United States Patent

[11] 3,581,082

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[54] STREET LIGHTING LUMINAIRE REFRACTOR
14 Claims, 14 Drawing Figs.

[52] U.S. Cl. 240/106, 240/25
[51] Int. Cl. F21v 5/00
[50] Field of Search 240/106, 25

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Primary Examiner—John M. Horan
Assistant Examiner—Monroe H. Hayes
Attorney—Nolte and Nolte

ABSTRACT: In a tilted oval street luminaire, a refractor for use with a physically oval, but optically round, reflector provides four substantially uniform light beams for intersection lighting. Vertical prisms in the forward beam sections of the refractor and vertical and horizontal prisms in the rear beam sections of the refractor provide the basic four way distribution from a tilted reflected beam which, because of reflector design considerations may be horseshoe-shaped or annular. Some or all of the vertical prisms may have their normally inactive or intermediate surface oriented to receive light to balance the candlepower as between the front and rear beams and horizontal prisms acting in conjunction with the vertical prisms lower the reflected and lateral refracted beams. Front and rear radial prisms redirect incident direct light and reflected plus direct light respectively, into the front and rear streets, the latter radial prisms building the below beam component in the rear streets. The bottom of the refractor provides four basic sections of variously oriented prisms on the incident surface, further subdivided into four further sections each to split the direct and reflected light from underneath the unit and uniformly distribute it over the entire intersection. Longitudinal flutes centrally located on the outer surface below the inside bottom sections, and a checkerboard pattern of crossing flutes on the lower portion of street side outer surface coact with the inside prisms to break up the strong component of reflected light while paying due respect to the direct light to confine the down light within the intersection.

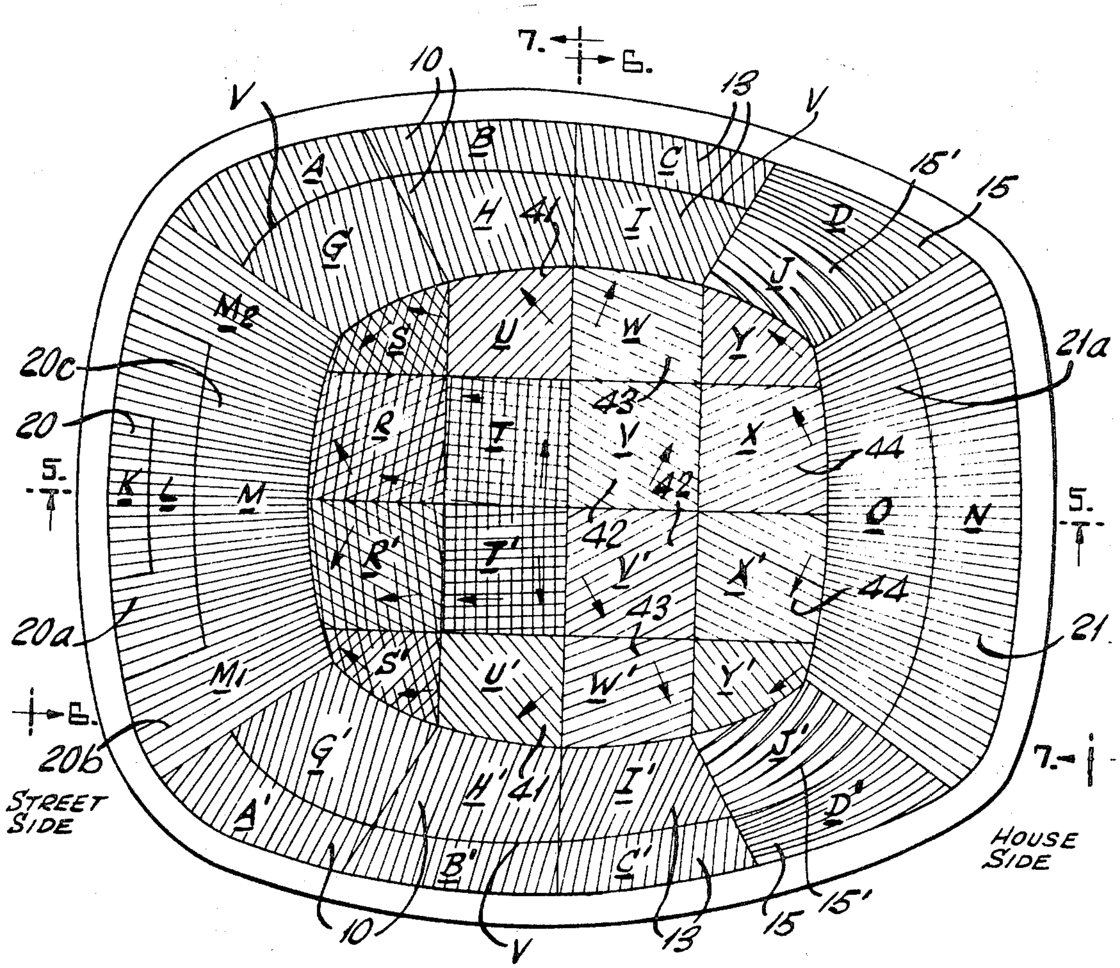
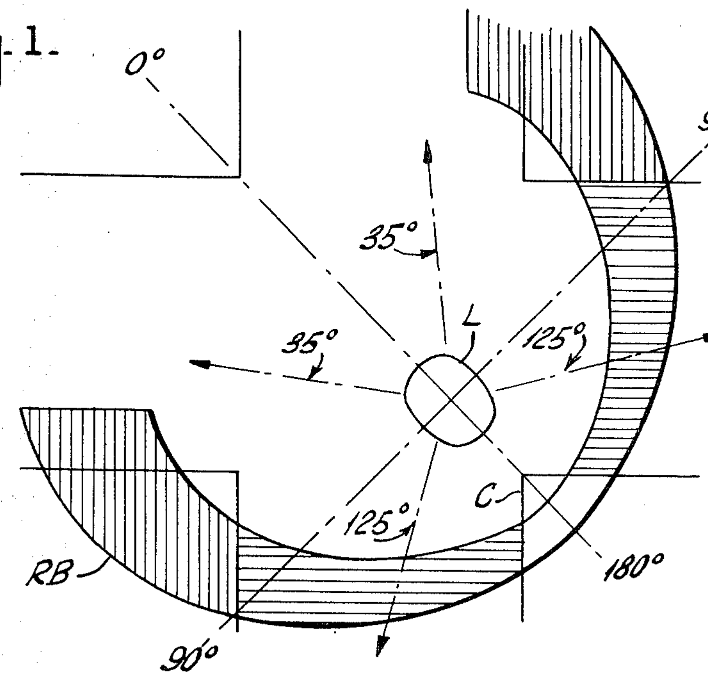


Fig. 1.



