Oct. 11, 1927. 1,644,915

W. A. DOREY

LUMINAIRE

Filed Nov. 16, 1925 3 Sheets-Sheet 1

Fig. 1.

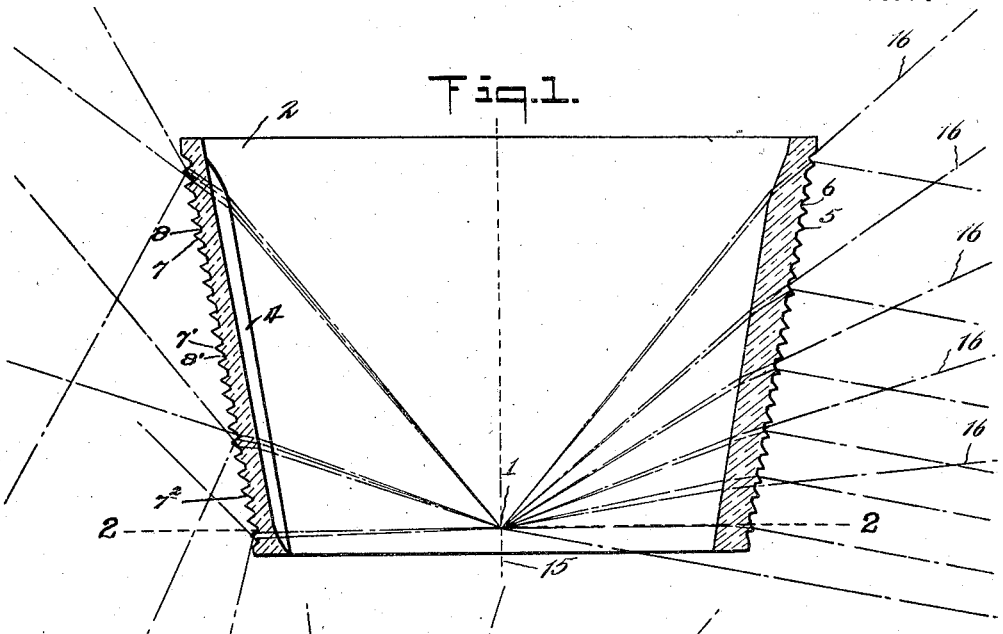
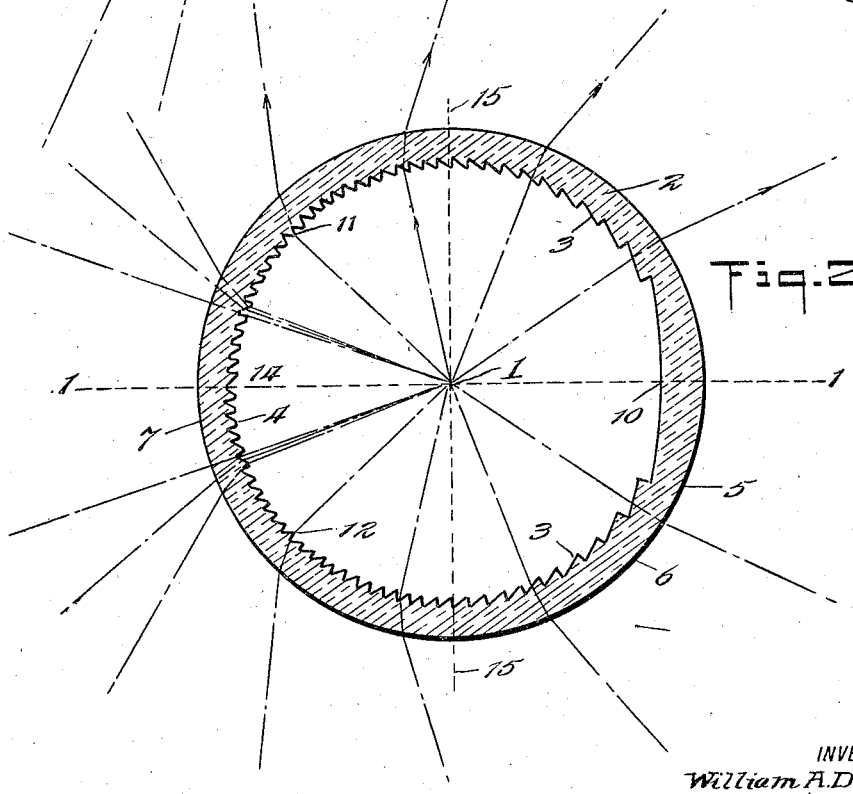


Fig. 2.



