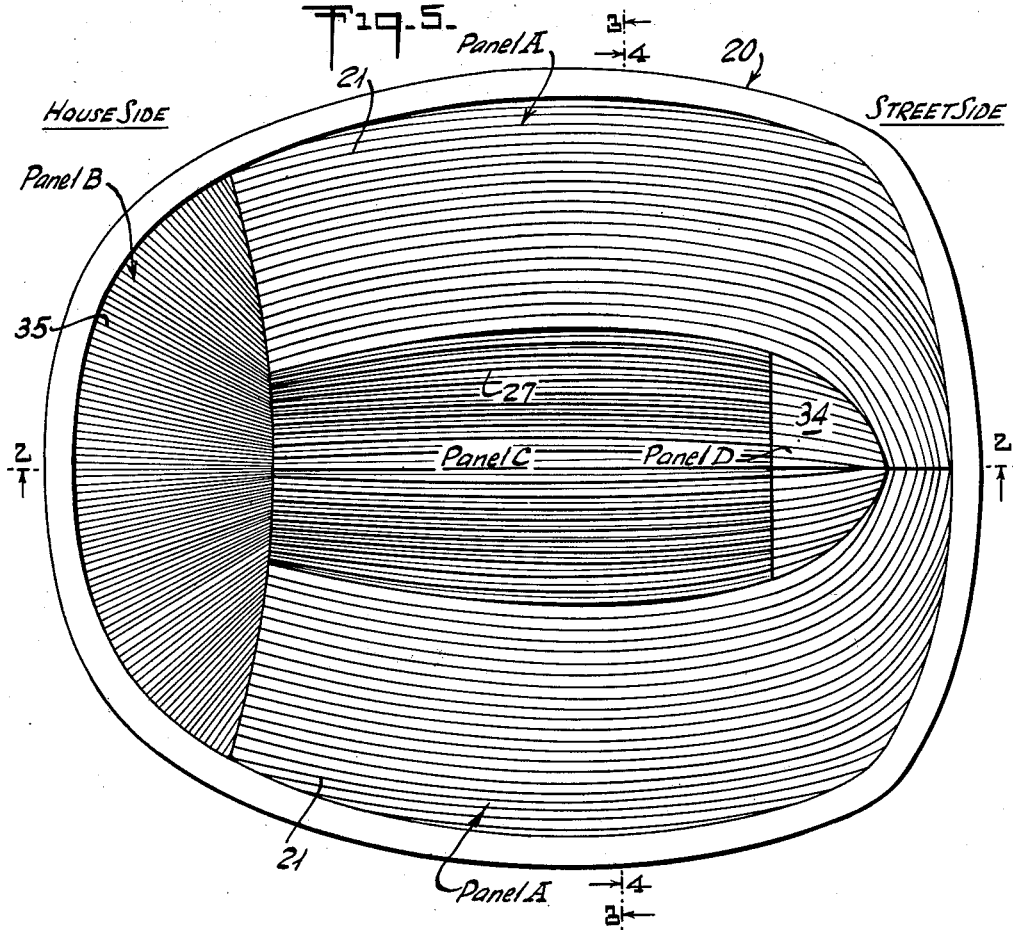


Fig. 6.

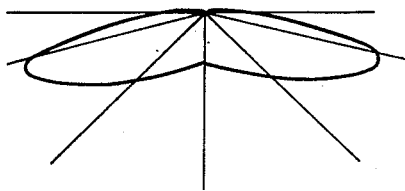
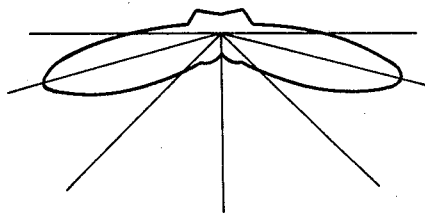


Fig. 7.