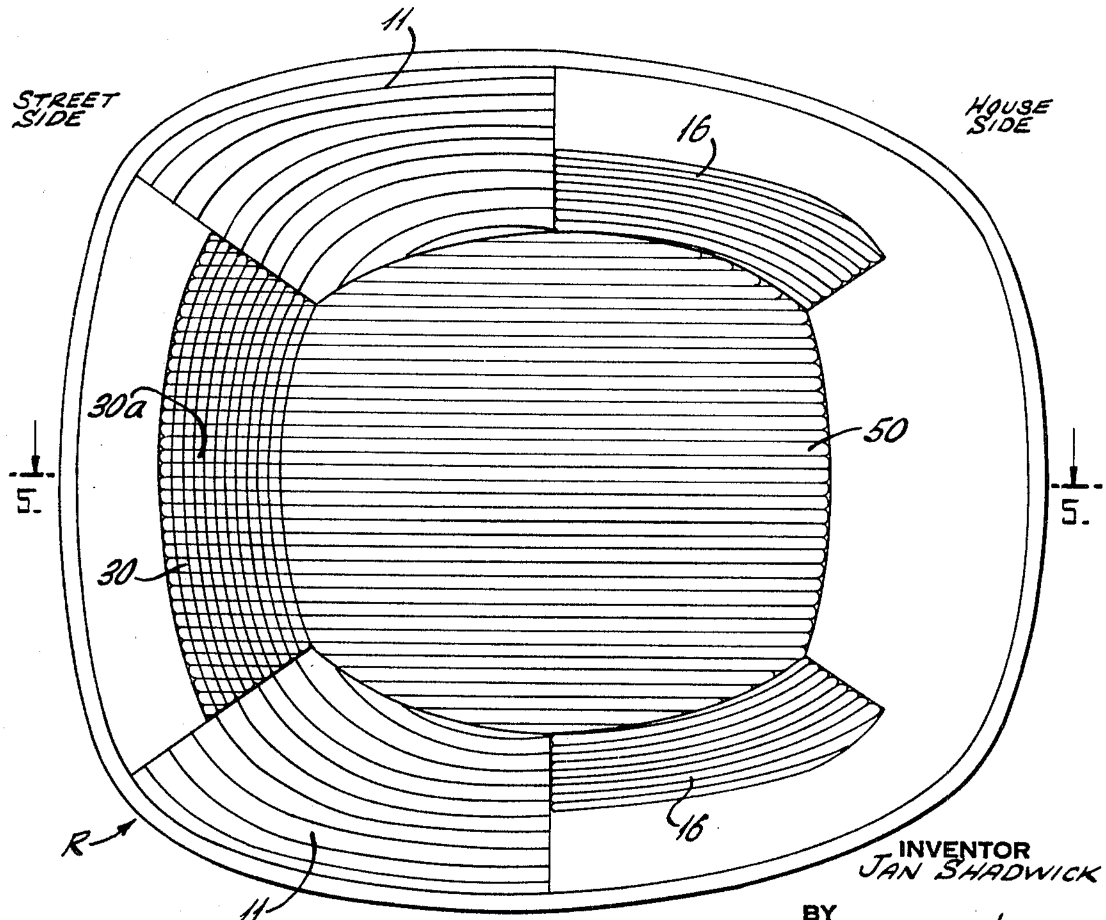


Fig. 2.

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Fig. 3.

