No. 737,979. PATENTED SEPT. 1, 1903.

F. L. O. WADSWORTH.

ILLUMINATING GLASS PLATE.

APPLICATION FILED JUNE 2, 1898.

NO MODEL.

Fig. 1.

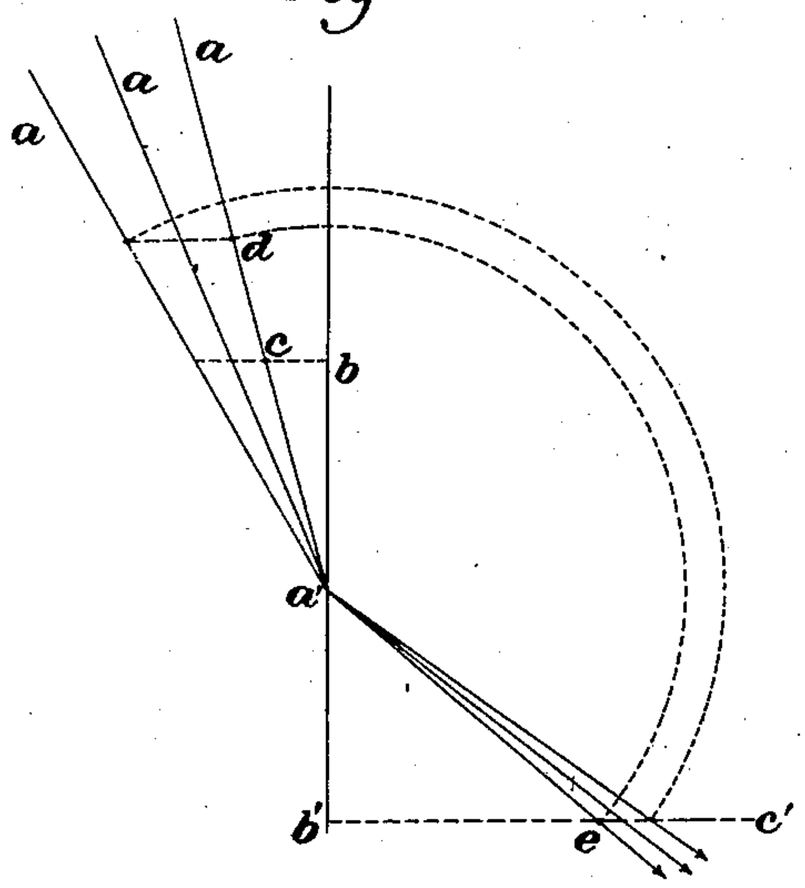


Fig. 2.

