No. 721,259. PATENTED FEB. 24, 1903.

F. L. O. WADSWORTH.

ILLUMINATING STRUCTURE.

APPLICATION FILED NOV. 12, 1898.

NO MODEL.

Fig. 1.

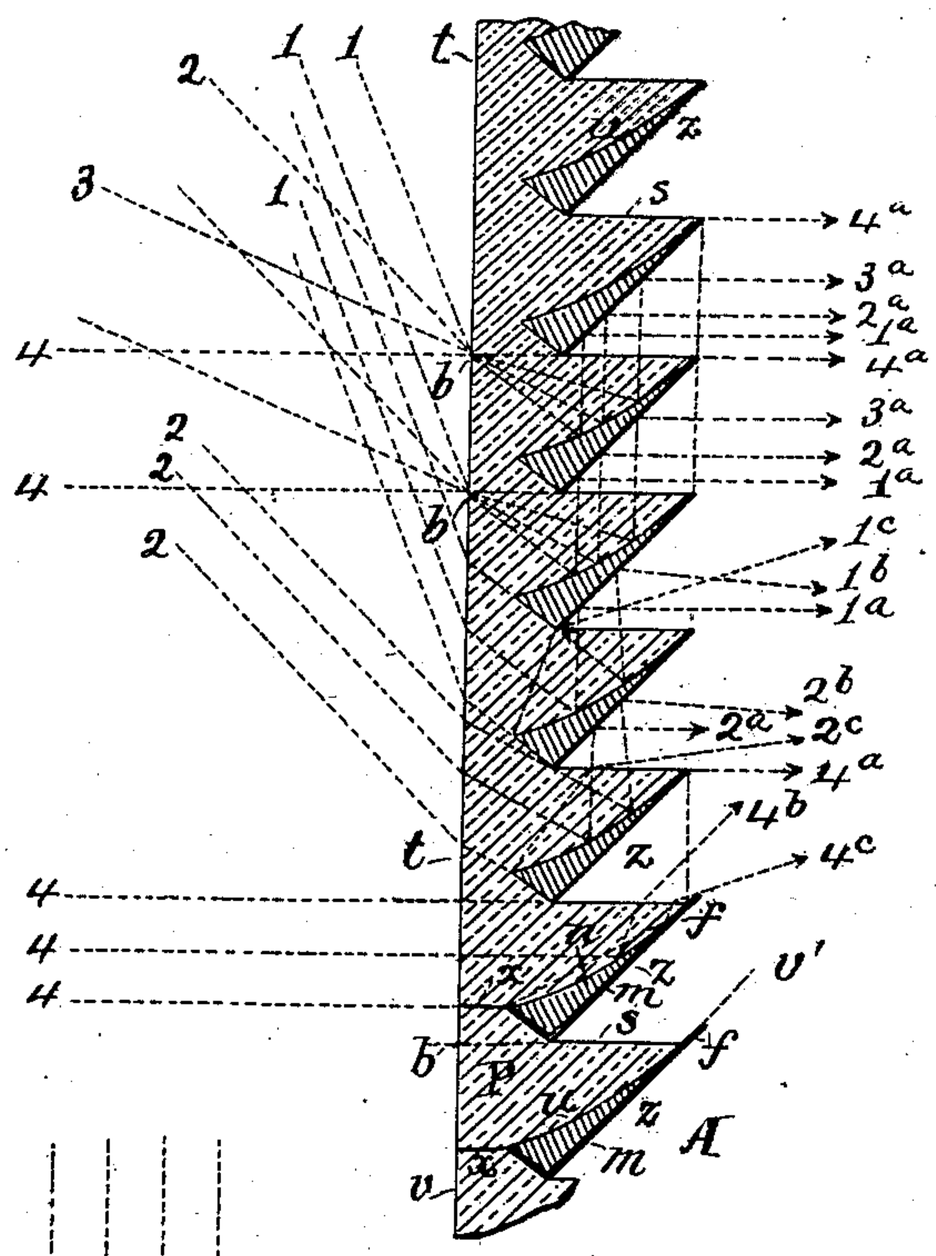


Fig. 6.

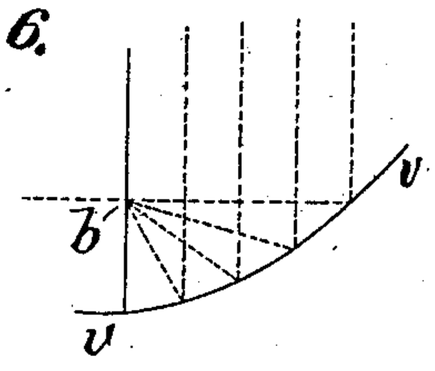


Fig. 5.

