

Oct. 11, 1927.

W. A. DOREY

1,644,877

LUMINAIRE

Filed Feb. 9, 1924

3 Sheets-Sheet 1

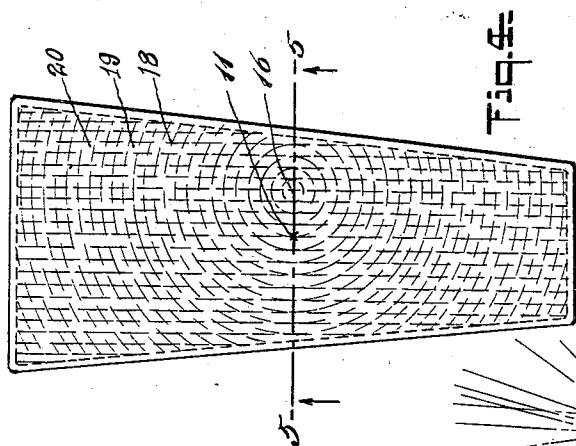


Fig. 4.

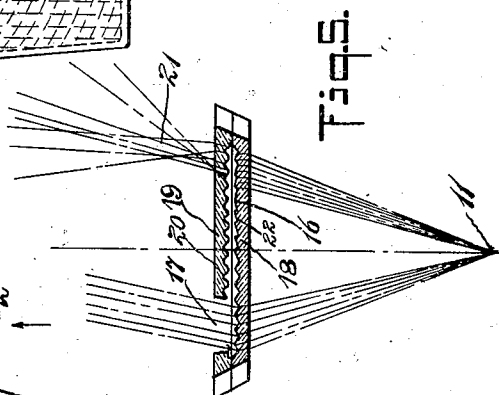


Fig. 5.

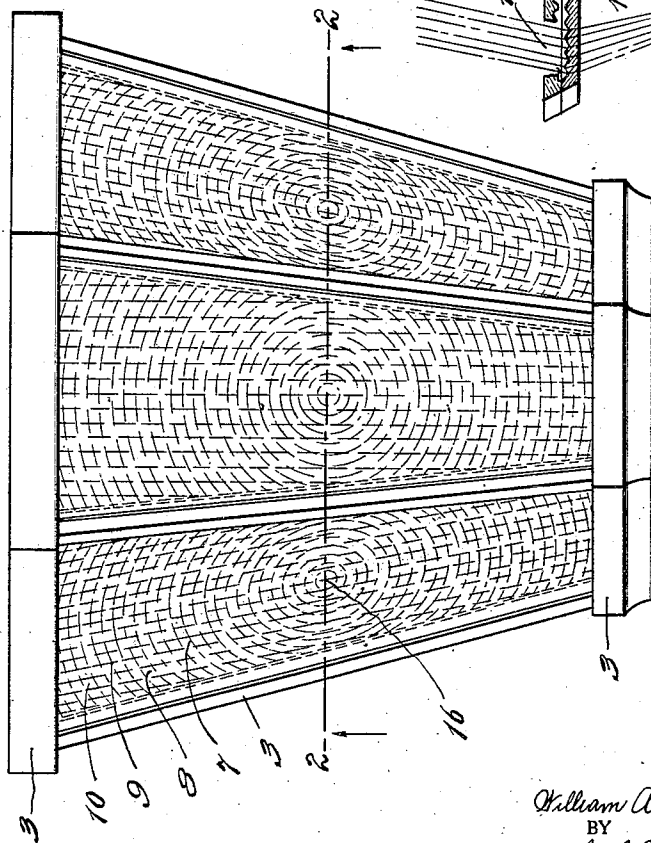


Fig. 1.