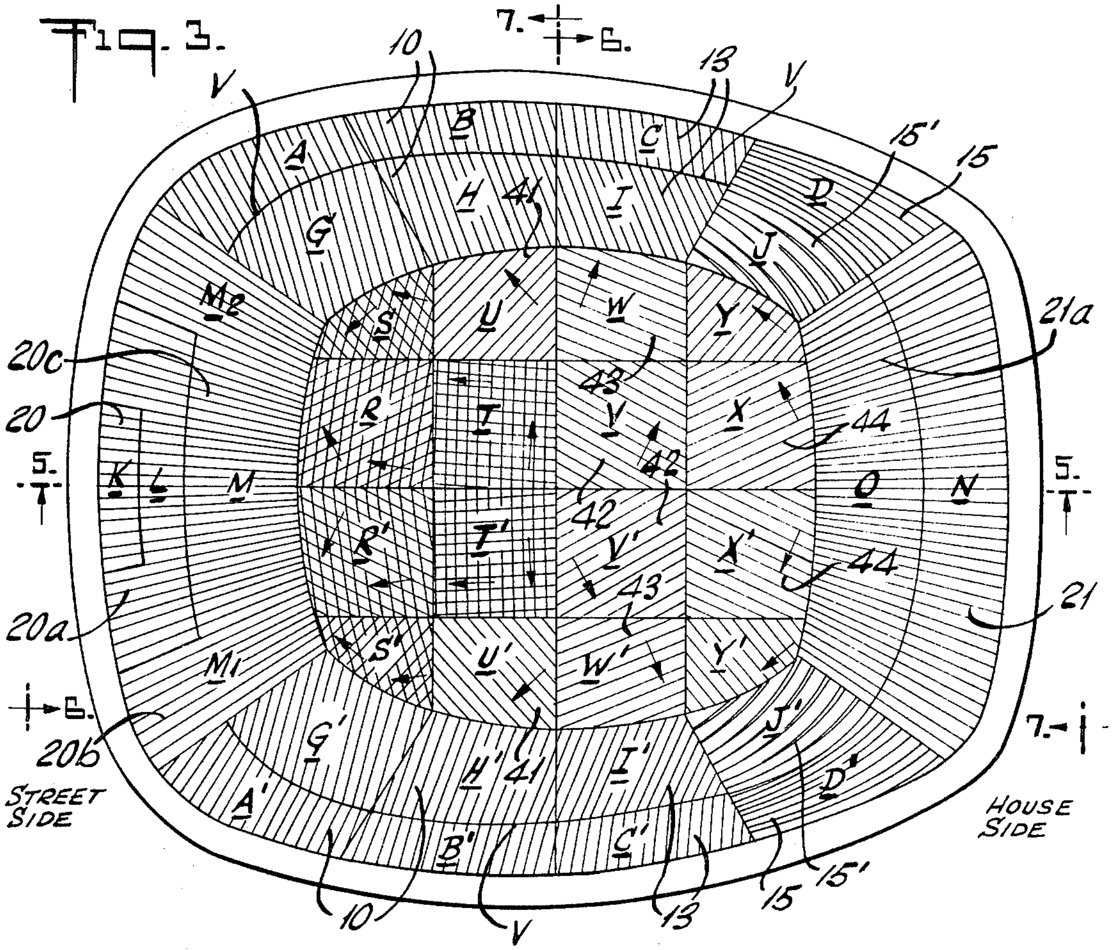

Fig. 4.

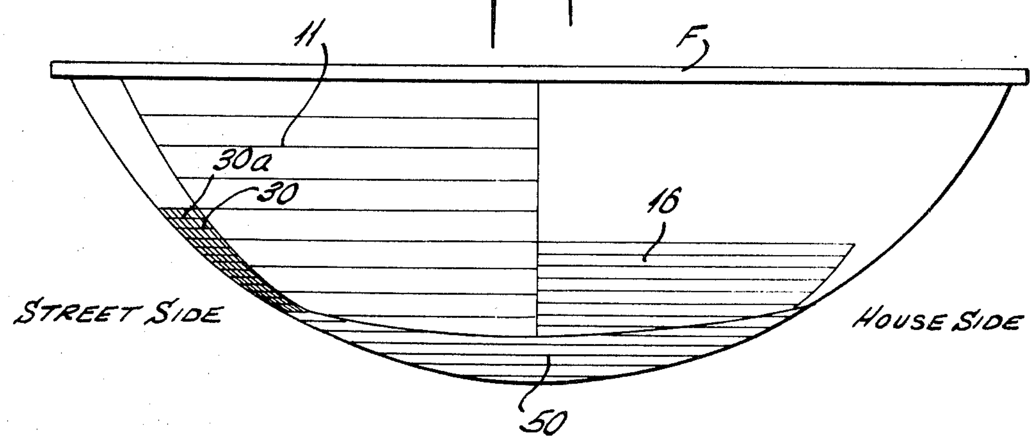

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Fig. 3S.

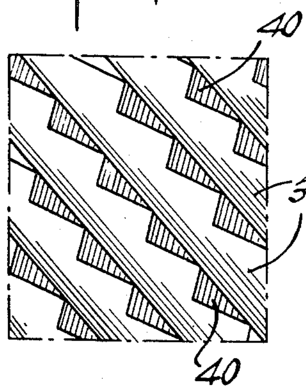

Fig. 3R.

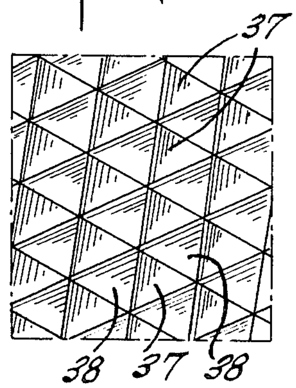

Fig. 3T.

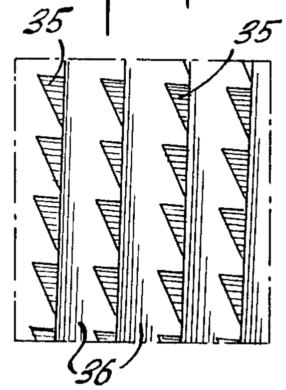

Fig. 5A.

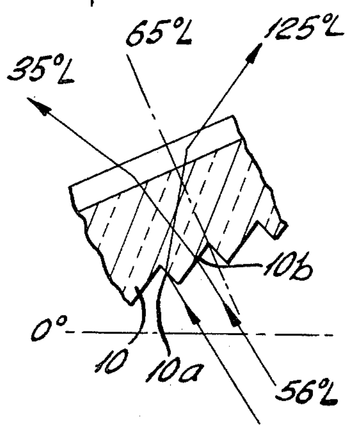

Fig. 5H.

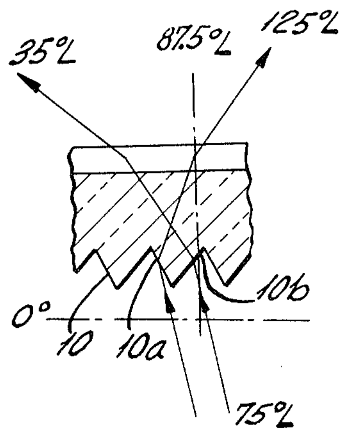

Fig. 5I.

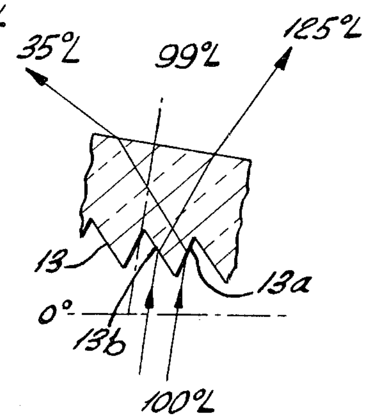

Fig. 8.

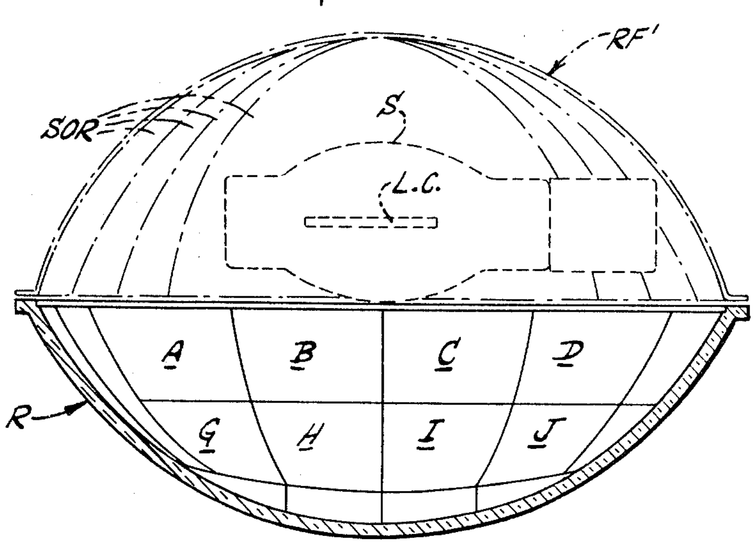

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Fig. 5.