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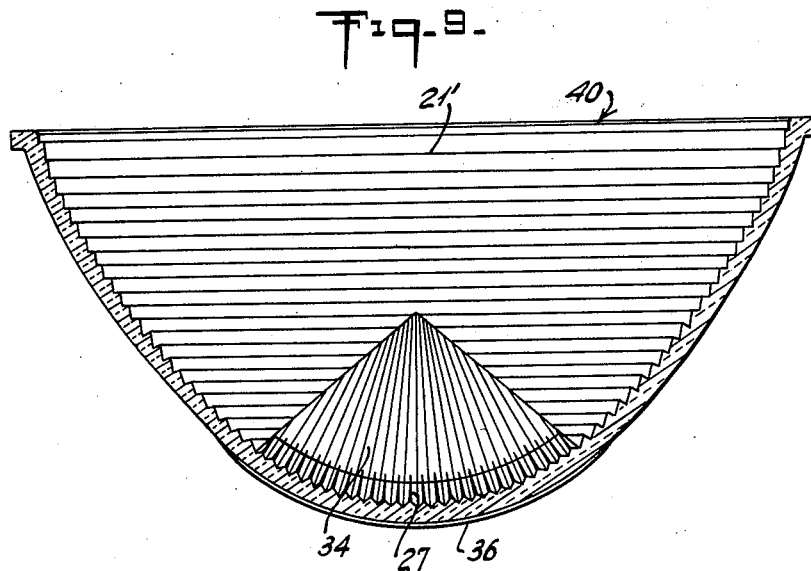
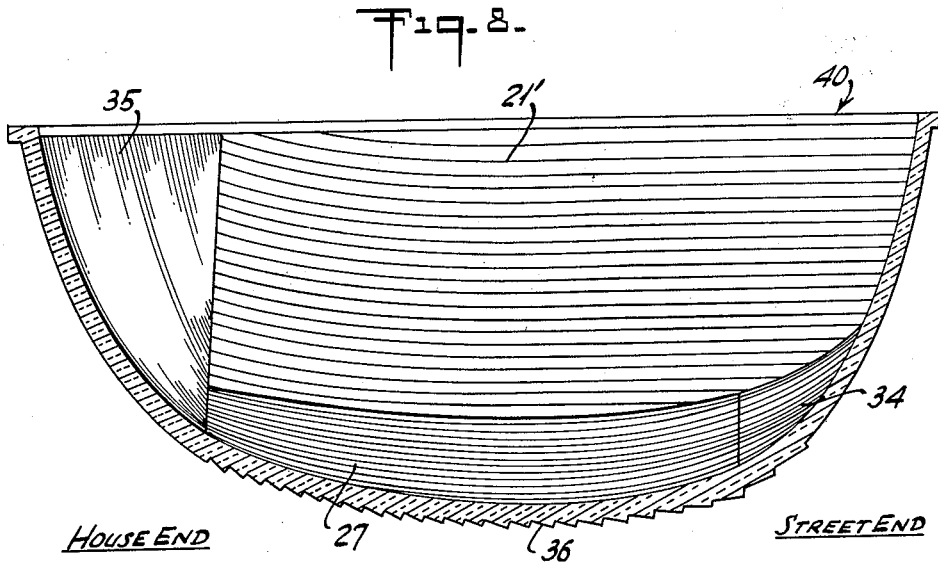
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4 Sheets-Sheet 4



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## STREET LIGHTING REFRACTOR

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a corporation of Delaware  
Continuation of applications Ser. No. 690,093, Oct. 14,  
1957, and Ser. No. 9,672, Mar. 3, 1960. This appli-  
cation Feb. 18, 1963, Ser. No. 259,781  
20 Claims. (Cl. 240—25)

The present invention relates to a refractor for a street lighting luminaire and more particularly to a luminaire employing a horizontal fluorescent-mercury lamp.

This application is a continuation of the application Serial No. 690,093, filed October 14, 1957, now abandoned, and my pending application Serial No. 9,672, filed March 3, 1960, now abandoned.

The inner surface of the mercury lamp bulb is coated with a translucent phosphor, causing the whole bulb to become the light source. Because of the large size of this source, each element of the surface of the reflector and the refractor receives a large solid angle of light and consequently, emits a large solid angle of light.