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3 Sheets-Sheet 2

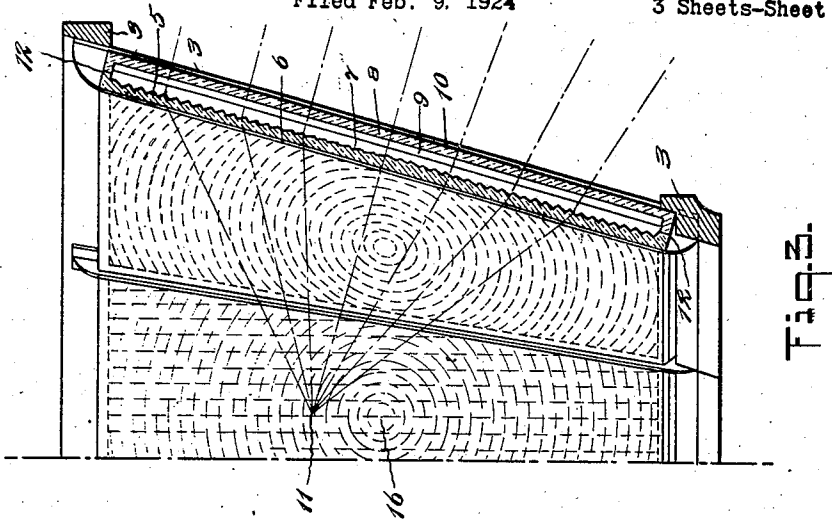


Fig. 3.

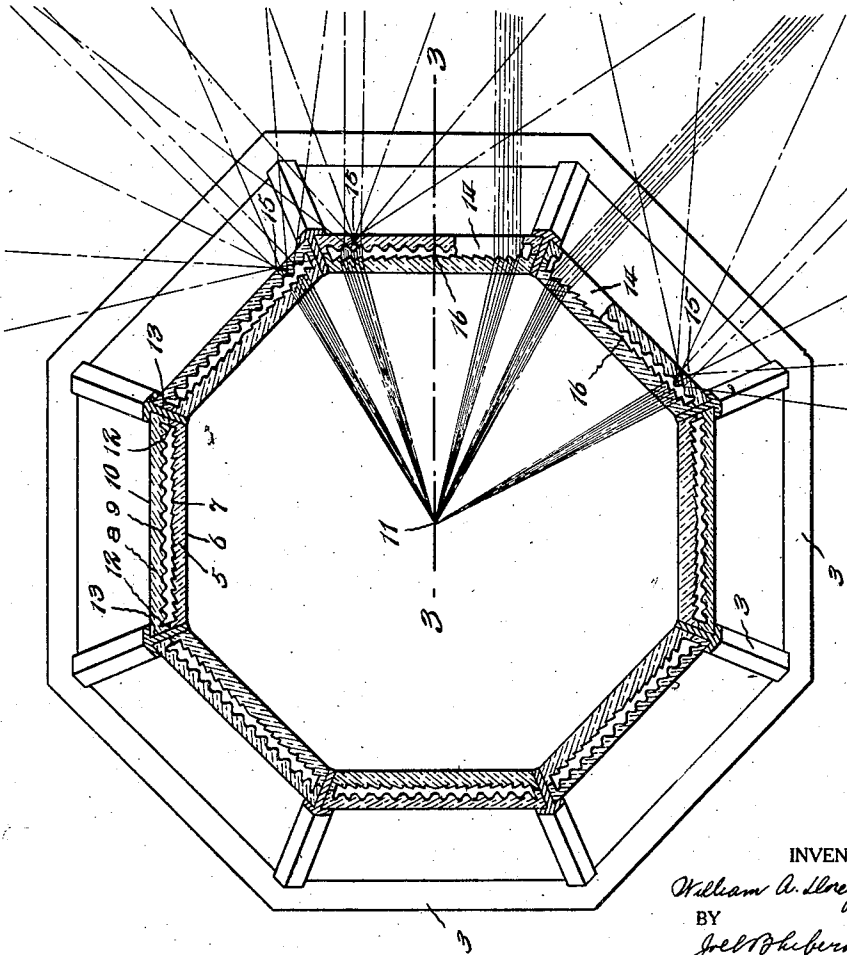


Fig. 2.