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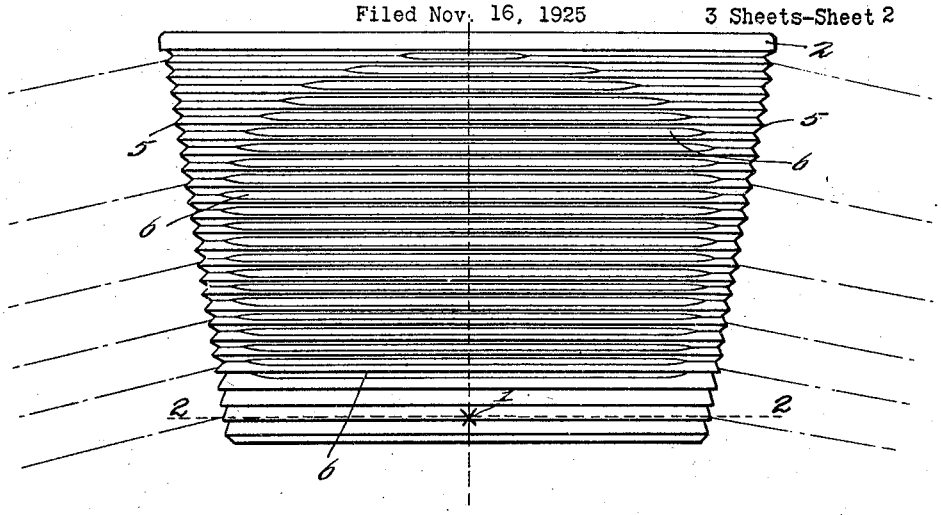

Fig. 3.

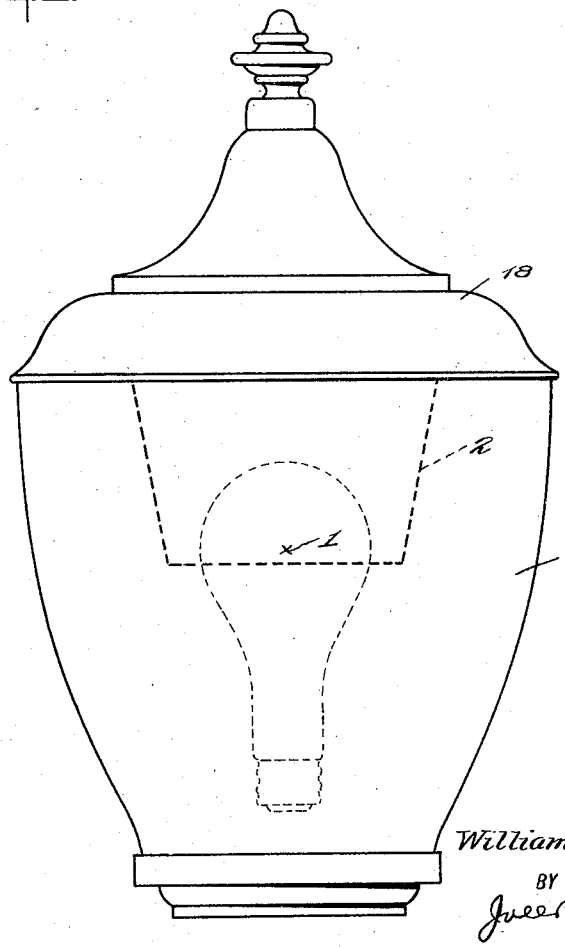

Fig. 4.

