April 15, 1969 B. I. SEEGER 3,438,699

OPTICAL CONTROL OF SUNLIGHT AT WINDOW AND DOOR OPENINGS WITH CONTROLLED POSITIONING OF COMPOSITE TRANSPARENT MATERIALS TO ELIMINATE GLARING SUNLIGHT RAYS WHILE PROVIDING NORMAL DAYLIGHT ILLUMINATION

Filed Oct. 21, 1965

Sheet 1 of 2

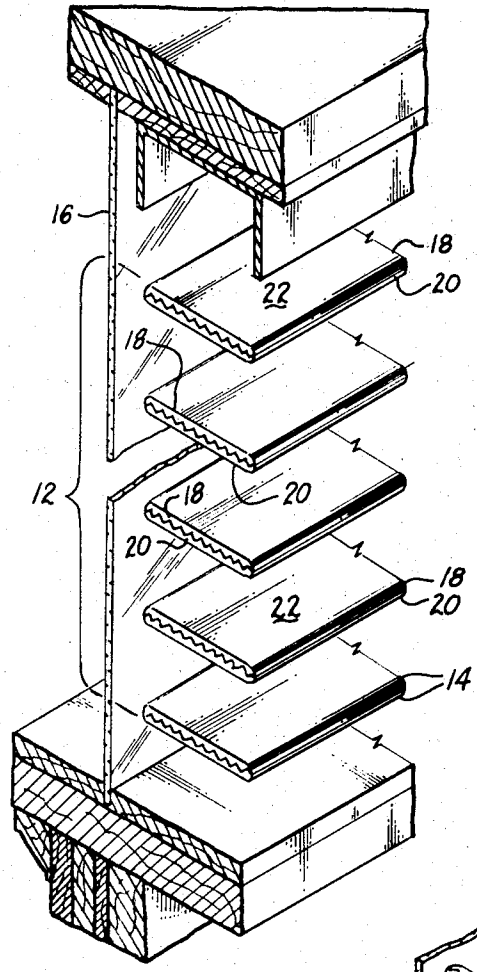


Fig. 1.

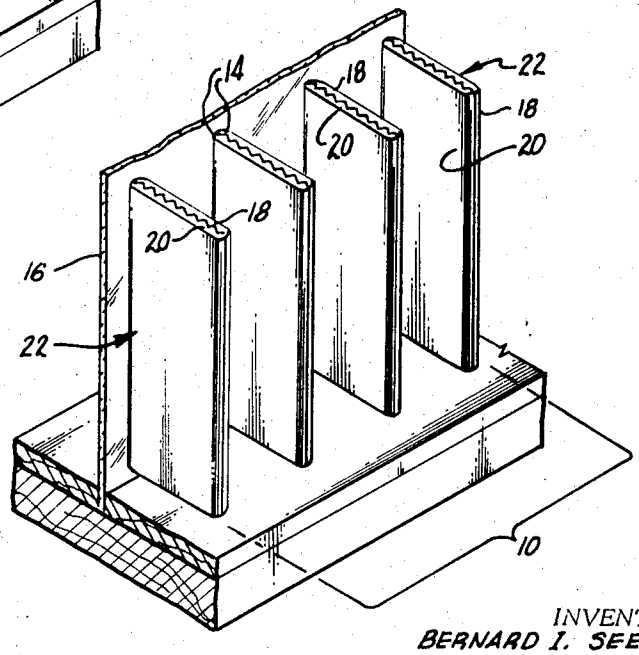


Fig. 2.

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Filed Oct. 21, 1965 Sheet 2 of 2

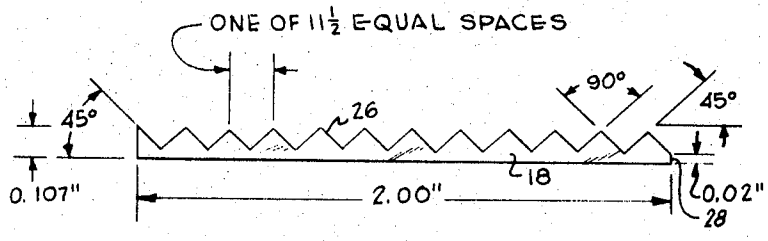


Fig. 3.

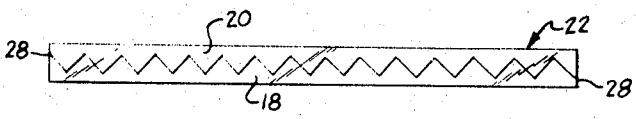


Fig. 4.