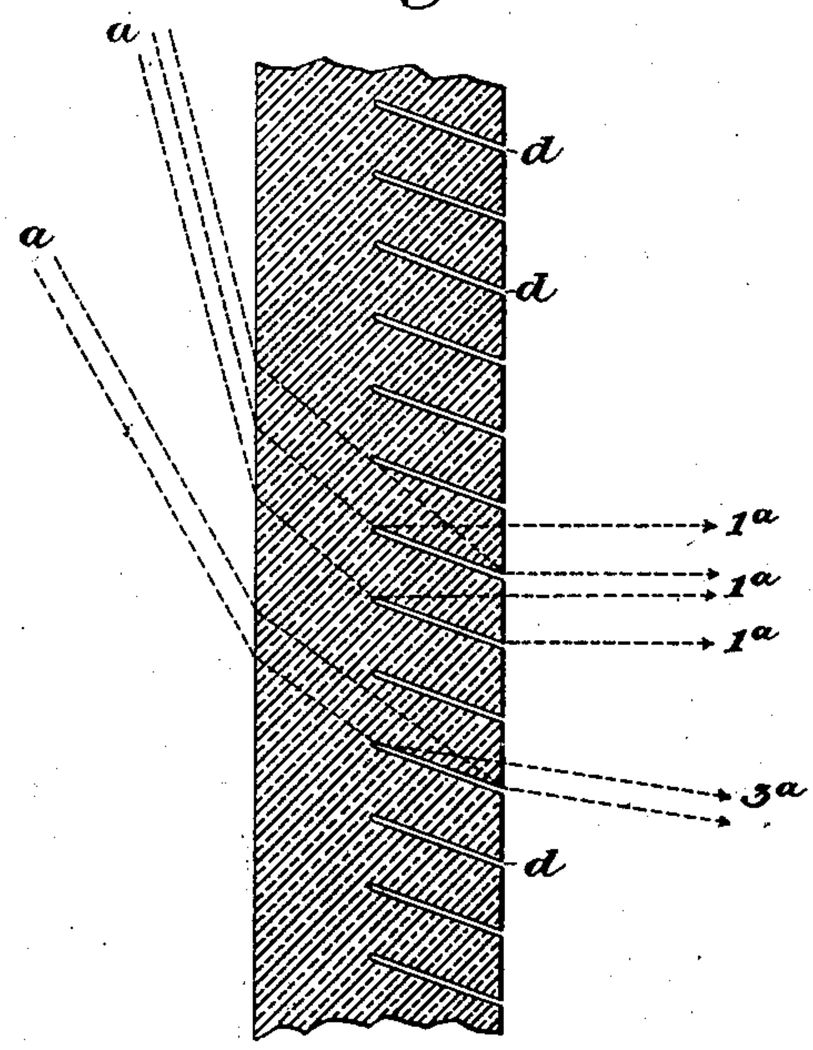


Fig. 3.

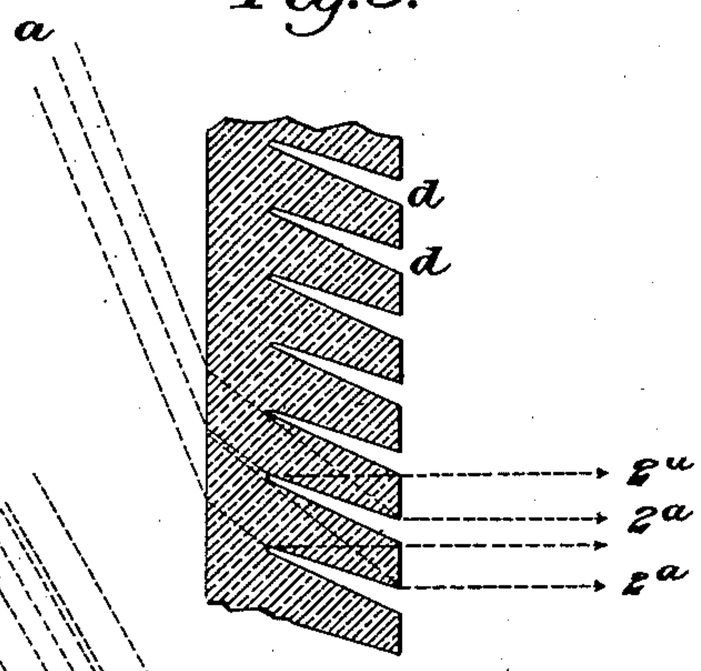


Fig. 4.

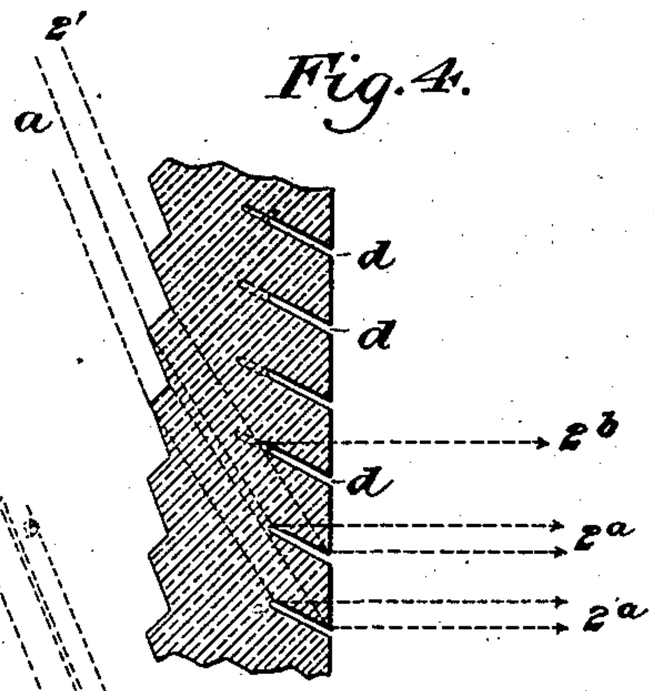


Fig. 6.