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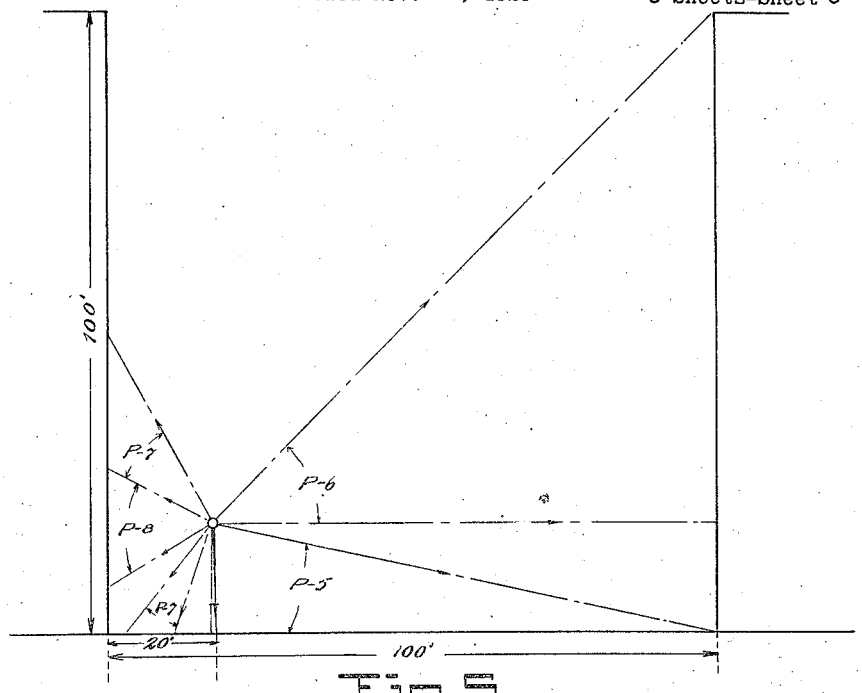

Fig. 5.

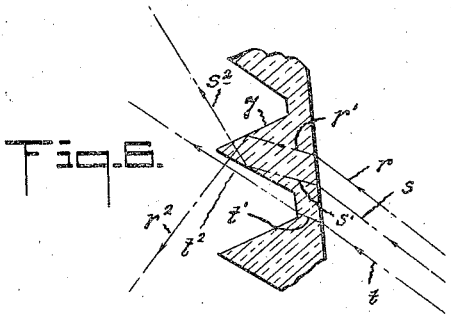

Fig. 6.

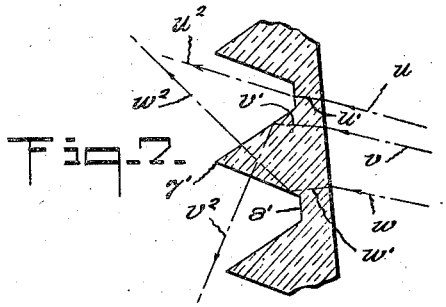

Fig. 7.

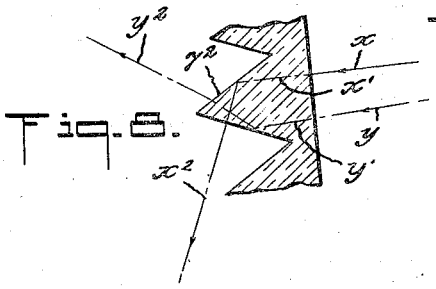

Fig. 8.

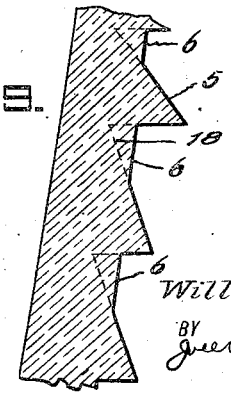

Fig. 9.

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UNITED STATES PATENT OFFICE.

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LUMINAIRE.

Application filed November 16, 1925. Serial No. 69,223.

The object of the present invention is to make a refractor preferably of ring like form and of a single piece of glass which is adapted for useful unsymmetrical distribution of light, both above and below the horizontal as for instance in brilliant illumination of streets which are lined with buildings. In business districts when a high level of illumination is used it is desirable to light the adjacent buildings to a moderate degree. This condition is ordinarily met by using an excessive amount of light with no redistribution of the rays from the lamps. This results in too much light falling on the building fronts and a considerable loss in light upward and between the buildings.

Besides giving an asymmetric downward distribution to light the surface of the street the band refractor described distributes a moderate amount of light over the adjacent and opposite building fronts while at the same time it suppresses the light at high angles up and down the street. It is preferably to be employed inside of some glassware of a slightly spreading character. The prismatic design is especially suitable for use on post tops mounted on the curb line of the street.