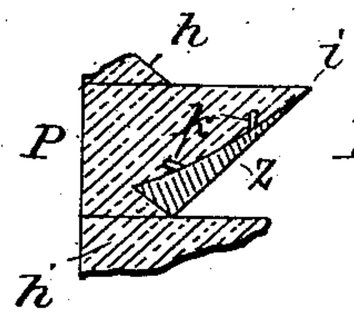


Fig. 4.

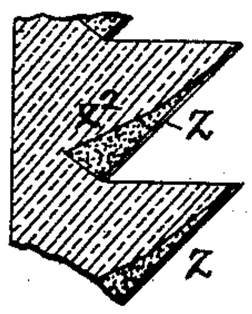


Fig. 3.

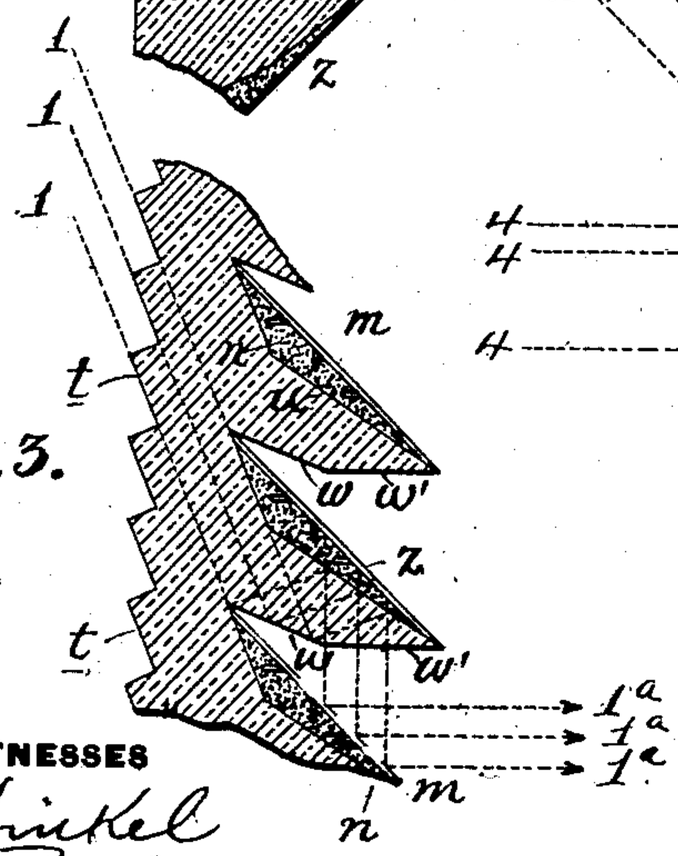
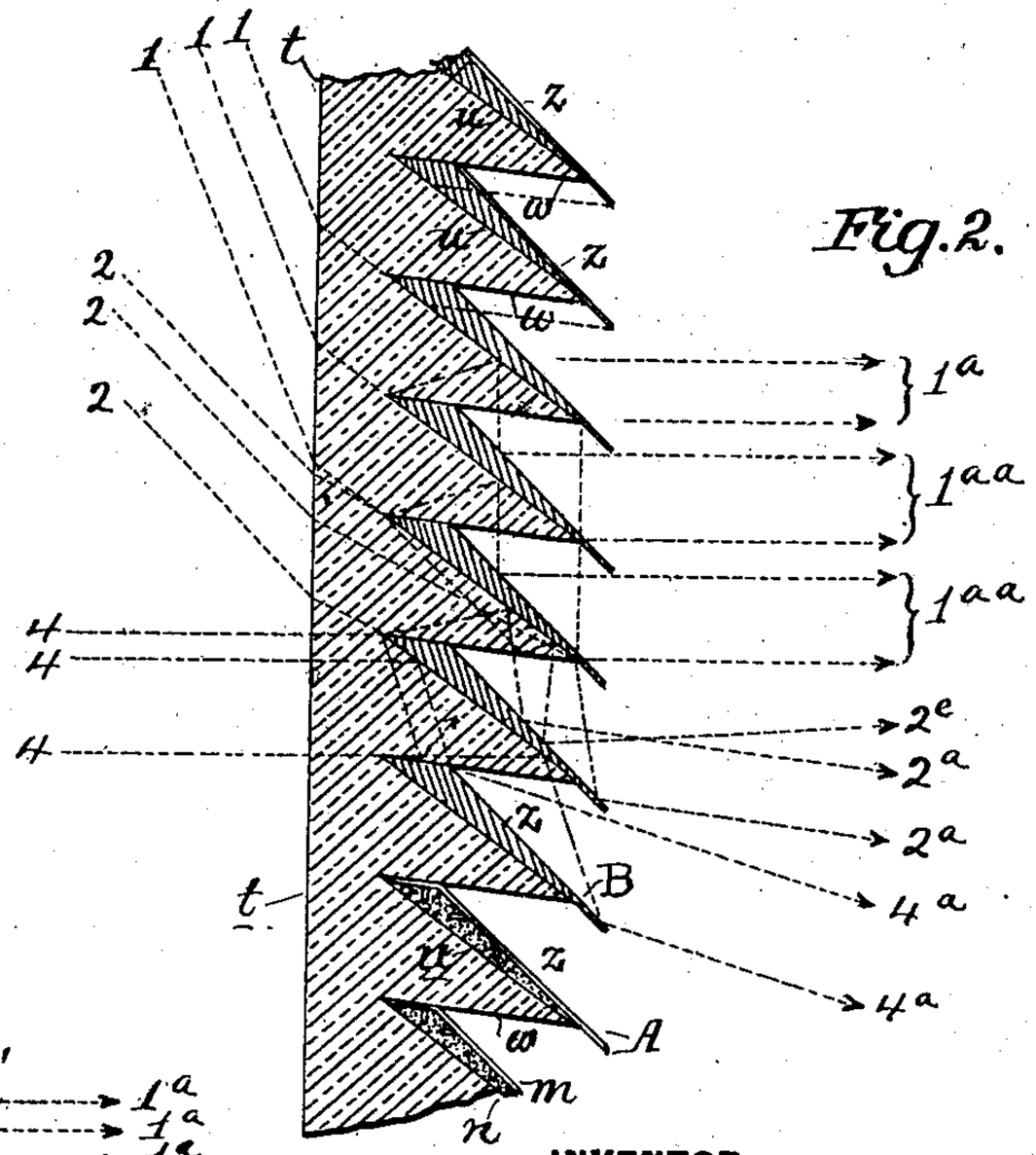