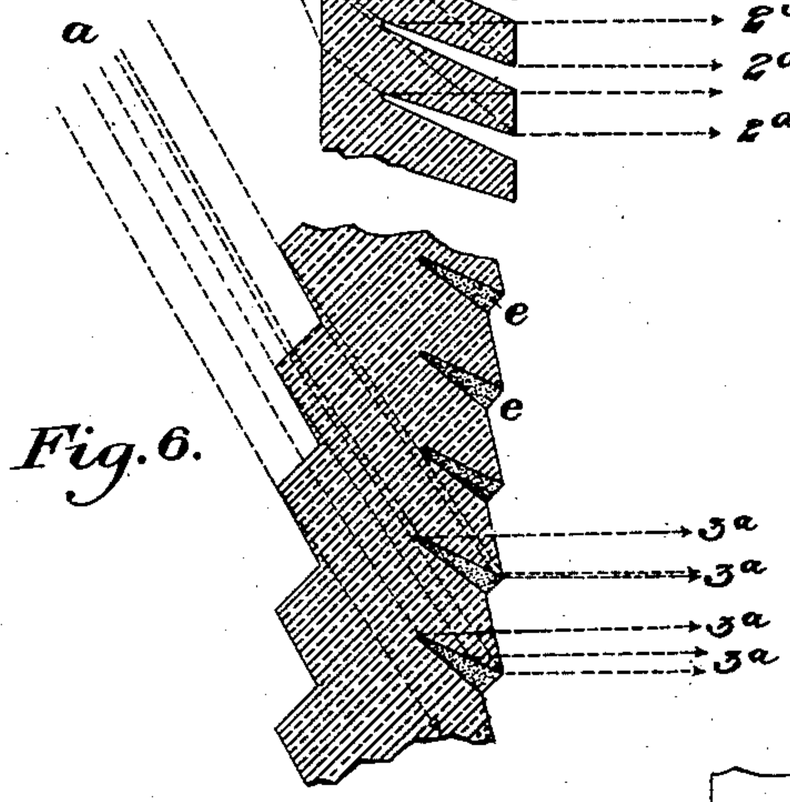


Fig. 5.

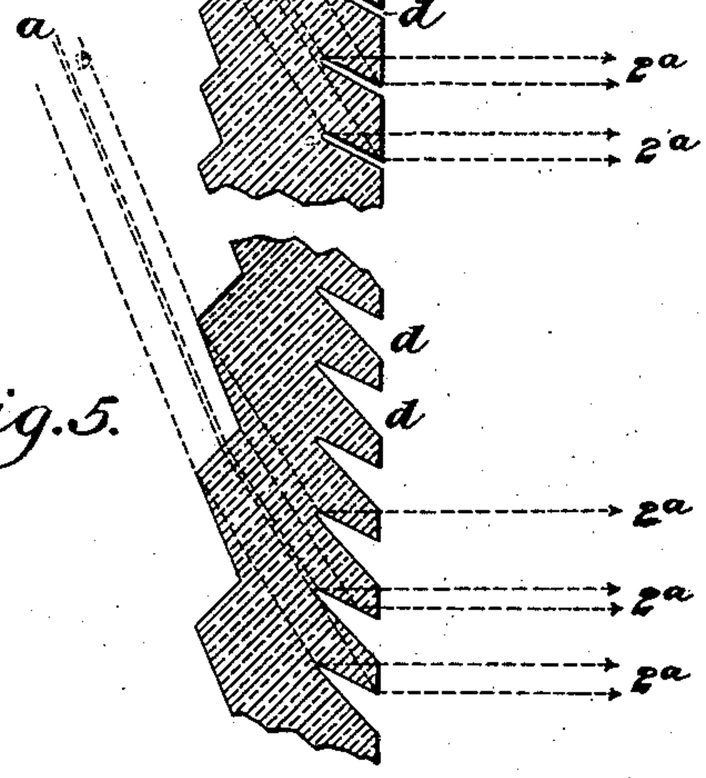
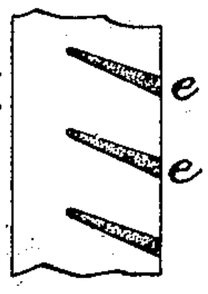


Fig. 7.