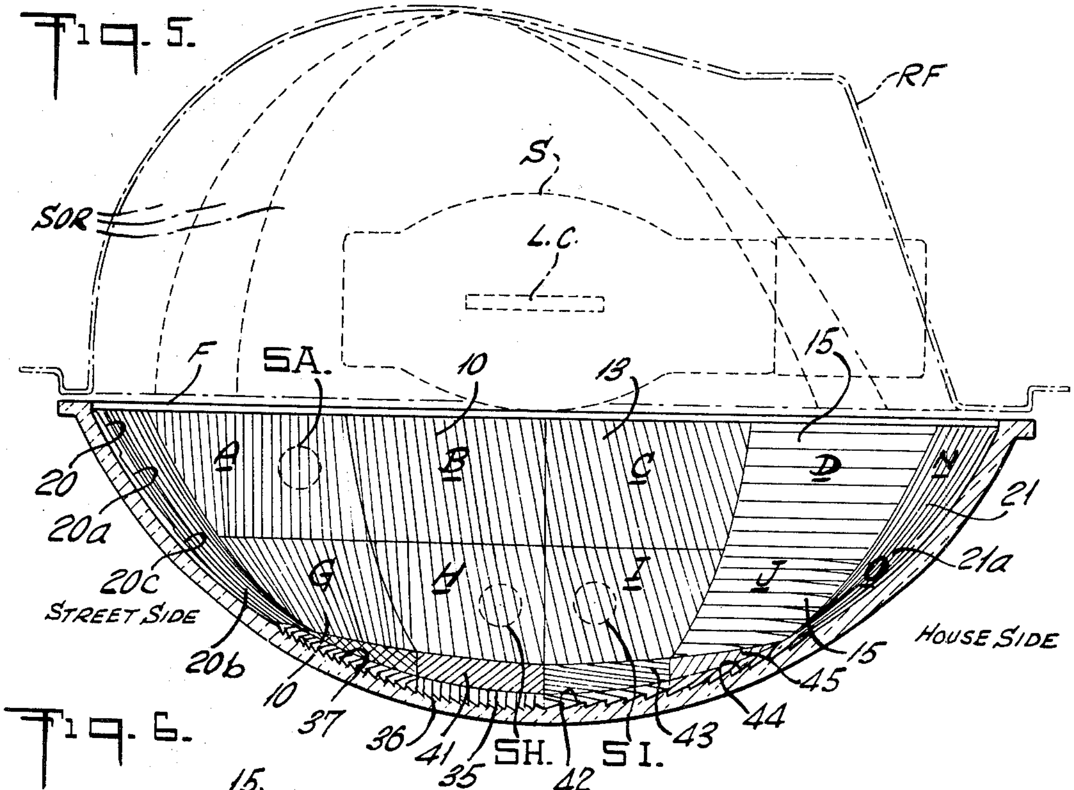


Fig. 6.

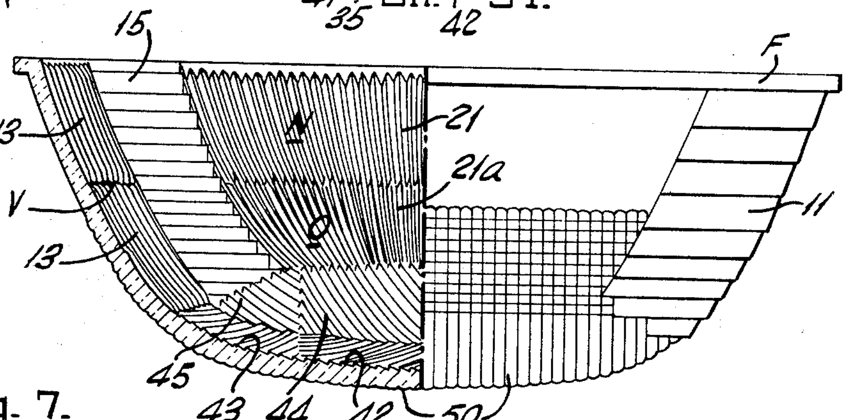
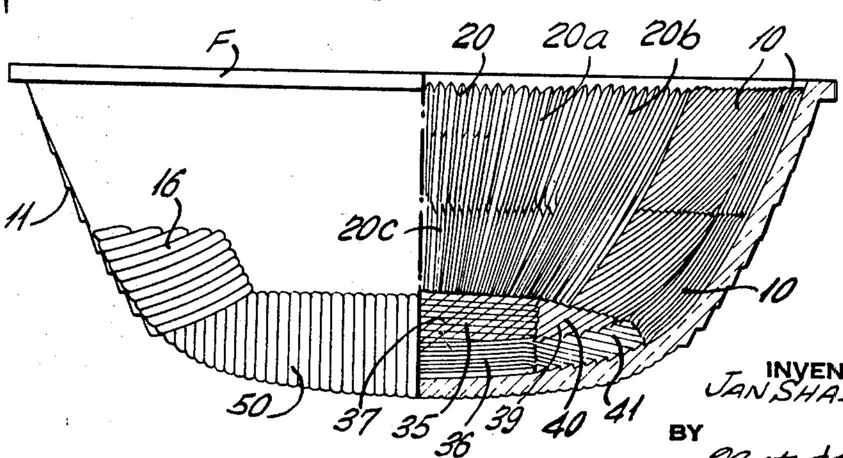


Fig. 7.



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STREET LIGHTING LUMINAIRE REFRACTOR

This invention in a street lighting luminaire derives its objects from the provision of a four-way street luminaire refractor to be used in conjunction with a physically oval, but optically round reflector to provide four substantially uniform light beams for intersection lighting and to substantially uniformly distribute the direct and reflected light from underneath the unit over the entire intersection.