A refractor according to the invention is used with a reflector consisting of two large parabolic sections, one at each side and largely below the lamp. The axes of these sections are inclined both downward and toward the center of the street, which produces two light beams with maxima at approximately 60° vertical and 75° lateral. Between these parabolic sections, above the lamp, the reflector is shaped to throw the light downward and forward into the street. It also sends as much of this light as possible in such directions as to miss the lamp. The net result is that a large amount of light is directed downward and slightly forward.

The refractor is formed so that with a relatively simple arrangement of prisms it elevates large portions of the light falling on the sides of the refractor into a parallel beam having an elevation of about 70° and spreads the light evenly along the street and deflects it away from the houses on either side of the street. Substantially, the entire portion of the sides of the refractor are covered by light elevating prisms which elevate the direct light about 10° while elevating the reflected light into high parallel beams. The prisms curve upwardly and extend along the street end of the refractor in parallel oblique planes to condense the light beams laterally. The bottom of the refractor is provided with prisms for spreading the light longitudinally of the street and these prisms are arranged radially. The bottom of the refractor, on its outer surface, is provided with the prisms extending in the longitudinal direction of the street for refracting the light toward the far curb, thereby increasing the illumination on the far side of the street.

An object of the invention is to provide a simple efficient refractor for a street lighting luminaire using a fluorescent mercury lamp.

Other objects and advantages of the invention will be apparent and the invention will be fully understood from the following description and drawings in which:

FIG. 1 shows the location of a luminaire relative to a street;

FIG. 2 is a vertical section taken along line 2—2 of

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FIG. 5 of a luminaire embodying a refractor according to the invention;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is a top plan view of the refractor;

FIG. 6 shows the vertical distribution curve of the luminaire;

FIG. 7 shows the lateral distribution curve of the luminaire; and

FIGS. 8 and 9 are sectional views of another refractor according to the invention.

Referring to FIG. 1, the luminaire 1 is adapted to be mounted at a height  $h$  of about 30 feet at one side of the street. It may be placed inward from the curb a distance of about 3 feet. In a typical installation, the horizontal distance  $w$  from the luminaire to the far curb of the street may be 75 feet and the angle  $\alpha$  subtended by the distance  $w$  at the luminaire may be 67½°. The above is the standard specification for a type III street light.

The luminaire is provided with a fluorescent mercury lamp 10. The inner surface of the lamp bulb is coated with a translucent phosphor, causing the whole bulb to become the light source. The refractor 12 consists of two large parabolic sections 13 and 14, one at each side of the median plane of the luminaire and extending a considerable distance below the lamp. The axes of the parabolic sections are inclined both downward and toward the center of the street which produces two beams with maxima at approximately 60° elevation and 75° lateral. Between these parabolic sections above the lamp, the reflector is shaped to throw the light downward and forward into the street. The refractor is also shaped so as to send as much of this light as possible in directions such as to miss the lamp. The net result is that a large amount of light is directed downward and slightly forward. The front end 16 of the refractor, that is, the street end, has a roughly spherical contour which directs some light rearwardly. The rear 17 of the refractor is relatively small and receives little light which it directs downward and forward toward the far curb.

The refractor 20 is symmetrical about a vertical median plane extending through the line 2—2 of FIG. 5. The refractor is in the form of an ovoidal bowl. The inside of the bowl has four panels of prisms. The prisms 21 of panel A extend along the sides of the bowl in a generally horizontal direction, curving upwardly at the street end. At this end of the refractor the prisms 21 extend in oblique parallel planes across the entire upper portion of the street end as shown in FIG. 4. The reflected beams represented by rays 22 and 23 are bent upwardly by prisms 21 to an elevation of 70°—75° and transmitted as substantially parallel beams. The direct light indicated by rays 24 and 25 are also bent upwardly by prisms 21 through an angle of about 10°. The prisms 21 at the street end of the refractor condense the light to some extent due to the curvature of the prisms' paths so as to bend the light away from the houses and toward the street.