WITNESSES

Thomas W. Bakewell

L. A. Sommerich

INVENTOR

Frank L. O. Wadsworth.

No. 737,979. Patented September 1, 1903.

UNITED STATES PATENT OFFICE.

FRANK L. O. WADSWORTH, OF WILLIAMS BAY, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PRESSED PRISM PLATE GLASS COMPANY, A CORPORATION OF WEST VIRGINIA.

ILLUMINATING GLASS PLATE.

SPECIFICATION forming part of Letters Patent No. 737,979, dated September 1, 1903.

Application filed June 2, 1898. Serial No. 682,349. (No model.)

To all whom it may concern:

Be it known that I, FRANK L. O. WADSWORTH, of Williams Bay, in the county of Walworth and State of Wisconsin, have invented a new and useful Improvement in Illuminating Glass Plates, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a diagram showing how the deviations of the light-rays are determined when they pass from air into glass, or vice versa. Fig. 2 is a drawing illustrating in cross-section one form of my improved construction. Figs. 3, 4, 5, 6, and 7 illustrate modifications.

My invention relates to illuminating structures; and some of its objects are to provide an improved construction whereby such structures may be made of larger size than is possible by the present usual methods of manufacturing, to avoid the loss of light by useless reflection, and to provide an illuminating-surface having no projecting portions to catch dust and dirt.

The light which is available for producing an increased illuminating effect in apartments by the use of illuminating-prisms generally comes in large part from one particular direction. When this is the case, it is most efficiently directed in the desired direction into the apartment by the use of plane reflecting-surfaces. Where prismatic structures are used for this purpose, the reflecting-surfaces are generally the lower sides of the prisms, the light being reflected therefrom by what is termed an "internal reflection." The second surface of the prism produces no advantageous effect. In fact, it is in most cases a disadvantage, since the light which strikes it generally does so at a considerable angle, and is therefore partly lost by reflection therefrom instead of being completely transmitted in the desired direction into the apartment. The prismatic surface is further a disadvantage, because the projecting prism portions catch dust and dirt and are difficult to clean. These disadvantages are completely avoided in the new form of structure which I have invented and which consists simply of a plane sheet of glass or other transparent material which has formed in its body adjacent to one of its faces a series of reflecting-surfaces by cutting or grinding a series of slots $d\ d\ d$ in one surface of the glass. The angle of these slots to the general plane of the structures is such that the light coming from any given principal direction from outside, such as the direction $a\ a\ a$, Figs. 2, 3, 4, 5, and 6, is reflected, when it strikes the surface of the slot in the desired direction $a'\ a^2\ a^3$, into the space to be illuminated. In order to determine the proper angle, we first determine the direction in which the principal rays falling on the outer surface of the glass when the latter is perpendicular are refracted therein, using conveniently for this means a simple geometrical method which I have discovered and illustrate in Fig. 1 and which consists in laying off from the point a' at which the ray strikes the glass the distances $a'\ b$ and $a'\ b'$, equal to each other, drawing through the points $b\ b'$ perpendiculars to the surface of the glass $b\ c\ b'\ c'$, laying off the distance $a'\ d$ on the line $a\ a'$ equal to n times the distance $a'\ c$, describing a circle about the point a' with the radius $a'\ d$, and finally drawing through the point of intersection e of this circle with the line $b'\ c'$ the line $a'\ e$, which is the desired direction of the ray $a\ a'$ as refracted at the surface of the glass $b\ b'$. I therefore slot the glass at such an angle that the upper surfaces of the slots make equal angles with the direction of the refracted rays as just determined and the direction in which it is desired to send the light into the apartment—namely, substantially at right angles to the surface of the glass. The proper angle of the slots having been thus determined their depth and the distance between them is made such that all the light refracted into the glass from the principal direction or directions will be received on the surfaces of the slots in succession and reflected into the room. In the figures of the drawings I show the minimum depth which secures the desired result; but it is evident that the depth may be made greater, as shown in dotted lines in Fig. 4, in which case each slot will catch and reflect the light a little farther back than it otherwise would, as at the ray $2'\ 2^b$ in Fig. 4.