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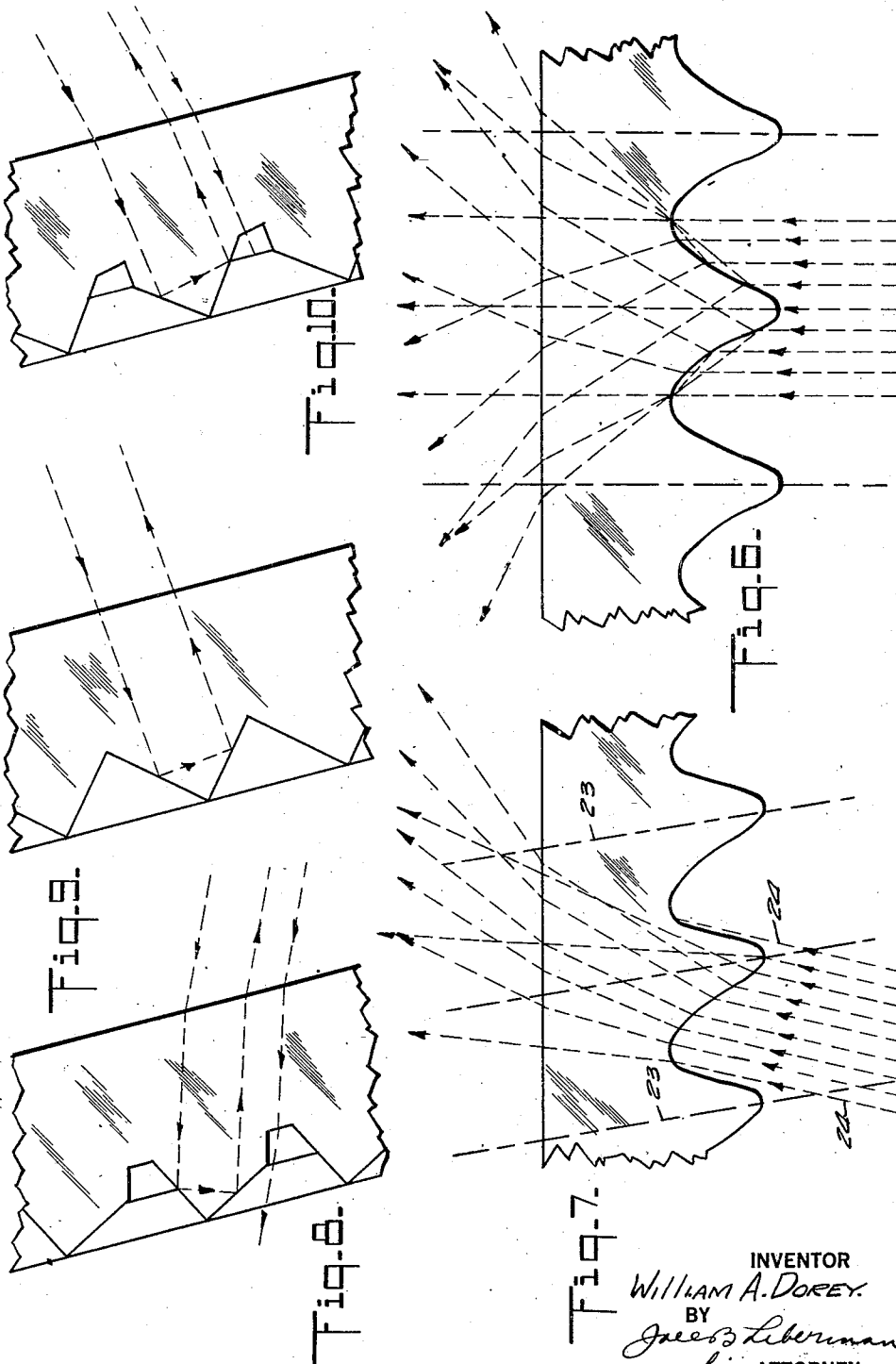
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LUMINAIRE

Filed Feb. 9, 1924

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

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HOLOPHANE COMPANY, INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

LUMINAIRE.

Application filed February 9, 1924. Serial No. 691,583.