The inner surface of the bottom of the refractor is covered by a panel C of prisms 27. These prisms extend in directions generally transverse of the street and also ra-

dially as shown in FIG. 3. Prisms 27 are light splitting prisms which spread the light along the street as indicated by the rays 28, 29, 30 and 31, FIG. 3. Prisms 27 are illuminated by direct light and reflected light from the top of the reflector. A part of the light elevated by prisms 27 at the uppermost portions of panel C meets the light elevated by the adjacent prisms of panel A and thus leaves no dark place under the beams. The other part of the light is depressed by prisms 27 to illuminate the street near the luminaire. Prisms 27 lie in planes which are radial with respect to a line 33 (FIG. 4).

The prisms 35 of panel B cover the inner surface of the house end of the refractor. These prisms extend vertically and radially and are designed to refract light to the right or left in the direction of the street.

At the bottom of the street end of the bowl, there is a panel D composed of shallow prisms or flutes 34, which radiate from the same line 33 as the prisms of panel C. Flutes 34 receive light from the back of the reflector in addition to direct light from the lamp. Flutes 34 are formed to spread the light along the street.

On the outside of the refractor, over the bottom thereof, along panels C and D, there are prisms 36 extending in the general direction of the street. These prisms bend the light toward the far curb and redirect light which would go outside the street on the house side. Prisms 36 correct the illumination pattern near the luminaire, which pattern otherwise would be too bright on the near side of the street and too dark on the far side of the street.

The vertical and lateral distribution curves achieved by the luminaire disclosed herein are shown in FIGS. 6 and 7. The curve of FIG. 6 shows the vertical candlepower distribution measured at 75° lateral. FIG. 7 shows a lateral candlepower distribution curve taken at 72½° vertical.

FIGS. 8 and 9 show a refractor 40 similar to the one shown in FIGS. 2-5. The bending of prisms 21 of refractor 20 upwardly at the street end, as shown in FIG. 4, prevents some light from reaching directly across the street. When lighting wider streets, it is desirable to send more light directly across the street toward the far curb. This is done by running prisms 21' round the entire street end of the refractor horizontally, as shown in FIGS. 8 and 9. The other prisms 35, 27, 34 and 36 of refractor 40 may be the same as those of refractor 20.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claims. It is to be understood that the particular form shown is but one of these forms, and various modifications and changes being possible, the application is not otherwise limited in any way with respect thereto.

What is claimed is:

1. A street lighting luminaire mounted high above one side of the street and including a refractor and a large light source mounted above the mouth of the refractor, said refractor being ovate and externally convex below its mouth and symmetrical about a vertical longitudinal median plane transverse of the street, the inner surface of the upper portion of each side of the refractor having light elevating prisms extending generally horizontally to elevate some of the light into a parallel beam and to elevate other portions of the light to angles below the parallel beam, said prisms curving upwardly at the street end of the refractor and covering the entire upper portion of the street end to refract light laterally along the street away from the houses on the street side while also elevating the light, light splitting prisms extending transversely of the street and covering the inner surface of the bottom of the refractor for spreading the light longitudinally along the street, the outer surface of the bottom of the refractor being covered by prisms extending longitudinally of the street for refracting light across the street.

2. A refractor according to claim 1, wherein the inner surface of the refractor on the house side thereof has

upwardly extending prisms for refracting light laterally away from the houses.

3. A refractor according to claim 1, wherein the light splitting prisms radiate from the street end of the refractor.

4. A refractor according to claim 3, wherein the bottom of the street end of the inside surface has light splitting prisms radiating from the street end.

5. A refractor according to claim 4, wherein the uppermost light splitting prisms are formed to elevate some of the light to substantially the angle of a component of the light transmitted by the lowermost of said light elevating prisms.

6. A street lighting refractor bowl of ovoidal shape for side of street mounting elongated in the direction transverse of the street and symmetrical about a vertical median plane transverse of the street for transmitting direct and reflected light along the street, the inner surface of the bowl being divided into panels of prisms A, B, C and D located on each side of the median plane, panel A extending from the house end of the bowl over the entire upper portion of the sides and the entire upper portion of the street end, the prisms of panels A extending generally horizontally along the sides and formed so as to elevate some of the light into a beam of about 70° elevation, said prisms turning obliquely upward at the street end to refract the light laterally away from said median plane, the panel B prisms covering substantially the entire house end of the bowl and extending upwardly for laterally deflecting the light away from the houses in the direction of the street, panel C extending from the house end to the street end and covering substantially the entire bottom of the bowl from panel A on one side to panel A on the other side, the prisms of panel C being light splitting prisms extending transversely of the street for spreading the light along the street, the panel D being at the lower portion of the street end of the bowl and including prisms arranged to spread the light laterally along the street.