Within the scope of my broader claims the slots may be formed with parallel sides, as in Figs. 2 and 4, or may be slightly wedge-shaped, as in Figs. 3, 5, 6, and 7. It is evident by an inspection of these figures that this may be done without interfering with the transmission of the light through the second plane surface of the glass plate, since those rays which are reflected from the extreme inner edge of one slot emerge from the inner surface of the plate somewhat below the extreme outer edge of the slot next above the inner edge of the lower slot, being at or below the level of the outer edge of the slot above. The rays of light are therefore reflected internally from the top surface of each slot upon and through the plane inner surface of the plate and not upon another surface of a slot. As shown in Figs. 2 and 3, in which the outer and inner surfaces of the glass plate are flat and parallel, the slots require to be cut quite deep relatively to the distance between them. This may be avoided by using plate-glass having a corrugated outer surface, as in Figs. 4, 5, and 6. The effect of these corrugations is to decrease the deviation by refraction of the light-rays which fall on the front surface, and thereby increase the distance between the slots, as shown in Figs. 4 and 5. The inner surface may also be corrugated or formed with oblique surfaces between the slots, as shown in Fig. 6.

It will be seen that whichever form of my improved plate be adopted the inner surface of the same is in general nearly perpendicular to the usual direction of the emergent light-rays, since the latter direction is commonly horizontal and the general plane of the illuminating structure is commonly vertical. This secures that there shall be no loss by internal reflection at the emergent surface. I prefer also that the inner surface shall present what is practically a smooth face of glass, thus avoiding the difficulties already mentioned attendant upon the use of prismatic structures. The continuity of the surface is, it is true, broken by the slots, in which dust might possibly accumulate; but this may be completely avoided without interfering in any way with the efficiency of the structure by filling these slots with some opaque and preferably reflecting material, such as plaster-of-paris, as in Fig. 6 at *e* or as in Fig. 7.

One of the greatest advantages of my invention is that it enables the illuminating structure to be made of any desired size from sheets of plate-glass. Heretofore prismatic structures have been built up usually out of small blocks about four inches square, and this is objectionable both because of the loss of light by the intervening strips and because of the cost of construction. In my form of structure a plate of any size may be constructed, since all that is necessary is to cut in one of its surfaces as many slots as is necessary to make up a structure of the desired size.

When a glass plate is slotted as above described, the parts of the plate between the slots are left with the original surface unchanged in shape and undisturbed. The plate is preferably ground and polished or otherwise brought to the desired finished surface before it is submitted to the action of the cutters, and the possibility of doing this constitutes an important advantage of my invention. The depth of the slots and their distance apart are determined according to the mathematical rule above stated, so that when the glass plate is set in position substantially all the rays of light coming from the principal direction and falling upon the upper surface of the slots shall be reflected internally therefrom and pass through the face of the plate without a second reflection from the under surface of adjacent slots.

By the word "slot" I mean a crevice or opening formed in the face of the plate and having nearly parallel sides as distinguished from the open V-shaped depressions between ordinary prism-surfaces.

I claim—

1. An illuminating glass plate with substantially parallel faces, and having on one side a series of slots inclined at such angle to the faces of the plate that the angle between the upper surface of the slots and the principal rays of light refracted from the light-receiving face of the plate shall be substantially equal to the angle between said upper surface and a line which is substantially at a right angle to the face of the plate; substantially as described.

2. An illuminating glass plate having grooves with intermediate translucent glass surfaces through which the rays of light may be directed, said grooves being filled with opaque material; substantially as described.

3. An illuminating glass plate having slots with nearly parallel sides, and intermediate translucent glass surfaces through which the rays of light may be reflected from the surfaces of the slots, said grooves being filled with opaque material; substantially as described.

In testimony whereof I have hereunto set my hand.

FRANK L. O. WADSWORTH.

Witnesses:
THOMAS W. BAKEWELL,
GEORGE B. BLEMMING.