A reflector having the physically oval, optically round, characteristics is disclosed in the Crosby Patent, U.S. Pat. No. 3,112,893.

The objects of the invention also derive from the contemplation of such a refractor in a luminaire which is tilted upwardly toward the front or 0° end and provides for this purpose, on either side of the refractor, near vertical beam section prisms in the 35° L (lateral) to 90° L, for laterally directing the forward portions of the tilted reflected annular or horseshoe beam emitted at comparatively high angles by the reflector. Similar near vertical prisms are provided on either side of the refractor in the 90° L toward 145° L area with generally "parallel to flange" prisms extending forward from 145° L to vertically redirect light from the lower rear portions of the tilted reflected beam.

In a refractor incorporating the invention, the outside surface of the refractor provides "parallel to flange" prisms in the 35° L to 90° L areas to depress the high forward portions of the legs of the beam which are laterally oriented by the near vertical prisms, which in the preferred embodiment of the invention, are on the inside of the refractor.

Another of the objects of the invention is to provide a balanced candlepower between the front and rear refracted beams, and to this end, some or all of the inside near vertical prisms may be designed by sloping their normally "intermediate" inactive surfaces to accept more or less light, thereby changing their character to double acting or light splitting prisms, to reduce the candlepower of their respective front or rear beams and increase the candlepower of the other beam. In this respect, these vertically oriented prisms also perform brightening functions by laterally enlarging the flashed area.

Radial vertically oriented inside prisms at the front end of the refractor move direct light from the source, which, because of lamp socket considerations at the rear of some such reflector, may be the only incident light in this area, laterally into the front streets and are designed to provide increasingly varying refractive power from the beam section toward the longitudinal centerline of the refractor and from the bottom to the flange to complement the direction of the beam section light in the front streets. Similar varying of refractive power in radial vertically oriented internal prisms at the rear of the refractor perform similar functions for the rear street beams. These rear radial prisms, however, are designed to accept reflected and direct light and in moving it into the back streets, assist in building the "below the beam" component of the over all rear street distribution.

In such a unit as described, direct and reflected light directly underneath the unit in the area of the refractor bottom is considerable and it is, therefore, also an object of the invention to uniformly distribute this light over the entire intersection as uniformly as possible. In keeping with this object, the invention provides four internal prismatic areas on the bottom of the refractor to accept approximately equal quantities of direct and reflected light. In an effort to break up the strong reflected light component and at the same time, pay due respect to the direct light, the four basic prismatic areas are subdivided into four sections each. In this way, the prismatic structures of each of the areas are such as to obtain optimum results. Thus, in the forwardmost sections confining the basically radial emission from the light source and the converging rays from the hemispherical reflector surfaces within the intersection, is accomplished by compound, superimposed prism designs in each section.

Diffusion, particularly of the strong downlight components and of the components of light emitted from the refractor at comparatively lower angles in the beam directions to smooth out the distribution and limit glare to a certain extent is provided basically by longitudinally disposed flutes on the outer surface of the refractor with a system of longitudinal and transverse superimposed flutes at the lower portion of the front end of the refractor.

The construction of a luminaire embodying the invention will best be understood by reference to the following drawings, in which:

FIG. 1 is a diagrammatic plan view of a street intersection showing one kind of reflected beam area derived from tilted, optically round reflector and showing, via the arrows, a desirable light distribution from a luminaire;

FIG. 2 is a bottom plan view of a four-way refractor embodying external prism constructions of the invention;

FIG. 3 is a top plan view of the refractor of FIG. 2 showing the internal prismatic constructions thereof;

FIG. 3T is magnified plan view of a portion of the prismatic panel designated T in FIG. 3;

FIG. 3R is a magnified plan view of a portion of the prismatic panel designated R in FIG. 3;

FIG. 3S is a magnified plan view of a portion of the prismatic panel designated S in FIG. 3;

FIG. 4 is a side elevational view of the refractor of FIGS. 2 and 3;

FIG. 5 is a sectional view taken along the lines 5–5 of FIGS. 2 and 3 and showing in phantom one type of optically round reflector, the design of which results in a horseshoe-shaped reflected beam;

FIG. 5A is a diagrammatic view of a detail encircled by 5A in FIG. 5 and showing arrowed ray traces directed by prisms disposed at about 65° L;

FIG. 5H is a diagrammatic view of a detail encircled by 5H in FIG. 5 and showing arrowed ray traces directed by prisms disposed at about 87.5° L;

FIG. 5I is a diagrammatic view of a detail encircled by 5I in FIG. 5 and showing arrowed ray traces directed by prisms disposed at about 100° L;

FIG. 6 is an end elevational view of the street side of the refractor partially in section, the sectional view being taken along lines 6–6 of FIG. 3;

FIG. 7 is an end elevational view of the house side of the refractor partially in section, the sectional view being taken along the lines 7–7 of FIG. 3; and

FIG. 8 is a sectional view similar to FIG. 5 but in less detail and showing another type of optically round reflector the design of which results in an annular shaped reflected beam.

The refractor R of the present invention was designed for the problems arising in the luminaire street lighting situation presented at an intersection (FIG. 1) where the object is to take the light emitted by the light source and reflector and to direct it into four substantially uniform beams in the 35° and 125° directions on either side of the luminaire, which is mounted closer to one corner C of the intersection along the 0° to 180° axis.

Besides the fact that the luminaire is diagonally offset in the intersection, the problems become compounded because of the physical characteristics of the fixture portions of modern luminaires and the desire to retain appearance characteristics both along the streets and at the intersection. In this respect, it is desirable, both from an appearance standpoint and from the standpoint of economics in the manufacture of fixture components that where tilted luminaire units are used along the street, a tilted luminaire should also be used at the intersection.

In any event, the problem becomes even more complex when, to the diagonal offset there is added a normal upward tilting of the street end of the luminaire to about 10° and when there is also added the ovate shape of the modern luminaire which developed from the desire to more efficiently use the short, but still linear light source presented by mercury arc lamps. Previously, the ovate design, carried through in the reflector, resulted in a pair of oppositely directed parallel ray reflected beams on either side of the longitudinal centerline of the luminaire. With such a reflector, design considerations for the refractor resulted in constructions which split the oppositely extending beams into two beams each for intersection lighting. When it was desired, however, to accurately place these beams along the perpendicular streets of the intersection from an offset tilted ovate refractor, more and more complex prismatic features had to be designed into the refractor. Also, mounting height, degree of tilt and amount of diagonal offset could vary from one installation to the next and accuracy of beam placement became a recognized problem.