Fig. 1 is a vertical cross section of a refractor embodying my invention on line 1—1 of Fig. 2;

Fig. 2 is a horizontal cross section on line 2—2 of Fig. 1;

Fig. 3 is an elevation as it would appear on the street side of an installation, the plane of the drawing lying in axis 15—15 of Fig. 2;

Fig. 4 is an elevation of a typical street lantern showing the refractor in use with a diffusing globe;

Fig. 5 is a diagrammatic view showing an assumed cross section of a street with the path of the beams from various points of the refractor in use as indicated;

Fig. 6 is an enlarged cross section of prisms employed near the upper rim on the outside of that portion of the refractor intended to be turned toward the building;

Fig. 7 is a similar cross section of similar prisms placed below those in Fig. 6;

Fig. 8 is a similar cross section of prisms toward the lower edge of the refractor; and

Fig. 9 is an enlarged cross section of prisms placed on the outside of that portion of the refractor intended to be turned toward the street.

In the figures, 1 is a light source, the upper part of which is surrounded by refractor 2 as indicated in Fig. 4. The inner surface of the refractor is provided with vertical refracting prisms 3 on the side turned toward the street and with vertical spreading flutes 4 on the side toward the building. The outside of the refractor is provided with horizontal downward refracting prisms 5 on the street side, while the building side is provided with horizontal prisms 7, 7′ and 7^2, the two surfaces of which react with each other to reflect and refract light upward and downward at extreme angles. The action of all is shown graphically by the course of typical light rays.

Since this side of the refractor is relatively close to the buildings, it is necessary to deviate the light very considerably on this side in order to cover the whole building front. Prisms 7, 7′ and 7^2 on the building side are shown in enlarged section in Figs. 6 to 8, inclusive, and the characteristics of these prisms are explained by these enlarged drawings.

Fig. 6 shows a portion of the refractor near the upper rim of the building side. The course of typical light rays is shown by dash lines. Ray (r) passing through the glass at r' is reflected by the upper surface of the prism to the lower surface and transmitted downward at r^2. Ray (s) passing through the glass at s' is reflected by the lower surface of prism 7 to the upper surface and transmitted upward at s^2. Ray (t) passing through the glass at t' is transmitted upwardly by the reflecting surface 8. Fig. 7 shows a portion of the refractor somewhat lower down. On the building side in which prism 7′ is somewhat similar to 7 and refracting surface 8^1 is somewhat similar to 8, typical rays u, v and w are acted upon in much the same way as rays r, s, and t except that all are emitted at somewhat lower angles.

Fig. 8 shows a portion of the refractor at the bottom of the building side in which prism 7^2 is somewhat similar to 7^1. Typical rays x and y are acted upon in much the same way as rays u and v, Fig. 7, except that both are emitted at somewhat lower angles. The form and operation of inter-

mediate prisms and refracting surfaces changes gradually between the typical examples shown in Figs. 6, 7 and 8 and at the point shown in Fig. 8, the flat refracting surface (8 and 8^1 of Figs. 6 and 7) disappears entirely.

On account of the small distance, very little volume of light is required at the horizontal and this is readily obtained from the small refracting surfaces such as 8 and 8'.

On the street side the ruts of the prisms 5 are partially cut away by horizontal prismatic surfaces 6 of less inclination with the general surface of the glass permitting emission of light in an upward direction. These secondary refracting surfaces 6 are formed at the rut of the main downward refracting prisms 5 permitting the light to pass out at moderate inclinations above the horizontal to light up the building on the opposite side of the street. The course of typical light rays from prism surfaces 6 is shown at 16—16—16 in Fig. 1. It is evident that the emitted rays 16, of greatest elevation above the horizontal, cannot be useful in lateral directions through as great an arc as those of moderate inclination above the horizontal. Therefore, the lateral extent of these prism surfaces is increased as the emission angle above the horizontal is decreased. This is indicated in the elevation Fig. 3.

Fig. 9 shows in enlarged section typical prisms on the street side. This figure shows that the refracting prisms used on the outside of this portion of the refractor have sharp apices and ruts. In making the mold the full ¾ of the circle toward the street are cut with these prisms and then the ruts which are projections on the iron are turned off (indicated as dotted line 18 in Fig. 9) to make the flat transmitting portions 6 of the central portions of Fig. 3 and street side of Fig. 1.

The interior prisms 3 are shown in Fig. 2 which is a horizontal cross section in a plane 2—2 through the light source Figs. 1 and 3. Prisms 3 are of gradually increasing angularity from point 10 on the transverse axis to point 11 on one side and point 12 on the other side so that the rays of light striking these prisms are deviated laterally toward the transverse axis 13—13. The vertical scattering flutes 4 are designed to scatter the light in lateral directions away from the point 14 on the transverse axis 13—13. The distribution is indicated graphically by the course of typical light rays and the action in this cross section is typical of that in any horizontal cross section of the refractor.