Fig. 2.



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ILLUMINATING STRUCTURE.

SPECIFICATION forming part of Letters Patent No. 721,259, dated February 24, 1903.

Application filed November 12, 1898. Serial No. 696,227. (No model.)

To all whom it may concern:

Be it known that I, FRANK L. O. WADSWORTH, a citizen of the United States, residing at Williams Bay, in the county of Walworth and State of Wisconsin, have invented certain new and useful Improvements in Illuminating Structures, of which the following is a specification.

The object of my invention is a single illuminating structure which will act to produce an increased illuminating effect in one part of the room and a decreased illuminating effect in another, thus combining the functions of an ordinary illuminator and of a screen; and a further object is to produce a structure which will have greater strength and rigidity than one composed of glass bars and plates alone.

In the accompanying drawings, Figures 1 to 5 show in cross-section several forms of structures embodying my invention. Fig. 6 is a diagram.

In ordinary illuminating structures having plane deflecting-faces, either reflecting or refracting, the rays of light falling on the structure from outside from different directions cannot all be discharged from the inner side in one direction, but will on emergence have an angular divergence equal to or in some cases greater than that at which they were incident on the structure. Thus with the common form of structure the rays incident on the outer face from various directions will on emergence have directions which differ from each other by an even greater amount than the extreme directions which they had on incidence, and which lie both above and below the direction in which the principal emergent rays (for which the structure is particularly designed) are discharged. This lateral spreading of the rays of light on emergence from the inner side of the structure is in many cases an advantage and in some cases a necessity, but in others it is highly disadvantageous. In certain cases in order to obtain the desired results from the use of such structures (particularly when ornamental effects are aimed at) it is desirable to cut off entirely the light which issues in certain directions and concentrate it in others, results which for the reasons just pointed out it is evidently impossible to secure with ordinary illuminating structures.

I have discovered that one very efficient and satisfactory way of securing the above results is to cover the emergent sides of the prisms of an ordinary prismatic plate with bars of material, so as to form a series of reflecting-faces, either flat or curved, inclined at a considerable angle to each other. The light is thus prevented from passing directly from the emergent faces of such prisms, as it would otherwise do, and can only emerge from the inner face of the structure after one or more reflections at the faces of the bars. By properly proportioning and inclining these faces to each other I am enabled to prevent almost completely the emergence of any of the rays of light in certain directions and to concentrate the light in other directions, as required. Two constructions illustrating this result are shown in Figs. 1 and 2.