While refractor design, in most instances, can, and indeed has, cured any given intersection problem resulting from the various considerations just discussed, a very desirable development occurred when a reflector RF, such as shown in phantom in FIGS. **5** and **8**, and as more thoroughly disclosed in the patent aforementioned, was designed. The overall physically ovate appearance of the reflector RF was in keeping with the desirably uniformity of appearance factor, but the fact that the reflector is, in fact, optically circular permitted a certain consistency of prismatic design features in a refractor to be used in conjunction with it.

Very succinctly stated, the reflector provided a series of surfaces of revolution SOR about a common directrix corresponding to a line extending upwardly form nadir with the surfaces of revolution SOR intersecting at least one plane perpendicular to the directrix to form a plurality of arcs of circles having differing radii, increasing toward the ends, and a common center at the intersection of the directrix with the perpendicular plane.

It is noted that the reflected beam pattern RB (FIG. **1**) from such a reflector RF is that of a horseshoe beam and when tilted the forward portions of the beam are emitted at higher angles resulting in a wider distribution on the street forwardly of the luminaire L. An annular reflected beam pattern, not shown, results from the reflector RF^1 shown in FIG. **8**, where luminaire component placement does not call for modification of the house side end of the reflector. When the luminaire is tilted, of course, the annular pattern assumes a wider distribution forwardly because of the higher forward angles of emission.

Keeping these beam patterns in mind, the present invention solves the distribution problems resulting from the intersection luminaire evolution just discussed with the prismatic structures now to be described.

The refractor R is generally ovate in horizontal planes and bowl shaped in vertical sections and, as can best be appreciated in FIG. **2**, is symmetrical relative to the longitudinal center line. A flange F is provided at the top of the refractor for mounting purposes.

The internal prisms along the sides of the refractor, about to be discussed, are designed for predominantly reflected light considerations but keeping in mind incident direct light.

The areas A, B, G, H, A′, B′, G′, H′, best viewed in FIGS. **3** and **4**, extending approximately from 35° L to 90° L on either side of the refractor are provided with internal prisms **10**, which when the refractor is tilted in the mounted luminaire L (FIG. **1**), are oriented substantially or nearly vertically and are basically designed to receive the front, higher portions of the annular or the horseshoe beam formed by reflected light and to receive the direct light from the source S disposed at and through the light center LC, and to redirect the same laterally to form the front beams in the 35° L directions. External prisms **11** in this same 35° L to 90° L area, best viewed in FIG. **4**, depress this laterally refracted light, placing the beams along the required vertical location.

The paths of the prisms **10** may vary from the vertical such as is indicated along lines V in order to dispose the prisms in paths for most efficient refraction. The variance of the path of prisms **10** facilitates plunger cutting for varying of the slope of the normally intermediate or inactive surfaces **10*a*** (FIGS. **5A** and **5H**) along the vertical length thereof so that these surfaces can most efficiently be disposed, preferably but not necessarily, along the lower portion of the prism, to accept light along with the always active surface **10*b***, as depicted with arrowed ray traces in FIG. **5H**.

By thus varying the path of prisms **10** and the slope of surface **10*a*** (and therefore the refracting power) along the vertical extension thereof and/or from adjacent prism **10** to adjacent prism **10**, as illustrated in FIGS. **5A** and **5H**, for instance at 65° L and 87.5° L, CP (candlepower) unbalance as between the front beam at 35° L and rear beam at 125° L on either side of the 0°—180° axis may be minimized by the fact that front beam candlepower will be reduced while increasing candlepower in the back street beams. The many variations in prism designing become apparent when it is again noted that the slope of the inactive surfaces in FIG. **5H** is greater relative to the slope of the inactive surfaces in FIG. **5A** thereby providing more refractive power toward the street end of the refractor sides than toward the intermediate portions thereof.

By adjusting the slope of surfaces **10*a*** to intercept just small amounts of light, as illustrated in FIGS. **5A** as opposed to FIG. **5H** where the incident reflected light is at 56° L and 75° L respectively, the effect of outside "brightening prisms" such as disclosed in U.S. Letters Pat. No. 3,249,750, is achieved, but with inside prisms as opposed to the outside brightening prisms of the referenced patent. Thus, the flashed area on the side of the refractor is laterally increased resulting in a reduction of brightness in the flashed area as viewed from the street and resulting in a corresponding reduction of "dark" spots or areas on refractor sides as similarly viewed.

The back beam sections of the refractor R are areas C, D, I and J, C′, D′, I′ and J′. Sections C and I extend from approximately 90° L on either side of the refractor toward the rear end and include inside near vertical prisms **13** and perform refracting functions similar to prisms **10** in the front beam sections A, B, G and H, the design thus being concerned with directing the reflected light into the back beams. FIG. **5I** discloses that these prisms **13**, shown at 90° L may also include active "intermediate" surfaces **13*a*** to minimize CP unbalance as between the front and rear beams at 35° L and 125° L. The incident ray traces are illustrated as being at 100° L.

Because of the tilt of the luminaire, there are no lifting prisms on the external surface in these rear or house end areas, that is, the lower portions of the reflected horseshoe or annular beams may be already vertically oriented by the tilt.

However, areas D and J extending from approximately 145° L forwardly to sections C and I respectively are provided with internal prisms **15** which lie generally parallel to the flange F of the refractor R. These parallel-to-flange prisms elevate the lowest light from the rear portions of the reflected beam to lift these portions to the required vertical position. Desirably, these prisms **15** follow paths dictated by the curvature of the refractor side, which near the 180° end is more emphasized in the lower portions, where prisms **15′** may have the slopes of normally inactive surfaces, or portions of them as shown in FIG. **3**, change to accept light at their rearmost ends for vertically spreading some of the light.

The outside surface of the refractor in the lower portions of the rear beam sections opposite internal prisms **13, 15′** in the I and J areas is covered with longitudinal flutes **16** for vertical diffusion of the lower rear beam components.