7. A refractor according to claim 6, wherein the outside of the bowl over panels C and D has prisms extending transversely of the median plane for refracting light transversely across the street.

8. A refractor according to claim 7, wherein the prisms of panels C and D extend radially with respect to the same line and radiate outward from the street end.

9. A street lighting refractor adapted to be mounted high above one side of the street, said refractor being ovate and externally convex below its mouth and symmetrical about a vertical longitudinal median plane transverse of the street, the inner surface of the upper portion of the refractor having light elevating prisms extending generally horizontally to elevate some of the light into a parallel beam and to elevate other portions of the light to angles below the parallel beam, said prisms covering each side and the entire street end of the refractor, light splitting prisms extending substantially parallel to said longitudinal median plane and covering the inner surface of the bottom of the refractor for spreading the light longitudinally along the street, the outer surface of the bottom of the refractor being covered by prisms extending longitudinally of the street for refracting light across the street.

10. A refractor according to claim 9, wherein the inner surface of the refractor on the house side thereof has upwardly extending prisms for refracting light laterally away from the houses.

11. A refractor according to claim 9, wherein the light splitting prisms radiate from the street end of the refractor.

12. A refractor according to claim 11, wherein the bottom of the street end of the inside surface has light splitting prisms radiating from the street end.

13. A refractor according to claim 12, wherein the uppermost light splitting prisms are formed to elevate some of the light to substantially the angle of a compo-

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ment of the light transmitted by the lowermost of said light elevating prisms.

14. A street lighting refractor bowl of ovoidal shape for side of street mounting elongated in the direction transverse of the street and symmetrical about a vertical median plane transverse of the street for transmitting direct and reflected light along the street, the inner surface of the bowl being divided into panels of prisms A, B, C and D located on each side of the median plane, the prisms of panel A extending generally horizontally from the house end of the bowl over the entire upper portion of the sides and the street end, the prisms of panels A being formed so as to elevate some of the light into a beam of about 70° elevation and to elevate other portions of the light to angles below the parallel beam, said prisms of panel A covering each side and the entire street end of the refractor, the panel B prisms covering substantially the entire house end of the bowl and extending upwardly for laterally deflecting the light away from the houses in the direction of the street, panel C extending from the house end to the street end and covering substantially the entire bottom of the bowl from panel A on one side to panel A on the other side, the prisms of panel C being light splitting prisms each extending over the entire length of said panel transversely of the street for spreading the light along the street, the panel D being at the lower portion of the street end of the bowl and including prisms arranged to spread the light laterally along the street.

15. A street lighting luminaire mounted high above one side of the street and including a refractor and a large light source mounted above the mouth of the refractor, said refractor being ovate and externally convex below its mouth and symmetrical about a vertical longitudinal median plane transverse of the street, the inner surface of the upper portion of each side of the refractor having light elevating prisms extending generally horizontally to elevate some of the light into a parallel beam and to elevate other portions of the light to angles below the parallel beam, said prisms curving upwardly at the street end of the refractor and covering the entire upper portion of the street end to refract light laterally along the street away from the houses on the street side while also elevating the light, light splitting prisms extending transversely of the street and covering the inner surface of the bottom of the refractor for spreading the light longitudinally along the street, the outer surface of the bottom of the refractor being covered by prisms extending longitudinally of the street for refracting light across the street.