In Fig. 1 the prismatic structure itself is refracting in character—*i. e.*, if used alone it would direct the light into the apartment by refraction at the faces *u u* of the prism elements; but instead of so allowing it to emerge these prisms' faces (or some of them) are in carrying out my improvement covered with bars *z z z*, forming inner reflecting-faces in contact with the prism-faces *u u* or *u' u'* and having also outer reflecting-faces inclined at an acute angle to the latter. The rays of light 1 2 3 4, &c., incident on the front face *t t* of the plate are refracted thereat and fall on the inner reflecting-surfaces between the bars *z z z* and the prism-faces and are thereby reflected upward through the neutral faces *s s* of the prisms, fall upon the reflecting-faces of the bars just above, and are thence reflected into the room. By thus coating what would ordinarily be the emergence-faces of the prism-plate, and thereby preventing their any longer performing that function, I have established a new set of emergence-faces *s s*, through which all the light which enters the interior space must pass. As these faces are presented upward, no rays can emerge from them except in an upward direction, and by inclining the outer faces of the bars *z z*, which

receive these emergent rays at different angles, I may send them in any direction I please above a certain plane, all the space below that plane remaining unilluminated or in shadow. As shown in the figure, the faces are so inclined that nearly all the rays falling from above on the outer face are directed into the room after a double reflection, as just described, in a substantially horizontal direction, as at 1^a 1^b 2^a 2^b 3^a 3^b 4^a, &c., and the remaining portions of the incident rays are directed upward, as at 1^c 2^c 4^b 4^c, &c., and practically none are allowed to emerge in a direction lower down than horizontal. In this particular case in order to secure the horizontal discharge of as large a proportion of the incident light as possible I have made the inner reflecting-faces, Figs. 1 and 6, which first receive the rays refracted at the faces *t t*, parabolic in transverse cross-section, the vertex *b* of the parabola being adjacent to the front of the prism-plate and the axis of the parabola being made parallel to the direction of the reflection of the incident rays at the faces *u u* of the bars *z z*. Under these circumstances all the rays which pass through the points *b b*, which correspond to the focal points of the parabolic surfaces, are reflected thereat in one direction parallel to the axis of the parabola, as shown in the diagram in Fig. 6 and as more fully set forth in my application Serial No. 675,587.

In Fig. 1 the direction of first reflection is parallel to the incident face *t t* of the structure. Hence the axes of the parabolic surfaces *v v'*, Fig. 6, are also parallel to this surface and preferably lie in said surface.

In Fig. 2 I show my improved construction in connection with an ordinary prismatic structure with reflecting-prisms on the emergence side. In such structures as ordinarily made rays of light, such as 1 1, falling on the front surface *t t* are refracted thereat, fall upon the faces *w w* at less than the critical angle of internal reflection, are reflected by said faces toward the faces *u u*, and are finally refracted by the latter into the room, as indicated at 1^a. When emergence from the faces *u u* is prevented, as before, by placing over them bars of material *z z*, the rays incident on the faces *u u* are again reflected, in this case downward through the faces *w w*, and fall upon the outer reflecting-faces of the bars below and thence into the room, as at 1^{aa} 1^{aa}, Fig. 2. Rays from other directions, as 2 2 4 4, &c., are similarly treated and emerge either nearly horizontally, as at 2^a 2^c, or are directed downward, as at 4^a 4^a, &c. In this case the new emergence-faces *w w*, being presented downward, no light will be discharged into the room above a certain inclination. In other words, all the space above a certain plane will remain in this case unilluminated.

Fig. 3 shows a modified form of structure similar to Fig. 2 in its action. It differs from the latter only in the form of the receiving-surface, which in this case is corrugated or ribbed to reduce the loss of light by partial reflection at the first incidence and in the form of the prism-faces *u u* and *w w*, each of these faces being in this case made up of two flat portions meeting at an obtuse angle.