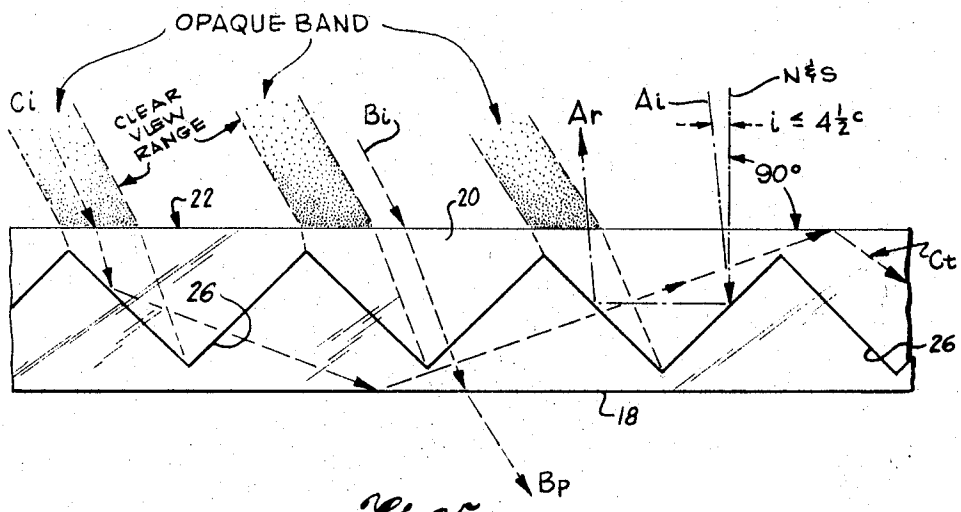


Fig. 5.

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U.S. Cl. 350—263 7 Claims

ABSTRACT OF THE DISCLOSURE

An adjustable multiple slat assembly assembled in a configuration similar to a Venetian blind is used to control glaring rays of sunlight through selectively changing angular adjustments without otherwise interfering with daylight illumination of a space, each slat being a composite subassembly of at least two transparent pieces of material having interfitting smooth surfaced ridges or prisms and otherwise smooth even outer surfaces.

This invention relates to transparent material assemblies used to control sunlight and primarily to avoid its direct glare. More particularly, in one preferred embodiment, such an assembly comprises composite transparent materials arranged as adjustable slats of a Venetian blind.

The purpose of the invention is to control sunlight and its glare effects with transparent material assemblies which at all times continue to pass sufficient quantities of indirect daylight for continued active use of the space beyond any slat assembly without having to resort to artificial lighting.

The invention, briefly described in reference to a preferred embodiment, comprises vertical or horizontal blind arrangements of multiple slats which are collectively moved and positioned to fully intercept the glare rays of the sun, with each slat being a composite subassembly of at least two transparent pieces having intermeshing smooth ridges or prisms and otherwise smooth even outer surfaces.

This invention is illustrated in the accompanying drawings, wherein:

FIGURE 1 is a perspective partial sectional view of a window in a home or office with a preferred horizontal blind of transparent materials arranged at a neutral position; a conventional controlling and holding strap being indicated in dotted lines;

FIGURE 2 is a perspective sectional view showing in part the installation of a vertical blind of transparent materials arranged at a neutral position, no conventional controlling and holding mechanism being indicated, nor conventional sectioning lines being used in the slats for clarity;

FIGURE 3 is an end view of one of two like transparent pieces or segments used in each slat of either the vertical or horizontal blind;

FIGURE 4 is an end view of two like transparent pieces or segments, as shown in FIGURE 3, fitted together as a slat of either the vertical or horizontal blind.

FIGURE 5 is an enlarged partial end view of two like transparent pieces or segments, as shown in FIGURE 4, with dotted lines indicating what happens to selected light rays A, B, and C when discriminately controlled by such a respective slat; the slat being arranged so sun glare light rays approach the first outside smooth transparent slat surface preferably at ninety degrees or within an allowable tolerance depending on the transparent materials being

used, such as 4½ degrees to either side of the normal, when certain plastic slats are assembled, as illustrated.

Referring to FIGURES 1 and 2, the illustrated embodiment of this invention is directed to providing vertical **10** or horizontal blinds **12** of transparent materials **14** to optically control sunlight at window or like openings **16**. The materials used are highly transparent to all visible light. However, these materials are generally shaped as indicated in FIGURE 3 to exclude light and heat rays coming from a particular direction which is generally in line with the position of the sun.

In reference to the utilization of a transparent polymethyl methacrylate material, having a refractive index of 1.49 a preferred construction of a segment **18** or **20** of the two segment slat **22** is shown in this FIGURE 3. A two inch segment or strip, having a length equal to the height or width of a window opening **16**, is made from near 0.107" stock. Multiple V ridges or prisms **26** at a 90° included angle are made leaving an unmodified 0.02" thickness **28** with all resulting surfaces being or appearing as being polished.

The dimensions shown in FIG. 3 are arbitrary rather than unique, and were chosen for compatibility with present suspension and adjustment mechanisms. The 45° x 90° prism pattern is also arbitrary, but uniquely provides a totally reflective zone symmetrical with respect to the normal, and rejects the direct sun rays backward toward the sun, with minimized annoyance to persons outside of the protected building area.