The object of my invention is the construction of luminaires having transmitting covers or envelopes made up of a glass structure provided with prismatic corrugations adapted to give a selective distribution of light in longitudinal directions and either uniform or selective distribution of light in lateral directions with some degree of diffusion. This is accomplished by means of a construction provided with concentric corrugations on a face of the glass adapted to selectively distribute the light in longitudinal directions and a cooperating construction having substantially parallel corrugations on a face of the glass adapted to diffuse and distribute the light in lateral directions.

The most important use of the invention is in building up luminaires of polygonal lantern form made up of compound light transmitting plates, in which the individual sections used may be of similar design so that in combination they produce a uniform lateral distribution of light or the individual sections may be of varying design so that in combination they produce a selective distribution in lateral directions or varying selective distributions in separate longitudinal planes. These are used in cases where a considerable departure from the natural light distribution is required by the type of service and yet a definite indication of the lantern form is desired when the luminaire is in operation.

The most obvious case is in street lighting where great concentration is required in vertical planes slightly below the horizontal and a somewhat wider spread of light is required in lateral directions. Considering only the question of distribution of illumination to the area to be lighted, park lighting will usually require a substantially uniform lateral spread throughout 360 degrees. The lighting of streets by sources mounted over the curbs will require at the most a lateral spread through slightly more than one-half circle on the street side and in some such cases a greater restriction of the beam up and down the street is found to be of advantage. By proper design and location of the various plate members in the lantern, the requirement of park lighting can be taken care of and the various requirements for lighting from street curbs can be met satisfactorily.

Fig. 1 is an elevation of one form of my invention.

Fig. 2 is a horizontal cross section through plane 2—2, Fig. 1.

Fig. 3 is a vertical cross section through plane 3—3, Fig. 2.

Fig. 4 is a normal view of one form of panel embodying my invention;

Fig. 5 is a horizontal cross section of Fig. 4;

Fig. 6 is a large size detail of a portion of Fig. 2;

Fig. 7 is a large size detail of a portion of Fig. 5; and,

Figs. 8, 9 and 10 are large size detail cross sections of a special form of reflecting prism used in connection with my invention.

In Figs. 1, 2 and 3, 3 is a lantern frame supporting the compound glass panels.

Each panel is made up of a rear plate 5 with a smooth inner surface 6 and concentric prisms 7 on its front face and a front plate 8 with vertical flutes 9 on its rear face and a smooth front or outer surface 10. The flanges of inner and outer plates project above the prism surfaces and are ground flat to seat against each other at 12. This ground joint may be gasketed or cemented and the two plates fastened together so as to make a unit of the panel. The lateral edges of the plates are bevelled at 13 so as to include the greatest possible lateral angle of light on the prism surfaces. This bevel also assists in keeping the panels in place and in permitting easy removal for cleaning or replacement. 11 is the light source, considered as a point. In Fig. 3 the course of typical light rays in vertical planes is indicated by broken lines. The concentric prisms 7 on plate 5 are formed at such angles as to produce a conical beam of just sufficient divergence to meet the vertical distribution requirements and this beam passes through the front plate 8 with very little change in the vertical inclination of the light rays. The course of typical light rays is shown in broken lines. From the centre of the plate where the annular rings are continuous and from the upper part of the plate the emitted rays are substantially parallel so as to produce the high intensities required near the upper limit of the emitted beam. From the lower part of the plate the emitted rays are of slightly increasing di-

vergence as the bottom of the plate is approached so as to provide the moderate intensities required at lower angles. In effect this modification in the action of the concentric prisms 7 produces a selective distribution of the light days in vertical or longitudinal directions. In Fig. 2 the course of typical light rays is indicated by broken lines. At 14 the outer plates are broken away near the edge of two adjacent panels to show more clearly the function of the inner plate. The light is concentrated into a narrow slightly divergent cone with the axis running through the centre 16 of the concentric system of prisms 7. It is evident that without the interposition of the outer plate the panels would produce distinct beams separated by dark areas. At 15 is shown the action of the vertical flutes 9 of outer plate 8 in spreading the light laterally. The action of these vertical flutes is also shown in larger scale in Fig. 6. Since the arc of each successive prism in the lower part of the plate is a smaller part of the complete circle, the lateral divergence across the face of the plate will increase very little notwithstanding the increase in vertical divergence. Therefore the emitted rays may be considered as substantially parallel in any horizontal cross section and the vertical flutes 8 may be made of the same contour across the whole rear face of the plate and will all produce substantially the same spreading effect on the beam from the inner plate. By use of the proper curved contour for the flutes, the beams from adjacent panels can be spread to overlap and produce substantially uniform intensities in lateral planes. Since the vertical flutes in each panel are of the same contour and their relation to the light incident upon them is substantially the same, the light will appear to be spread uniformly across the face of each panel and thus the flat sided lantern form will be clearly indicated.