Referring to details of this construction the interior refracting prisms 3 are continuous and may be said to be formed as a conical concave or substantially cylindrical concave surface broken up into prisms and functioning with the outer surface as a meniscus lens to concentrate the light in lateral direction. I prefer to use a gradually increasing angularity from the axis outwards so as to obtain a gradual increase in deviation but in some cases the construction can be simplified without undue inaccuracy by using prisms of the same angularity for four or five spaces and then a bank of prisms of somewhat greater angularity and continuing this approximation of the theoretical construction through the lateral extent of the meniscus.

In Fig. 3 the plane of the drawing lies in axis 15—15, Fig. 2. The downward refracting surfaces 5 are complete in this plane and function to refract the light downward as shown.

In the type embodied in the drawing, the walls of the refractor have been run up much higher with reference to the position of the light source than is usual in constructions of this class. In fact, it reaches the actual height limit at which any light would be refracted down to the angle required for lighting the street surface itself. This means that in planes up and down the street, some of the light striking the upper prisms will be reflected back into the refractor and some will be reflected and refracted sharply downward from the outside. It is thought advisable to go to this extreme because this light would otherwise be wasted. Moreover, in planes across the street, the light striking the upper prisms can be directed very effectively to light the building fronts.

In Fig. 4 the refractor is shown in use with an enclosing globe 17 with a cover 18. It is placed high therein so that the top edge is practically on a line with the lower edge of the globe cover. If then (as shown) the globe is made translucent the portion of the light passing out through the top of the refractor will tend to light it up.

In Fig. 5 is shown a diagrammatic view of a cross section of a typical street in which the path of light rays from the source and refractor is indicated. The section is assumed for a street 100 feet between buildings of 100 feet in height. The refractors being placed on poles 20 feet high and 17 feet from the building line. P^6 shows the general direction of light from surface 6 in Figs. 1 to 3 and the other beams being similarly indicated by the letter P with the index designating portions of the refractor in Figs. 1 to 3.

The band form of refractor shown is especially suited to meet the distribution characteristics desirable in downtown business districts. It is also very desirable for use with extremely high candle power lamps on account of the free circulation of air secured through the large top and bottom openings. It is therefore, possible with this refractor

to obtain a very high level of illumination without an excessively close spacing of the light sources.

While I have shown the refractor surrounding the upper part of the light source only, it is evident that the same unique construction for distributing light to the building fronts may be applied to the upper part of a bowl refractor which intercepts and redirects downward as well as upward light.

I claim:

1. A luminaire comprising a light source, a ring-like refractor, and an outer transmitting envelope, the source being placed near the bottom of the ring and the refractor being placed high in the envelope, the refractor having on one side means for distributing and transmitting an extreme upward light component and on the other means for distributing and transmitting a moderate upward light component adapted to produce an asymmetric light distribution.

2. A luminaire comprising a light source, a ring-like refractor, and an outer transmitting envelope, the source being placed near the bottom of the ring and the refractor being placed high in the envelope, the refractor having on one side means for distributing and transmitting an extreme upward light component and on the other means for distributing and transmitting a combined upward light component of different angularity.

3. A refractor for asymmetric distributions having on its interior surface two opposite groups of longitudinal ribbings the individual ribbings of both groups being placed symmetrically with reference to a vertical plane through the light source, one of such groups being composed of diffusing members, the second of such groups being a prismatic development of a substantially conical condensing meniscus lens surface, and having on its outer surface annular transverse downwardly refracting prisms which are displaced by outwardly reflecting and refracting prisms in that portion covering the interior diffusing group of ribbings and partially displaced by upwardly refracting surfaces through a definite area covering the central portion of the meniscus lens group of interior prisms.

4. A one piece refractor for asymmetric distributions in street lighting having on its interior surface two opposite groups of longitudinal ribbings the individual ribbings of both groups being placed symmetrically with reference to a vertical plane through the light source, one of such groups being composed of laterally diverging and diffusing members the second of such groups being a prismatic development of a substantially conical condensing meniscus lens surface, and having on its outer surface annular transverse downwardly refracting prisms which are displaced by outwardly reflecting and refracting prisms in that portion covering the interior diffusing group of ribbings and partially displaced by upwardly refracting surfaces through a definite area covering the central portion of the meniscus lens group of interior prisms.

Signed at New York, in the county of New York and State of New York, this 11th day of November, 1925.

WILLIAM A. DOREY.