Two of these like strips, segments or pieces **18, 20** are oppositely oriented and placed in contact with each other to form a rectangular cross-sectioned slat **22** as illustrated in FIGURE 4. The ridges or prisms **26** are left immersed, so to speak, in a very thin medium, preferably air or vacuum, having a refractive index suitably lower than that of the transparent material. The like strips **18, 20** are only mechanically fastened as necessary at spaced locations (not shown) and preferably continuously bonded about the periphery.

The multiple arrangement of these slats **22** may be undertaken by any of the conventional ways already well known as suggested by dotted line illustration of a strap **24** in FIGURE 1. Preferably, the movement of one slat **22** by controls (not shown) will move all slats **22** to confront the glare rays which may be coming directly from the sun, reflected from a water surface, glass surface of an adjacent building, etc.

The successful control of sunlight or other glare rays of extreme intensity and the simultaneous control of less intense and indirect light is illustrated in FIGURE 5. A portion of a slat is enlarged in this FIGURE 5 to illustrate what occurs in reference to three selected light rays.

Ray A coming as an incident light ray A*i*, comes from a direction within a tolerance range of 4½ degrees either side of the normal, N, which may be considered also as the direction of the sun S. Any ray like ray A in this tolerance range of 4½° for the plastic material illustrated will be totally reflected externally both avoiding the glare and reducing the possibility of any substantial radiant heat increases inside a room beyond the window opening which would otherwise be caused by these glare rays of high intensity.

Ray B, coming as an incident light ray B*i* is passed through as ray B*p*, without net deviation, thus emerging in its original direction. Similarly, an occupant of the protected interior space has a clear and undeviated view outward along line of such a ray. Such rays as B and those in the so called "clear view range" as noted in FIGURE 5, are not the glare rays and therefore enter to supply wanted light to an interior space beyond the window opening. It will be noted, the B rays encounter a first oblique

prism face X which has a slope of opposite sense to the ray direction.

Ray C, coming as an incident light ray C*i*, encounters, however, an oblique prism face which has a slope of similar sense to the ray direction. As a result, these rays, similar in relative direction and location to ray C are trapped throughout successive internal total reflections within the parallel faces of the resulting slat. The trapping of these rays C*t*, causes the appearance of "opaque bands" or "opaque view ranges" which are alternately spaced with the "clear view ranges" or "clear bands," when viewed from the interior of a room looking at the slat in a direction opposite to the direction of a ray C.

The appearance of these "clear" and "opaque" view bands or ranges in reference to their relative widths will vary when viewed from the interior of a room in different locations. However, at all times glare rays are totally reflected and cannot be viewed from within the interior room. This remains true providing that over a period of time, the group of slats are caused to confront or to track direct sunlight and thereby remain capable of total reflection of A rays.

Therefore, by construction of slats in this way or similar thereto from transparent materials having refractive indices equal to or greater than the square root of two, and by control of their collective movement with changes in the location of high intensity glare rays coming from an indirect source such as a lake surface or directly from the sun, are effectively eliminated by total reflection while other less intense light energy is skillfully provided in places beyond the location of such transparent slats.

I claim:

1. A transparent material assembly to optically control sunlight, especially its direct glare rays, while continuing to pass other rays to allow active use of space beyond such transparent material assembly without resorting to artificial lighting, comprising:

(a) conventional Venetian blind positioning devices adapted to hold and to pivot multiple slats of the said transparent materials across an area being subjected to direct sunlight; and

(b) multiple slats of transparent materials fitted in part into the positioning devices for adjustment to prevent passage of glare rays of sunlight through the sunlight area, each slat, comprising, at least, two transparent pieces having intermeshing smooth ridges forming prisms and otherwise smooth even outer plane surfaces.

2. A transparent material assembly to optically control sunlight, as claimed in claim **1**, wherein said intermeshing smooth ridge prisms are equal sided.

3. A transparent material assembly to optically control sunlight, as claimed in claim **2**, wherein said two pieces are a very slight distance apart along their near mating complementary smooth ridges that form the nearly complete resulting intermeshing prism slot structure.

4. A transparent material assembly to optically control sunlight, as claimed in claim **3**, wherein the said two pieces are formed from a transparent polymethyl methacrylate material.

5. A transparent material assembly to optically control sunlight, as claimed in claim **3**, wherein the said two pieces are continuously bonded only about their resulting periphery.

6. A transparent material assembly, to optically control sunlight, as claimed in claim **5**, wherein said transparent materials used have a refractive indices of the square root of two and greater.

7. A transparent material assembly to optically control sunlight, as claimed in claim **6**, wherein each said transparent piece is made from a stock piece which is initially rectangular in cross section, being 0.107 inch thick and 2 inches wide and as long as one dimension of the sunlight area, with eleven and one half equal spaces being established between apexes formed by making multiple V, 90° prism structures in the thickness of the cross section, leaving an unmodified 0.02" of thickness throughout the length of each piece.

References Cited

UNITED STATES PATENTS

1,937,342	11/1933	Higbie	350—263
2,991,697	7/1961	Vetere	350—263

FOREIGN PATENTS

562,077	10/1932	Germany.
429,340	5/1935	Great Britain.

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U.S. Cl. X.R.

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