In Figs. 1, 2 and 3 the lines from the light source to the centers 16 of each concentric system of prisms 7 is normal to the plate surface 6 and the vertical flutes are formed symmetrically with reference to the plate surface 10. The resultant distribution of light is therefore symmetrical with reference to all vertical planes through the vertical axis of the lantern and the centers of all the panels and due to the symmetrical lateral spreading effect of the vertical flutes 9 the distribution is substantially symmetrical with respect to any vertical plane through the axis of the lantern.

It is often desirable however to build up the intensity in certain vertical planes through the lantern axis and reduce the intensity in other vertical planes. This can be accomplished to a moderate degree in my construction by a separate design of the va-

rious panels in the lantern without producing shadows due to sharp drops in the illumination intensities or bizarre variations in brightness of the panels.

Fig. 4 is a normal view from the exterior of a panel designed to give a lateral shift to the incident light rays. Fig. 5 is a horizontal cross section through plane 5—5, Fig. 4. The concentric prisms 18 are similar to those shown in Fig. 1 with the exception that their center 16 has been shifted laterally to the right with reference to light source 11.

The general direction of the cone of light emerging from rear plate 5 will then be shifted laterally to the right with respect to the light source. In Fig. 5 a portion of the front plate 8 has been broken away at 17 and the direction of typical light rays proceeding from rear plate 5 is shown by dotted lines.

The vertical flutes 19, Fig. 5 are of uniform contour and similar to those shown in Fig. 2 except that their axes are tilted so as to cooperate with the shifted prism system on the inner plate. The form of the vertical flutes and their action on typical light rays received from the inner plate is shown in large scale in Fig. 7. Referring to Fig. 7, the axes 23—23 of the flutes 19 are inclined with reference to the normal to the plate surface and in the opposite direction to the inclination of the light rays 24—24 received from the inner glass. This reduces the flute surface refracting light to the left and tilts the balance of the flute surface operating to refract light to the left at a grazing angle with the incident light ray so that the proportion of the light rays striking this surface is reduced and the percentage of surface reflection of the incident ray onto the opposite surface is increased. Therefore that portion of the flute contour refracting to the right is mainly operated.

Now if a panel of this design be substituted for one of those shown in Fig. 2, the intensity near the normal to that panel station will be reduced and the intensity near the normal of the next adjacent panel station on the right will be built up.

In most cases where it is desirable to give a lateral shift to the light from certain panel stations, the intensity will not be decreased through a sufficient lateral arc if the lantern be built up solely from panels of the form shown in Figs. 1, 2 and 3 and the panels of the form shown in Figs. 4 and 5. I therefore make use of a third form of panel in which the front plate is substantially the same as front plate 8, Fig. 2. The rear plate in this third panel form has concentric prisms similarly placed to prisms 7 on rear plate 5 in Figs. 1, 2 and 3 but the contour of the prisms is such as to reflect a portion of the light back through the source and

to refract and scatter the balance in extreme upward and downward directions. The light reflected back through the source serves to intensify the beam from the plates on the opposite side of the lantern.

Figs. 8, 9 and 10 show large size vertical cross sections of three typical portions of such a plate having special reflecting prisms of the form described. All of these sections are made so as to show the transverse cross section of the prisms. Fig. 8 shows a portion of the upper part of the plate. Fig. 9 shows a portion of the central part of the plate. Fig. 10 shows a portion of the lower part of the plate. In all of these the action of typical light rays is shown in broken lines.