The bars *z z* may have different forms and be constructed in different ways. They may have both sides flat, as in Figs. 2 and 3, or one side curved, as in Figs. 1 or 5, or with one side flat and the other side made up of two or more meeting planes, as in Fig. 4. In some cases in order to produce a more perfect screening action in certain directions they may project beyond the points of the prisms, as shown in Fig. 2 or at *f f*, Fig. 1. They may be bars of solid metal, as in Figs. 1, 2, and 5, or bars of opaque enamel, cement, or other material, as in Figs. 3 and 4. When the bars are solid metal, they may be attached to the prism-faces by cement or flusible flux or simply brought into close contact thereto, or they may be united to the faces by projecting lugs or ears *k k*, which are embedded in the material of the plate in the process of manufacture. Another method of forming the bars is that shown in Fig. 3 and also at A, Figs. 1 and 2, and consists in the use of a polished metal plate *m*, which forms the outer reflecting-face of the bar, and of an intermediate filling of plaster or cement *n*, as in Figs. 2, 3, and 4, or enamel or other suitable material *n'*, as in Fig. 1, between this plate and the prism-face *u* and which in contact with the latter forms the inner reflecting-face of the bar. The plate *m m* may be attached more firmly to the backing by means of ears or lugs attached to the plate and embedded in the filling material, as shown in Figs. 2, 3. Instead of using metal the bars may in other cases be of glass placed in substantial contact with the prism-faces, the interposed film of air acting as a reflector for those rays which fall on it at less than the critical angle, while the outer face of the bar is silvered, as at *z*, Fig. 4, so as to reflect all rays which fall upon it externally as well as any that may pass through the air film and fall upon it internally.

While I have referred to the plate as a "continuous structure," it may be built up of separate prism-bars, as P, Fig. 5, each with a bar applied thereto, as just described, or in any other suitable manner.

The separate bars may be united into one structure in any suitable manner.

I do not claim, broadly, prism-bars with one coated reflecting-face; but,

Without limiting myself to the construction shown, I claim—

1. An illuminating-bar consisting of a transparent prism-block, with a bar *z* applied to one of the faces, said bar having an outer reflecting-surface and forming in conjunction with the prism-face an inner reflecting-surface at an angle to the first, substantially as described.

2. An illuminating-bar consisting of a transparent prism-block, with a reflecting-bar *z* applied to one of the faces, said bar having a reflecting-face in contact with the block and also an outer reflecting-face, substantially as described.

3. An illuminating structure provided with prisms on the emergence side and with bars applied to faces of the prisms said bars having inner reflecting-faces in contact with the bars and outer reflecting-faces, substantially as described.

4. An illuminating-bar consisting of a transparent prism-block with faces of unequal width, and a bar *z* having an outer reflecting-surface applied to the wider of said prism-faces and forming in conjunction with it an inner reflecting-surface, substantially as described.

5. An illuminating structure provided on one side, with a series of prisms having faces of unequal width, and with bars having outer reflecting-surfaces applied to the wider of said prism-faces and forming in conjunction therewith inner reflecting-faces, substantially as described.

6. An illuminating-bar consisting of a transparent prism-block and a bar *z* applied to one of the faces of said block, said bar having an outer polished metallic reflecting-surface and forming in conjunction with the prism-face to which it is applied, a second reflecting-surface coincident with said face, substantially as described.

7. An illuminating structure provided on one side with a series of prisms and with bars applied to faces of the prisms said bars having outer reflecting-surfaces, and forming in conjunction with the prism-faces inner reflecting-surfaces at an angle to the first, substantially as described.

8. An illuminating structure provided on one side with a series of prisms and with bars applied to faces of the prisms said bars having outer reflecting-surfaces, and forming in conjunction with the prism-faces inner reflecting-surfaces corresponding in transverse cross-section with part of a parabolic curve having its vertex on the incidence face of the structure, substantially as described.

9. An illuminating structure provided on one side with a series of prisms and with bars applied to faces of the prisms, said bars having an outer reflecting-surface formed by a metal plate and an inner reflecting-surface formed by a body of non-metallic material connecting the prism and bar together, substantially as described.

10. An illuminating structure provided on one side with a series of prisms and with bars applied to faces of the prisms, said bars having an outer reflecting-surface formed by a metal plate and an inner reflecting-face formed by a body of non-metallic material connecting the prism and plate together, the two reflecting-surfaces at an angle to each other, substantially as described.

11. An illuminating structure provided on one side with a series of prisms, and with bars applied to the faces of the prisms, said bars having an outer reflecting-surface formed by a metal plate projecting beyond the points of the prisms, and an inner reflecting-face formed by a body of non-metallic material connecting the prism and the plate together, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANK L. O. WADSWORTH.

Witnesses:
E. G. FERGUSON,
H. E. CARMACK.