The front or 0° end of the refractor R receives substantially only direct light and in the embodiment utilizing the reflector RF depicted in FIG. **5** and provides, on either side of the longitudinal centerline, internal radial prisms **20, 20*a*, 20*b*, 20*c***, having varying slopes resulting in five defined areas of prismatic action K, L, M, M_1 and M_2. A high degree of lateral refraction takes place in the upper central portion K where prisms **20** receive high angled light at slight lateral angles near the longitudinal centerline. The refracting power of prisms **20*a*** is reduced in area L which receives high angled light on either side of area K at greater lateral angles; and is again reduced to the greatest degree along prisms **20*b*** in areas M_1

and M_2 where the wide lateral angles of the light on either side of area L need even less lateral refraction to place the light into the front beams. Decreasing the refracting power of prisms **20**, **20**a, **20**b and **20**c from the flange downwardly through the central portions of areas K, L, M effects a spreading of some of the lower angled front light across the intersection between the front beams.

In this last respect, diffusion of light between the two front beams is effected by the provision of transverse and longitudinal flutes **30**, **30**a superimposed on one another on the outer surface of the refractor opposite the lower portion of area M.

The rear or house or 180° end of the refractor, which receives both direct and reflected light, is also provided with internal radial prisms **21**, **21**a which may decreasingly vary in refracting power from upper area N to the lower portions of the end in area O, and for the same light lateral diverging and spreading functions as performed at the front end by prisms **20**, **20**a, **20**b, **20**c. At this end, however, since it faces rearwardly downwardly and no lifting action is provided as in sections D and J, the light refracted by prisms **21**, **21**a is directed to build the below-the-beam components in the rear streets.

The bottom of the refractor is designed to take the downlight from the source and the reflector and spread it as uniformly as possible over the entire intersection.

To this end, four relatively equal areas of the bottom portion of the refractor, divided by the longitudinal and transverse centerlines of the refractor, are further divided into internal forward prism panels R, S, T, U and R′, S′, T′, U′, on either side of the longitudinal centerline and internal rearward prism panels V, W, X, Y and V′, W′, X′, and Y′ on either side of the longitudinal centerline. In FIG. **3**, the arrows on the panels generally indicate the prismatic redirection of incident light with respect to planes normal to the prism axes.

Because of the forward tilt of the luminaire, and the desire to spread the reflected rays which are generally converging just beneath the refractor together with the rays of direct light which are diverging, a system of panels of superimposed prisms for lateral, longitudinal and diagonal light deviation is provided.

Longitudinally extending prisms **35** and transversely extending prisms **36** in panel T, T′ are superimposed on one another (see FIG. **3T**) and lie generally in parallel paths, perpendicular to one another and at slight outward and rearward angles, respectively, to the transverse and longitudinal centerlines with the active surface of prisms **35** and **36** disposed to effect lateral deviation of the light away from the longitudinal center line and forward deviation at a slight outward angle respectively.

Similarly, the prisms **37** lying in diagonal planes running forwardly toward the longitudinal center plane and generally transversely oriented prisms **38**, lying in planes at a slight rearward angle to the longitudinal centerline, of forwardmost panels R, R′ are superimposed on one another and have their respective surfaces disposed to deviate light laterally forwardly toward the front beam but below it and into the intersection and forwardly of the luminaire respectively.

In panels S, S′, prisms **39** lying in diagonal planes running forwardly away from the longitudinal centerline, and prisms **40** which lie in planes at a slightly greater rearward angle to the longitudinal centerline than prisms **38** are also superimposed on one another, the respective surfaces of prisms **39** and **40** being disposed to respectively deviate the incident light forwardly toward 0° and forwardly and slightly away from 0°.

Panels U, U′ are provided with diagonal parallel prisms **41** with the active surface of each prism disposed to deflect the incident light in forward but more outwardly lateral angles.

Rear panels V, W, V′ and W′ are provided with parallel diagonal prisms **42**, **43** lying in planes running forwardly and away from the longitudinal centerline and having their surfaces disposed to direct the incident light rearwardly and outwardly, prisms **43** lying in planes at smaller angles to the longitudinal centerline for more outward redirection of the light.

Finally, rear panels X, X′, Y and Y′ are provided with parallel diagonal prisms **44**, **45** lying in planes running rearwardly and away from the longitudinal centerline to dispose the surfaces for directing the incident light forwardly and outwardly, prisms **45** lying in planes at wider angles to the longitudinal centerline for more forward redirection of the light.

Lateral diffusion of the light broken up and spread throughout the intersection via the prisms of the bottom panels, is accomplished by external, longitudinal flutes **50** (FIG. **2**) extending from the rear end to the front end and also occupying the space between the sides of the refractor so as to operate over the entire bottom section.

Flutes **50** actually continue past the bottom section onto the front end as flutes **30**a which as noted are superimposed with transverse flutes **30** for both lateral and transverse diffusion of between-the-beam light redirected by the lowermost portions of internal radial prisms **20** in area M of the front end.

Thus, it can now be appreciated that a luminaire having a light source, which may be linear, within the cavity of a forwardly and upwardly tilted reflector having concave reflecting surfaces constructed along arcs having increasingly longer radii toward the ends can best produce four-way beam lighting for intersections by utilizing an elliptical or ovate refractor embodying the present invention, which provide for redirection of the reflected annular or horseshoe beams as well as for redirection of the stronger down-light components by assigning distinct areas of internal prisms for beam lighting and intersection area lighting as described, in combination with external light lifting and diffusing means. Besides effecting the light distribution desired in an efficient manner, the prism paths are calculated to be consonant with mold and plunger construction techniques.

I claim:

1. A refractor for use in a luminaire for intersection lighting wherein a light source within an optically round reflector provides a beam symmetric about the 0°—180° axis of the luminaire and considerable direct and reflected light directly beneath the luminaire, the luminaire and therefore the beam being tilted upwardly toward the 0° end of the luminaire axis; said refractor being ovate and bowl shaped and comprising an upper rim, opposing sides one on either side of the 0°13 180° axis thereof, the portions of each side forwardly and rearwardly of a transverse center plane of the refractor including means for laterally and vertically redirecting reflected light into forward and rearward street beams at predetermined beam angles, said means on the portions of each side rearwardly of the transverse plane comprising first inside prisms which, when the refractor is in operative position in the luminaire with the rim thereof tilted upwardly toward the 0° end, extend in near vertical paths along each said side and occupy an area extending from the transverse plane rearwardly and constitute means for laterally redirecting laterally intermediate portions of the light from the beam into substantially the rearward street beams only, and second inside prisms extending continuously along each said side in paths substantially parallel to said rim and from the rearmost of said first prisms toward the 180° end of the refractor and constituting means for vertically redirecting rearward portions of the light from the beam from such an optically round reflector into substantially the rearward street beams only.