16. A street lighting luminaire mounted high above one side of the street and including a refractor bowl of ovoidal shape having a large light source above its mouth and elongated in the direction transverse of the street and symmetrical about a vertical median plane transverse of the street for transmitting direct and reflected light along the street, the inner surface of the bowl being divided into panels of prisms A, B, C and D located on each side of the median plane, the prisms of panel A extending generally horizontally from the house end of the bowl over the entire upper portion of the sides and the street end, the prisms of panel A being formed so as to elevate some of the light into a beam of about 70° elevation and to elevate other portions of the light to angles below the parallel beam, said prisms of panel A covering each side and the entire street end of the refractor, the panel B prisms covering substantially the entire house end of the bowl and extending upwardly for laterally deflecting the light away from the houses in the direction of the street, panel C extending from the house end to the street end and covering substantially the entire bottom of the bowl from panel A on one side to panel A on the other side, the prisms of panel C being light splitting prisms each extending over the entire length of said panel transversely of the street for spreading the light along the street, the panel D being at the lower portion of the street end of

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the bowl and including prisms arranged to spread the light laterally along the street.

17. In a street lighting refractor for use with a large light source mounted high above one side of the street within a downwardly opened reflector which reflects light from the light source into downwardly and forwardly main reflected beams, said refractor being ovate and externally convex below its mouth and symmetrical about a vertical longitudinal median plane transverse of the street, the upper portion of the refractor from the mouth downwardly and along the major portion of the sides and along the entire street end having prism means for elevating the reflected main beams and direct light from the light source, said prism means consisting of vertically adjacent continuously formed prisms extending continuously horizontally along their entire length throughout the sides and entire street end of the refractor and prismatic elements covering substantially the entire bottom of the refractor for spreading the light along the street and transversely of the street.

18. A street lighting luminaire mounted high above one side of the street and including a downwardly opened reflector, a large light source disposed within said reflector, a refractor bowl of ovoidal shape having a mouth opening upwardly and disposed below said light source and said reflector and being elongated in the direction transverse of the street and symmetrical about a vertical median plane transverse of the street for transmitting direct and reflected light along the street, said reflector directing light from the light source into two vertically, laterally and forwardly extending main reflected light beams, one on either side of the vertical median plane of said refractor, said refractor bowl including panels of prisms A, B and C, located on each side of the median plane, the prisms of panel A being vertically adjacent and continuously formed and extending over the inner surface of the bowl continuously horizontally along their entire length from the house end of the bowl over the entire upper portion of the sides and the street end of the bowl, said prisms of panel A constituting light elevating means disposed relative to said light source and said reflector for raising the main reflected light beams from said reflector and direct light from said light source, the prisms of panel B covering substantially the entire house end of the bowl and extending upwardly for redirecting the light away from the houses in the direction of the street, and the prisms of panel C extending from the house end to the street end and covering most of the bottom of the bowl from panel A on one side to panel A on the other side, the prisms of panel C constituting prism means for spreading the light laterally along the street.

19. A refractor for a street lighting luminaire mounted high above one side of the street and having a large light source above the mouth of the refractor and within a reflector which directs light from the source into two downwardly, laterally and forwardly extending main reflected light beams; comprising a bowl of ovoidal shape elongated in the direction transverse of the street and symmetrical about a vertical median plane transverse of the street for transmitting direct and reflected light along the street, prism means located on each side of the median plane for raising the main reflected light beams from said reflector and direct light from the light source, said prism means including vertically adjacent and continuously formed prisms extending continuously horizontally along their entire length from the house end of the bowl over the entire upper portion of the sides and street end of the bowl, further prisms covering substantially the entire house end of the bowl and extending upwardly for redirecting the light away from the houses in the direction of the street, and prismatic elements covering substantially the entire bottom of the bowl for spreading the light along the street and transversely of the street.

20. In a street lighting refractor for use with a large

light source mounted high above one side of the street within a downwardly opened reflector which reflects light from the light source into downwardly and forwardly main reflected beams, said refractor being ovate and externally convex below its mouth and symmetrical about a vertical longitudinal median plane transverse of the street, the upper portion of the refractor from the mouth downwardly and along the major portion of the sides and along the entire street end having prism means for elevating the reflected main beams and direct light from the light source, said prism means consisting of vertically spaced continuously formed prisms extending continuously along their entire length throughout the sides and entire street end of the refractor, said prisms extending horizontally along the sides of the bowl and turning from the horizontal and extending obliquely up-

wardly at the street end of said bowl and prismatic elements covering substantially the entire bottom of the bowl for spreading the light along the street and transversely of the street.

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15 NORTON ANSHER, *Primary Examiner.*