I have shown my construction with the concentric prism center located at the intersection of the normal to the plate passing through the light source and also with the concentric prism center shifted laterally from this position. In some cases an upward or downward or intermediate shift of this center may be required. Moreover the front plate of the panel shown in Fig. 5 may be combined with the rear plate shown in Fig. 2 and the front plate in Fig. 2 may be combined with the rear plate in Fig. 5 to obtain lateral distributions intermediate between those shown when such intermediate distributions are required.

I have shown in Fig. 1 panels which are integral from top to bottom but for convenience and economy in manufacture it is often desirable to use a double tier of panels in each panel station, the lower panel being similar in design to the lower part of the panels shown in Fig. 1 and the upper panel similar in design to the upper part of the panels shown in Fig. 1. In such cases cross bars rest on the top of the lower tier to support the upper tier and to mask the flanges of both panel sections. By this means much larger prismatic luminaires can be built than are practicable in the usual two or three piece forms. This is of importance in cases where it is desirable to reduce intrinsic brilliancy by delivering the light from a large surface and where it is desirable to attain large size for ornamental purposes.

I have shown my invention built up in octagonal lantern form but it is applicable to square, pentagonal, hexagonal or other polygonal forms and in some special cases can be used effectively in single panels.

While my invention is especially adapted to separate panel constructions it is possible in small sizes to make the rear or interior plates integral with each other and the outer plates integral with each other. Such integral constructions will usually have panel designs to shift the beam laterally of the general type shown in Figs. 4 and 5.

While I have described my construction as filling all the panel stations in a lantern, it

can often be used to advantage for certain purposes in combinations with transmitting and reflecting glasses which do not involve my invention. When the lantern is mounted on a bracket supported from a building front it will often be found desirable to use on the building side one or more panels made of opal glass or one or more panels having the interior plate of the prismatic reflecting construction previously described and with an outer plate of opal or other diffusing glass.

It will often be found desirable to use auxiliary diffusing transmitting glasses above or below the main lantern frame indicated in Fig. 1 or reflectors to catch the extreme upward and downward rays and redirect them to the prismatic panels.

I claim:—

1. A luminaire comprising a light source and a concentrating lens element having on an outward surface a series of concentric corrugations the part above the common centre being adapted to transmit light rays from the source in substantially parallel directions and the part below the common centre being adapted to transmit light rays from the source in increasingly divergent directions as the distance from the common centre increases and a cooperating construction having on an inner surface a series of substantially straight parallel corrugations adapted to diffuse and distribute the light rays in transverse directions.

2. A luminaire comprising a light source and a concentrating lens element provided on an outward surface with a series of concentric corrugations, the common centre of the corrugations being off-set from the normal of the element passing through the center of the light source, such corrugations being adapted to give a concentration of the light rays in the direction in which the common centre is off-set and a cooperating construction having on an inward surface a series of substantially straight parallel corrugations adapted to diffuse and distribute the light rays in lateral directions.

3. A luminaire comprising a light source and an enclosure consisting of a series of lens elements, each element having on an outward surface a series of curvilinear corrugations adapted to give a varying degree of concentration in longitudinal directions and on an inward opposed surface a series of straight parallel corrugations adapted to diffuse and distribute the light rays symmetrically in transverse directions so that the spread beams from adjacent elements combine to produce substantially uniform distributions in all vertical planes.

4. A luminaire comprising a light source, and an enclosure consisting of various lens elements, certain of these elements having on an outward surface a system of curvilinear

ear corrugations and on an inward opposed surface a series of straight parallel corrugations, and adjacent thereto elements of similar construction in which the center of the system of curvilinear corrugations is offset from the normal of the element passing through the center of the light source to shift the beam transversely, and the straight parallel corrugations having their planes of symmetry tilted to spread the beam asym-

metrically, the beams of the various elements combining to produce a distribution of increased intensity in certain vertical planes and a gradual dropping off of intensity at either side of these planes.

Signed at Newark, in the county of Licking and State of Ohio, this 7th day of February 1924.

WILLIAM A. DOREY.