2. A refractor for use in a luminaire for intersection lighting wherein a light source within an optically round reflector provides a beam symmetric about the 0°—180° axis of the luminaire and considerable direct and reflected light directly beneath the luminaire, the luminaire and therefore the beam being tilted upwardly toward the 0° end of the luminaire axis; said refractor being ovate and bowl shaped and comprising an upper rim, opposing sides one on either side of the 0°—180° axis thereof, the portions of each side forwardly and rearwardly of a transverse center plane of the refractor including means for laterally and vertically redirecting reflected light into forward and rearward street beams at predetermined beam angles, said means including inside prisms which, when

the refractor is in operative position in the luminaire with the rim thereof tilted upwardly toward the 0° end, extend in near vertical paths, said near vertical inside prisms comprising means in the street side and house side areas of said opposing sides for redirecting incident incident light substantially into forward and rearward street beams respectively, at least some of said near vertical prisms having two active vertical surfaces so disposed to thereby constitute means for redirecting unequal amounts of light from such an optically round reflector into forward and rearward street beams for balancing candlepower distribution between the street beams and for increasing the longitudinal flashed area along said sides for reducing brightness.

3. The refractor of claim **2** wherein at least one of said active vertical surfaces of at least some of said near vertical prisms, which said active surfaces constitute means for redirecting smaller amounts of light, varies in refracting power from upper to lower portions thereof.

4. The refractor of claim **2** wherein the surfaces of at least some of said near vertical prisms, which surfaces constitute means for redirecting smaller amounts of light, vary in refracting power from one longitudinally spaced near vertical prism to another.

5. The refractor of claim **2**, including prisms extending substantially parallel to said rim from the 180° end of the refractor forwardly and constituting means for vertically redirecting rearward portions of the light from the lower portions of the beam onto the rearward street beams.

6. The refractor of claim **5** wherein said prisms which extend in paths substantially parallel to said rim extend within a discrete panel toward the 180° end of the refractor, the lowermost of said prisms including at least two active surfaces for vertically splitting incident light rays.

7. A refractor for use in a luminaire for intersection lighting wherein a light source within an optically round reflector provides a beam symmetric about the 0°—180° axis of the luminaire and considerable direct and reflected light directly beneath the luminaire, the luminaire and therefore the beam being tilted upwardly toward the 0° end of the axis; said refractor being ovate and bowl shaped and comprising an upper rim, opposing sides one on either side of the 0°—b **180°** axis, the portions of each side forwardly and rearwardly of a transverse center plane of the refractor including means for laterally and vertically redirecting reflected light into forward and rearward street beams at predetermined beam angles, said refractor including a bottom portion extending between said sides an including a plurality of discrete prismatic panels, the forwardmost of said panels including systems of at least two sets of parallel prisms, one said set extending at a predetermined angle to and being superimposed upon the other on the inner surface of said bottom portion, each said forwardmost panel of superimposed prisms constituting means for redirecting light incident thereon from such an optically round reflector and from a light source into downward outward and lateral directions for substantially uniformly lighting the intersection between the forward street beams.

8. The refractor of claim **7**, wherein the sets of parallel prisms in the forwardmost discrete panels include sets of prisms extending at acute rearward angles to a vertical longitudinal center plane through said refractor, one set of superimposed parallel prisms in each panel extending at a greater rearward acute angle than the other set.

9. The refractor of claim **8** wherein the forwardmost discrete panels include one on each side of the bottom of the refractor spaced from the vertical longitudinal center plane and include superimposed parallel prisms extending at acute rearward and acute forward angles with respect to said plane.

10. The refractor of claim **9**, wherein said forwardmost discrete panels include a pair of panels one on either side of the longitudinal vertical center plane and adjacent the transverse center plane and wherein said superimposed parallel prisms include a set extending along planes generally parallel with the transverse plane and a set extending along planes generally parallel with the longitudinal plane.

11. The refractor of claim **7**, including rearwardmost panels of parallel prisms extending at forward acute angles to the vertical longitudinal center plane of said refractor and including panels of prisms extending at rearward acute angles to the vertical longitudinal center plane, said parallel prisms of said rearwardmost panels constituting means for respectively redirecting light rearwardly laterally and forwardly laterally between the rear street beams for substantially uniformly lighting the intersection therebetween.

12. The refractor of claim **11**, including a set of longitudinal flutes on said bottom of said refractor and externally thereon and constituting means for transversely diffusing light redirected by said prisms of said discrete panels.

13. The refractor of claim **12**, including a front portion including internal prismatic means for laterally redirecting incident light into and between the forward street beams, said front portion internal prismatic means including a lower portion adjacent said forwardmost panels, said lower portion adjacent said forwardmost panels, said lower portion constituting means for redirecting relatively low angled incident light between the forwardmost street beams upon the intersection forwardly of the luminaire, said longitudinal flutes on said bottom of said refractor extending forwardly onto said front section opposite said lower portions of said internal prismatic means, and transverse flutes superimposed on said longitudinal prisms on said front portion, said superimposed longitudinal and transverse flutes constituting means for laterally and longitudinally diffusing light emitted toward the intersection between the forward street beams.

14. The bowl shaped refractor of claim **7**, wherein the depth of one set of superimposed prisms of at least one panel is less than the depth of the other superimposed prisms of the same panel so as to constitute the superimposed prisms of said panel as means for redirecting more light in the direction generally normal to the prisms having more depth.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,581,082 Dated May 25, 1971

Inventor(s) Jan Shadwick

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 1, line 8, "0° 13 180° should read --0° to 180°--

Claim 7, line 8, "0°-b 180°" should read --0° to 180°--

Claim 7, line 13,"an" should be --and--

Claim 13, lines 5 and 6, delete "said lower portion adjacent said forwardmost panels"

Signed and sealed this 9th day of November 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents