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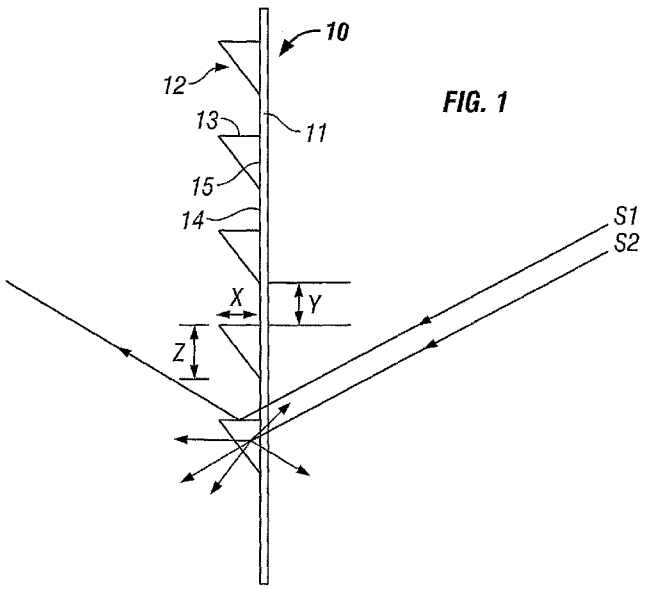


FIG. 1

(57) Abstract: A glazing panel comprises sheet of glass (11) and a series of spatially separated optical elements (12) disposed on a major face of the glass. Each element (12) has an upwardly-facing reflective surface 13 which extends out of the plane of the glass. A region (15) of a material, having an optical transmission coefficient which varies across its width, is disposed below the surface (13). Light incident on the upwardly facing reflective side surfaces (13) is reflected upwardly into the area on the other side of the glazing panel. Light entering the area through the region (15) is attenuated and diffused. The elements (12) may be printed onto the glass or onto a film that is applied to the glass. Alternatively, the elements may comprise profiled formations which are adhered to the glass.

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GLAZING PANEL

This invention relates to a glazing panel for the control of unwanted solar glare and heat caused by sunlight travelling through the panel.

It is well known to mount horizontal slats in the form of Venetian blinds across the rear of glazing panels on buildings in order to attenuate and redirect the sunlight. Such blinds are only a temporary solution to the problem and their effect is dependant on them being lowered and correctly adjusted.

It is also well known to mount permanent horizontal slats across the front of glazing panels on some buildings in order to attenuate and redirect the sunlight. Such so-called brise soleil or solar veils are expensive in construction, unsightly and heavy as well as being difficult to clean and maintain. Once such brise soleil is disclosed in Taiwanese Patent Application TW552344B.

I have now devised a glazing panel which alleviates the above mentioned problems.

In accordance with this invention, there is provided a glazing panel comprising a substrate sheet and a series of spatially separated optical elements disposed on a major face of the substrate, each element having an optical transmission coefficient which varies across its width, parallel to the plane of the substrate, from a first side to a second side thereof, the first side being less optically transmissive than said second side, wherein the thickness of each element, perpendicular to the plane of the substrate, is greater at said first side thereof than said second side thereof, said first side of each element comprising a reflective side face directed generally parallel to the plane of the substrate and facing in substantially the same direction as adjacent elements of the series.

In use, the glazing panel is installed such that the reflective side faces of the elements face generally upwardly. As sunlight shines downwardly from the sky above onto one side of the glazing panel, the light incident on the upwardly facing reflective side surfaces will be reflected upwardly towards the ceiling of the room or area on the other side of the glazing panel. In this manner, the amount of direct light incident on people in the room is substantially reduced, yet the redirected light still maintains a sufficient degree of natural light in the room or other area.

Preferably the optical transmissivity of at least a portion of each element increases gradually from said first side to said second side of the element.

The total area of the reflective side faces can be significant (e.g. 3 times greater) compared with the area of the glazing panel and thus it will be appreciated that a large proportion of the direct sunlight is reflected upwardly and redirected based upon the angle of orientation of the reflective side face.

Any light incident on the front face of the elements will be transmitted through the elements in accordance with the optical transmission coefficient thereof. Some of the incident light is reflected, absorbed and/or diffused as it passes through the element, thereby controlling the intensity and/or colour of the light passing directly through the glazing panel.

A glazing panel in accordance with the present invention is simple, inexpensive and light in construction, yet is able to reliably control the amount of light entering a room or other area.

The elements are spatially separated and thus some of the sunlight is able to pass directly through the substrate of the glazing panel in the normal way. It will be appreciated that the separation of the elements, the area of the elements as well as the area of the reflective faces can all be selected to control the characteristics of the light entering the room or other area. Preferably the elements are spaced by a distance which is substantially equal to the height of the reflective face of the adjacent element from the surface of the substrate.

The spatial separation of the elements may vary along the length or width of the substrate, for example such that there are fewer elements at the bottom of the glazing panel in order to improve visibility, and more at the top in order to shield the persons in the room from direct sunlight from above.

In a preferred embodiment, the elements comprise lines which extend fully or partially across the width of the substrate and which, in use, lie generally horizontally and parallel to each other.

In an alternative embodiment, the elements may comprise an array of spatially separated dots, pixels or other individual elements which extend across the width and length of the substrate.

The reflective faces of the elements may all face in the same direction. Alternatively, the direction may vary across the width and/or length of the substrate in order to control the characteristics of the light entering the room to take account of the changes in the direction and intensity of light during the day or of external shading.

Preferably the substrate comprises glass. The elements may be applied directly to the substrate or to a film which is applied to the substrate. In the former case, the surface of the substrate onto which the elements are applied is preferably treated, for example by plasma treating. In the latter case, the film may comprise a spectrally selective film which controls the amount of visible light and/or the amount of solar energy passing through the panel. Alternatively, the substrate may be coated with a spectrally selective layer. The filter characteristics of the film may vary across its width and/or length.

The substrate may be mounted in parallel with another substrate which may be interconnected around their peripheries to form a glazing unit. Preferably, the elements are applied to a side of one substrate which faces the side of the other substrate, such that they are disposed between the two substrates.

The substrate may be laminated to another substrate with said elements being disposed between the substrates. The elements may be applied directly to the surface of one of the substrates or to a film which is disposed between the substrates. In the former case, the substrates are preferably bonded to each other, the surface of the substrate on which the elements preferably being treated (eg by plasma treating) to improve the adhesion of the elements therewith and to avoid de-lamination of the substrates. In the latter case, the film is preferably apertured to allow direct adhesion of the substrates through the apertures.

The elements may be positioned behind a protective layer, such as a layer of lacquer.

In one embodiment, the elements may be formed by depositing or depositing an ink or other formable material onto the substrate or onto the film which is applied to the substrate.

Preferably the elements are formed by deposting a uniform colour onto the substrate or film, the transmission coefficient of the elements being varied by varying the amount of ink or other formable material that is deposited.

Preferably the ink or other formable material is applied by depositing pixels of the same intensity of ink onto the substrate or film, the transmission coefficient being varied by varying the spacing of the pixels and/or their degree of overlap.

Preferably the reflective side face of each element is formed by depositing more ink or more pixels of ink at said first side of the element than at said second side, thereby increasing the thickness of the first side relative to the second side. Preferably the reflective side face of each element is formed by depositing white material which reflects a broad spectrum of the incident light.

Commercially available printing apparatus generally comprise a leading print head of white followed by three print heads of cyan, magenta, yellow and black. These so-called CMYK heads are then followed by another print head of white. Each head is only able to pass over the same at limited number of times, such that the thickness of the reflective side face is limited by the number of times that white can be deposited in one place. Thus, the reflective side face of each element is preferably formed by depositing ink of a plurality of colours at said first side of the element onto white ink, the coloured ink then being overprinted by white ink, preferably in a manner such that the white ink encapsulates the coloured ink.

The optical transmission coefficient of each element may vary abruptly, gradually or linearly between said first and second sides of the element.

The thickness of each element may vary abruptly, gradually or linearly between said first and second sides of the element.

The elements may be triangular or stepped in section.

Preferably the elements are substantially white in colour so that the side faces of each element reflect visible light across a broad spectrum of wavelengths.

The side face of the elements may be metallised or comprise another material which absorbs very little of the incident light being reflected.

The front or/rear surfaces of the element may be formed of a different colour or colours to at least said side surface, in order to present a coloured or patterned appearance to persons outside and/or inside the building.

In an alternative embodiment, each element comprises a pre-formed 3-dimensional formation which is adhered to the substrate.

The 3-dimensional formation may comprise a sheet material which is deformed out of its plane at said first side thereof. Preferably, the sheet is printed or otherwise provided with means forming the or each element, said means comprising a first region having an optical transmission coefficient which varies across its width from a first side to a second side thereof, the first side being less optically transmissive than said second side, and a second region at side first which is reflective, said sheet being deformed such that said second region extends out of the plane of the sheet and provides said reflective face directed generally parallel to the plane of the substrate and facing in substantially the same direction as adjacent elements of the series.

Preferably the sheet is printed or otherwise provided with parallel spatially-separated lines respectively forming each element, each line comprising a first longitudinal region having an optical transmission coefficient which varies across its width from a first side to a second side thereof, the first side being less optically transmissive than said second side, and a second longitudinal region at side first which is reflective, said sheet being deformed such that said second region extends out of the plane of the sheet and provides said reflective face directed generally parallel to the plane of the substrate and facing in substantially the same direction as adjacent elements of the series. Preferably the sheet is clear such that the lines are separated by clear lines which allow light to pass therethrough.

Also in accordance with the present invention, there is provided a method of forming a glazing panel as herein before defined, the method comprising the steps of surveying the external light incident at the location at which the glazing panel is to be provided and selectively varying the parameters for at least the spatial separation elements, the height for the reflective side faces of the elements and the distance for between the first and second sides of the elements in accordance with the survey, and applying said elements to said substrate accordingly.

The method may be performed on a substrate panel which is already in situ or on a substrate panel for mounting in situ.

The parameters may be varied over the area of the substrate to take account in changes in light during the day, externally shaded areas or areas in building the light through the panel needs to be controlled.

Embodiments of the present invention will now be described by way of examples only and with reference with accompanying drawings, in which:

Figure 1 is a sectional view through a first embodiment of glazing panel in accordance of this invention;

Figure 2 is an enlarged sectional view through an optical element of the glazing panel of Figure 1;

Figure 3 is an enlarged sectional view of an optical element of a second embodiment of glazing panel in accordance with the present invention;

Figure 4 is an enlarged sectional view through an optical element of a third embodiment of glazing panel in accordance with present invention;

Figure 5 is an enlarged sectional view through an optical element of a fourth embodiment of glazing panel in accordance with the present invention;

Figure 6 is an enlarged sectional view through an optical element of a fifth embodiment of glazing panel in accordance with the present invention;

Figure 7 is a front view of a sixth embodiment of glazing panel in accordance with the present invention;

Figure 8 is a front view of a seventh embodiment of glazing panel in accordance with the present invention;

Figure 9 is a sectional view of an eighth embodiment of glazing panel in accordance with the present invention;

Figure 10 is a sectional view of a ninth embodiment of glazing panel in accordance with the present invention;

Figure 11 is a sectional view of a tenth embodiment of glazing panel in accordance with the present invention;

Figure 12 is a sectional view of an eleventh embodiment of glazing panel in accordance with the present invention;

Figure 13 is a sectional view of an twelfth embodiment of glazing panel in accordance with the present invention;

Figure 14 is a perspective view of a sheet for forming a thirteenth embodiment of glazing panel in accordance with the present invention, the sheet being unformed; and

Figure 15 is a perspective view of the sheet of Figure 15 following formation.

Referring to Figures 1 and 2 of the drawings, there is shown a first embodiment of glazing panel 10 in accordance with the present invention, the panel comprising a substrate panel 11 of glass or other transparent material, such as plastics. A plurality of elongate optical elements 12, in the form of horizontal parallel lines, extend between opposite side edges of the substrate 11.

The optical elements 12 are digitally printed directly onto the inner face of the substrate 11. Each element 12 is generally triangular in section and comprises a generally flat upper surface lying perpendicular to the plane of the substrate 11. The thickness of each element 12 gradually reduces towards the lower side edge thereof. Each element 12 is constructed by depositing a series of white or light coloured pixels, with the thickness of elements 12 being varied by adjusting the spacing between the pixels and/or their degree of overlap: the thickest portion of each element 12 is formed by depositing a denser array of overlapping pixels, whilst the thinner region is formed by depositing pixels which are widely spaced apart. In the example shown, the ink density (i.e. the density of pixels) is varied linearly from 100% at the upper side edge to 10% at the lower side edge.

The upper face of each element 12 defines a so-called light shelf 13 having a height X off the surface of the substrate 11. Each light shelf 13 faces an adjacent unprinted clear region 14 of the substrate 11 having a width Y. The distance X and Y are variable parameters and are preferably equal.

The elements 12 comprise an inner face or so-called glare control panel 15 which are directed through the substrate 11 towards the exterior of the glazing panel 10. The height Z of each glare control panel 15 is also a variable parameter, which preferably varies inversely proportionally to Y.

In use, the sun's rays S1, S2 shine down from the sky onto the glazing panel 10 and some of the incident rays e.g. S1 hit the so-called light shelves 13 formed by the upper side faces of elements 12 and are reflected upwardly into the room and redirected at an equal and opposite angle instead of passing downwardly through the glazing panel onto people or work surfaces within the building. Preferably none of the reflected light is attenuated and thus the level of reflected light entering the room is the same as that which would have passed straight through the panel.

Other incident rays e.g. S2 hit the so-called glare control panel 15, which reflects, attenuates and diffuses the light according to the characteristics of the panel thereby allowing a softer and more diffuse light to shine directly into the room. The colour of the transmitted light can be varied by adjusting the colour of the ink used for the glare

control panel 15. The amount of direct light can be varied by adjusting the width Z of the glare control panel 15. The amount of reflected light can be adjusted by varying the height X of the light shelf 13.

Referring to Figure 3 of the drawings, in a second embodiment the light shelf 13 is coated with a metallised or reflective layer 20. Alternatively, the layer 20 may be formed by depositing the elements 12 with a more reflective colour at their upper edge.

Referring to Figure 4 of the drawings, in a third embodiment the outer face of the glare control panel 15 is printed with a layer 21 of a different colour to present a coloured appearance to the exterior of the glazing panel. The layer 21 of each element 12 could alternatively carry a different portion of an image. In an alternative embodiment, the layer may be provided on the inner face of the elements 12, in order to present a coloured appearance to the interior of the glazing control panel.

Referring to Figure 5 of the drawings, in a fourth embodiment the upper edge of the elements 12 are printed with a high density of ink to provide the light shelf 13, the density of the ink then changing abruptly to provide a glazing control panel 15 having a uniform optical transmission co-efficient as shown. In an alternative embodiment, the glazing control panel 15 may have a variable optical transmission co-efficient.

Referring to Figure 6 of the drawings, in a fifth embodiment the glazing control panel 15 is printed in white with the ink density varying from 100% at the upper side edge to 10% at the lower side edge. The upper edge of the elements 12 are then over-printed with a plurality of coloured inks eg cyan, magenta, yellow and black (CMYK) to form an upstanding block 29 of solid ink. The block 29 is then over-printed with white ink 30, which encapsulates the sides of the block 29 to provide the light shelf 13.

Referring to Figure 6 of the drawings, in a seventh embodiment, the elements 12 are printed as an array, each element being crescent-shaped and having a concave upper surface defining the light shelf 13. The direction in which the light shelves 13 face may be varied across the width of the glazing panel to take account of changes in light during the day.

Referring to Figure 8 of the drawings, it will be appreciated that the elements 12 could be of any shape, provided that an upwardly-facing light shelf 13 is provided below a clear area with a glazing control panel 15 extending below the light shelf 13.

Referring to Figure 9 of the drawings, there is shown an eighth embodiment of glazing panel 10 in accordance with the present invention, which is similar to the glazing panel of Figures 1 and 2 and like parts are given like reference numerals. In this embodiment, the optical elements 12 are digitally printed onto a film 28 which is applied to the inner face of the substrate 11.

Referring to Figure 10 of the drawings, there is shown an ninth embodiment of glazing panel 10 in accordance with the present invention, which is similar to the glazing panel of Figures 1 and 2 and like parts are given like reference numerals. In this embodiment, the elements 12 are digitally printed either onto a film (not shown) which is applied to the inner face of the substrate 11, or directly onto the inner face of the substrate 11. The substrate 11 is mounted in parallel with another substrate 31, the substrates 11,31 being interconnected around their peripheries by side members 32 to form a glazing unit. The elements 12 are arranged on the inner surface of the substrate 11, such that they are disposed between the two substrates.

Referring to Figure 11 of the drawings, there is shown a tenth embodiment of glazing panel in accordance with the present invention. In this embodiment, the optical elements 12 are provided on a film 33 disposed between two substrates 11,31 which are laminated together by a bonding material 35. A plurality of apertures 34 are formed in the film 33 to allow the bonding material 35 to directly interconnect the substrates 11,31 and so as to avoid de-lamination of thereof.

Referring to Figure 12 of the drawings, there is shown an eleventh embodiment of glazing panel in accordance with the present invention, which is similar to the glazing panel of Figure 11 and like parts are given like reference numerals. In this embodiment the inner surface of one of the substrates eg 11 is provided with a spectrally selective layer 36 which controls the amount of visible light and/or the amount of solar energy passing through the panel.

Referring to Figure 13 of the drawings, there is shown a twelfth embodiment of glazing panel 10 in accordance with the present invention, which is similar to the glazing panel of Figures 1 and 2 and like parts are given like reference numerals. In this embodiment, the elements 12 are covered with a protective layer 37 of lacquer.

Referring to Figure 14 of the drawings, there is shown a sheet 40 for applying to a substrate (not shown) to form a thirteenth embodiment of glazing panel in accordance with the present invention. The sheet 40 comprises a plurality of parallel strips or bands 41 disposed on a clear plastics film. Each strip or band 41 comprises an upper longitudinally-extending line 42 of a reflective material or of a colour such as white which reflects a broad spectrum of light, a central longitudinally-extending line 43 and a lower longitudinally-extending line 44 of a material having an optical transmissivity which increases gradually from its upper edge to its lower edge. Each strip or band 41 is separated from an adjacent strip or band 41 by a region 45 which is left clear.

Referring to Figure 14 of the drawings, the sheet 40 is folded along each strip or band 41 to provide a projection 46 having an upper face which carries said upper longitudinally-extending line 42 eg of reflective material and defines the so-called light shelf. The line 44 of variable transmissivity material extends below the projection 46 and provides the so-called glare control panel. The sheet 40 may be folded by deforming it between a pair of mould halves. Once formed, the sheet 40 can be adhered to a sheet of glass. In an alternative embodiment, each element is provided as an individual profiled member for adhering to a sheet of glass.

The present invention thus provides a system of designed and printed patterns of varying size and printed intensity that can be digitally placed in desired positions on the printed surface to manage and control the amount of light travelling through or acting upon a glazed or external sun facing panel. The optical height of the elements off the substrate panel and the density of the elements can be varied to suit particular applications.

Claims

1. A glazing panel comprising a substrate sheet and a series of spatially separated optical elements disposed on a major face of the substrate, each element having an optical transmission coefficient which varies across its width, parallel to the plane of the substrate, from a first side to a second side thereof, the first side being less optically transmissive than said second side, wherein the thickness of each element, perpendicular to the plane of the substrate, is greater at said first side thereof than said second side thereof, said first side of each element comprising a reflective side face directed generally parallel to the plane of the substrate and facing in substantially the same direction as adjacent elements of the series.

2. A glazing panel as claimed in claim 1, in which the optical transmissivity of at least a portion of each element increases gradually from said first side to said second side of the element.

3. A glazing panel as claimed in claims 1 or 2, in which the elements are spaced by a distance which is substantially equal to the height of the reflective face of the adjacent element from the surface of the substrate.

4. A glazing panel as claimed in any preceding claim, in which the spatial separation of the elements varies along the length or width of the substrate.

5. A glazing panel as claimed in any preceding claim, in which the elements comprise lines which extend fully or partially across the width of the substrate.

6. A glazing panel as claimed in any of claims 1 to 4, in which the elements comprise an array of spatially separated dots, pixels or other individual elements which extend across the substrate.

7. A glazing panel as claimed in any preceding claim, in which the reflective faces of the elements all face in substantially the same direction.

8. A glazing panel as claimed in any of claims 1 to 6, in which the reflective faces of the elements face in a direction which vary across the substrate.

9. A glazing panel as claimed in any preceding claim, in which the substrate comprises glass.

10. A glazing panel as claimed in any preceding claim, in which the substrate comprises a spectrally selective material which controls the amount of visible light and/or the amount of solar energy passing through the panel.

11. A glazing panel as claimed in any preceding claim, in which the elements are applied directly to the substrate.

12. A glazing panel as claimed in claim 11, in which the surface of the substrate onto which the elements are applied is plasma-treated.

13. A glazing panel as claimed in any of claims 1 to 10, in which the elements are applied to a film which is applied to the substrate.

14. A glazing panel as claimed in claim 13, in which the film comprises a spectrally selective film which controls the amount of visible light and/or the amount of solar energy passing through the panel.

15. A glazing panel as claimed in claim 10 or claim 14, in which the spectral filter vary across the panel.

16. A glazing panel as claimed in any preceding claim, in which the substrate is mounted in parallel with another substrate.

17. A glazing panel as claimed in claim 16, in which the substrates are interconnected around their peripheries to form a glazing unit.

18. A glazing panel as claimed in claims 16 or 17, in which the elements are applied to a side of one substrate which faces the side of the other substrate, such that they are disposed between the two substrates.

19. A glazing panel as claimed in any of claims 1 to 15, in which the substrate is laminated to another substrate, with said elements being disposed between the substrates.

20. A glazing panel as claimed in claim 19, in which the elements are applied directly to the surface of one of the substrates.

21. A glazing panel as claimed in claim 20, in which the substrates are bonded to each other.

22. A glazing panel as claimed in claim 19, in which the elements are applied to a film which is disposed between the substrates.

23. A glazing panel as claimed in claim 22, in which the film is apertured to allow direct adhesion of the substrates through the apertures.

24. A glazing panel as claimed in any of claims 1 to 16, in which elements are positioned behind a protective layer.

25. A glazing panel as claimed in claim 24, in which the protective layer comprises lacquer.

26. A glazing panel as claimed in any of claims 1 to 11, in which the elements are formed by depositing an ink or like material onto the substrate.

27. A glazing panel as claimed in claim 13, in which the elements are formed by depositing an ink or like material onto the film which is applied to the substrate.

28. A glazing panel as claimed in claims 26 or 27, in which the elements are formed by depositing an ink or like material of a uniform colour.

29. A glazing panel as claimed in claim 28, in which the transmission coefficient of the elements is varied by varying the amount of ink or other material that is printed.

30. A glazing panel as claimed in claim 29, in which the ink or other material is applied by depositing pixels of the same intensity of ink onto the substrate or film, the transmission coefficient being varied by varying the spacing of the pixels and/or their degree of overlap.

31. A glazing panel as claimed in any of claims 26 to 30, in which the reflective side face of each element is formed by depositing more ink or more pixels of ink at said first side of the element than at said second side.

32. A glazing panel as claimed in any of claims 26 to 31, in which the reflective side face of each element is formed by depositing white ink.

33. A glazing panel as claimed in claim 32, in which the reflective side face of each element is formed by depositing ink of a plurality of colours at said first side of the element onto white ink, the coloured ink then being overprinted by white ink to encapsulate the coloured ink.

34. A glazing panel as claimed in any preceding claim, in which the optical transmission coefficient of each element varies abruptly, gradually or linearly between said first and second sides of the element.

35. A glazing panel as claimed in any preceding claim, in which the thickness of each element varies abruptly, gradually or linearly between said first and second sides of the element.

36. A glazing panel as claimed in claim 35, in which the elements are triangular or stepped in section.

37. A glazing panel as claimed in any preceding claim, in which the elements are substantially white in colour.

38. A glazing panel as claimed in any preceding claim, in which the side face of the elements are metallised or comprise another material having a high spectral reflectivity.

39. A glazing panel as claimed in any preceding claim, in which the front or/rear surfaces of the element are formed of a different colour or colours to at least said side surface.

40. A glazing panel as claimed in claim 1, in which each element comprises a pre-formed 3-dimensional formation which is adhered to the substrate.

41. A glazing panel as claimed in claim 40, in which the 3-dimensional formation comprises a sheet material which is deformed out of its plane.

42. A glazing panel as claimed in claim 40, in which the sheet is printed or otherwise provided with means forming the or each element, said means comprising a first region having an optical transmission coefficient which varies across its width from a first side to a second side thereof, the first side being less optically transmissive than said second side, and a second region at side first which is reflective, said sheet being deformed such that said second region extends out of the plane of the sheet and provides said reflective face directed generally parallel to the plane of the substrate and facing in substantially the same direction as adjacent elements of the series.

43. A glazing panel as claimed in claim 40, in which the sheet is printed or otherwise provided with parallel spatially-separated lines respectively forming each element, each line comprising a first longitudinal region having an optical transmission coefficient which varies across its width from a first side to a second side thereof, the first side being less optically transmissive than said second side, and a second longitudinal region at side first which is reflective, said sheet being deformed such that said second region extends out of the plane of the sheet and provides said reflective face directed generally parallel to the plane of the substrate and facing in substantially the same direction as adjacent elements of the series.

44. A glazing panel as claimed in claim 42 or 43, in which the sheet is clear such that the elements are separated by clear regions which allow light to pass therethrough.

45. A method of forming a glazing panel, the glazing panel being as claimed in any preceding claim, the method comprising the steps of surveying the external light incident at the location at which the glazing panel is to be provided and selectively varying the parameters for:

    a. the spatial separation elements;
    b. the height for the reflective side faces of the elements; and/or
    c. the distance for between the first and second sides of the elements

in accordance with the survey, and applying said elements to said substrate accordingly.

46. A method as claimed in claim 45, comprising applying said elements to a substrate panel which is already in situ.

47. A method as claimed in claim 45, comprising applying said elements to a substrate panel for mounting in situ.

48. A method as claimed in claim 45, comprising selectively varying the parameters over the area of the substrate to take account in changes in light during the day.

49. A method as claimed in claim 45, comprising selectively varying the parameters over the area of the substrate to take account of externally shading.

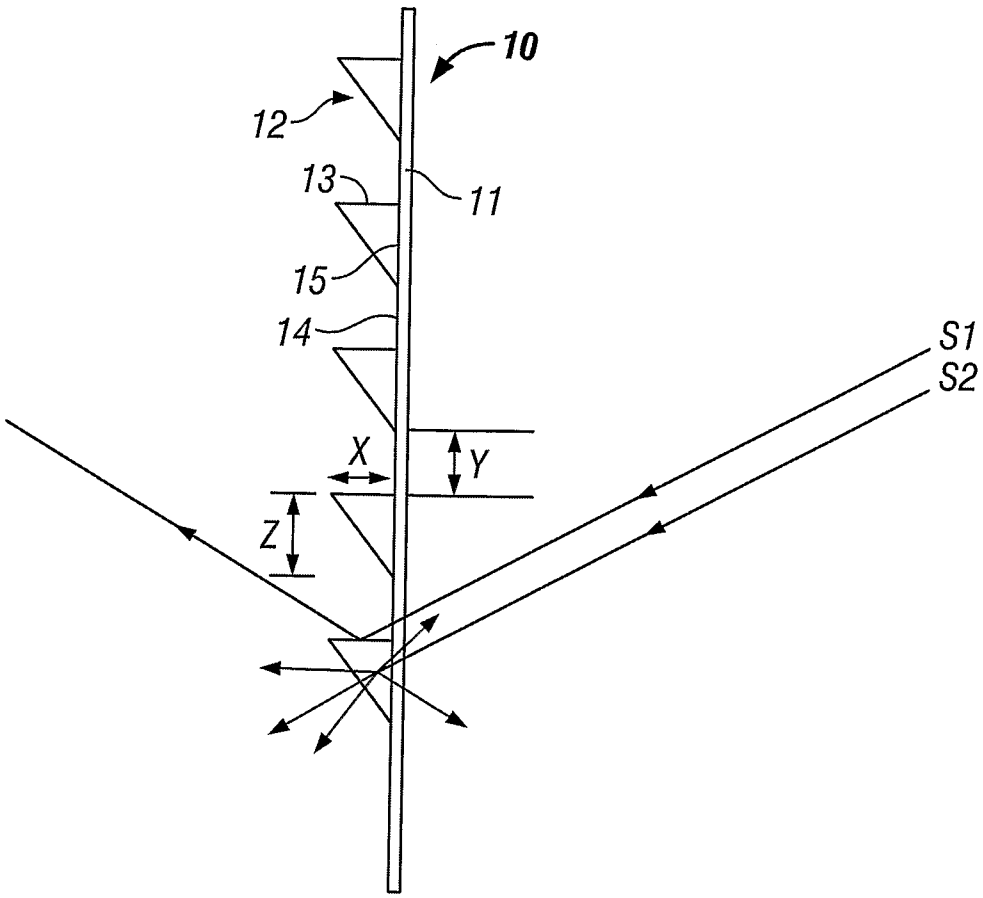


FIG. 1

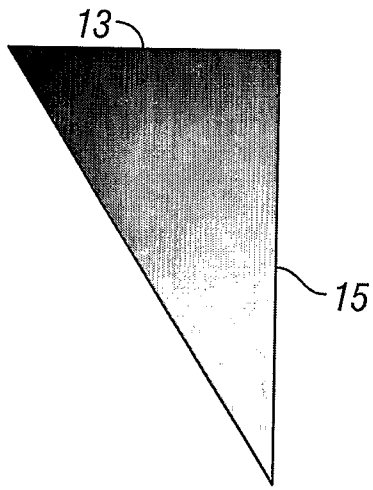


FIG. 2

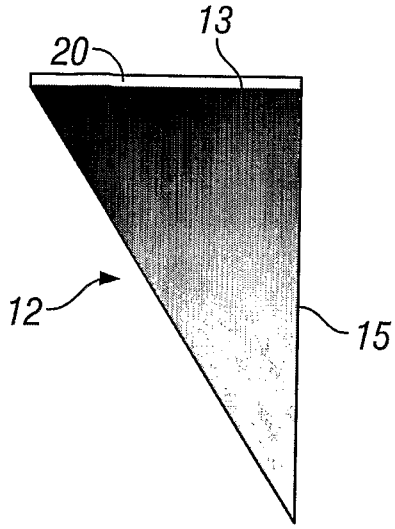


FIG. 3

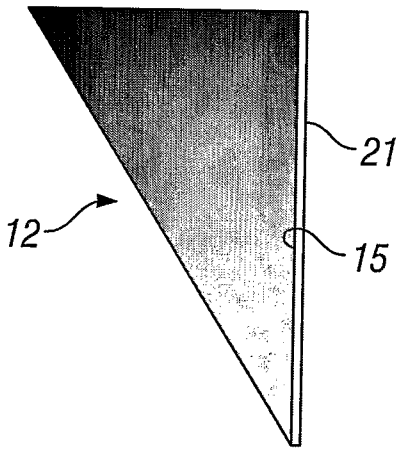


FIG. 4

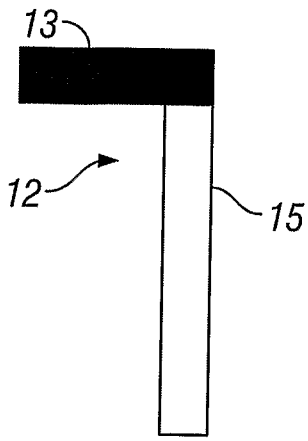


FIG. 5

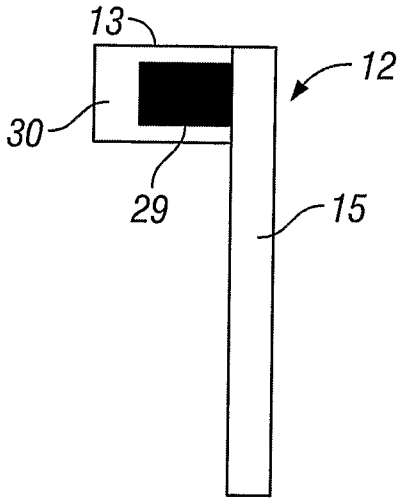


FIG. 6

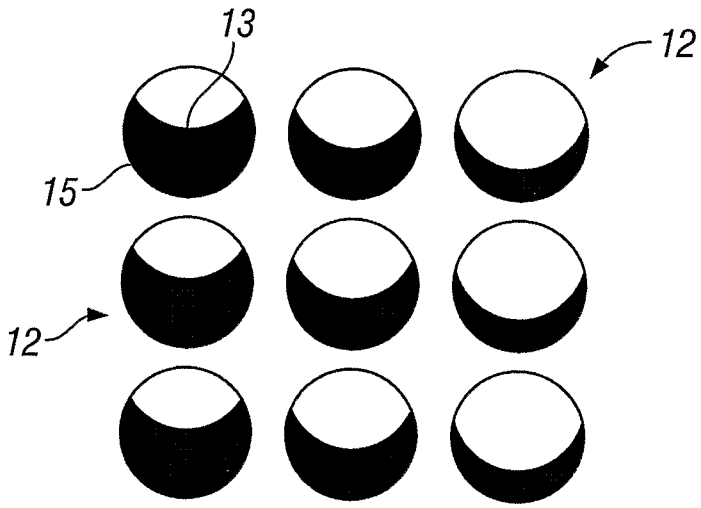


FIG. 7

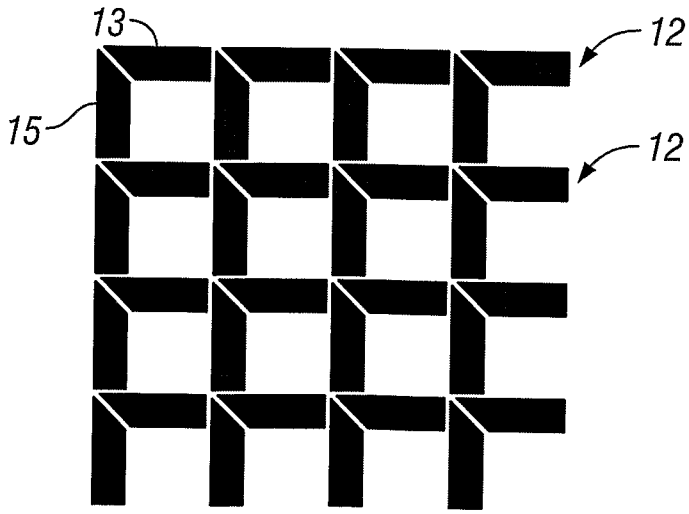


FIG. 8

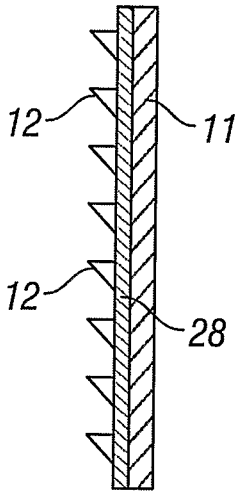


FIG. 9

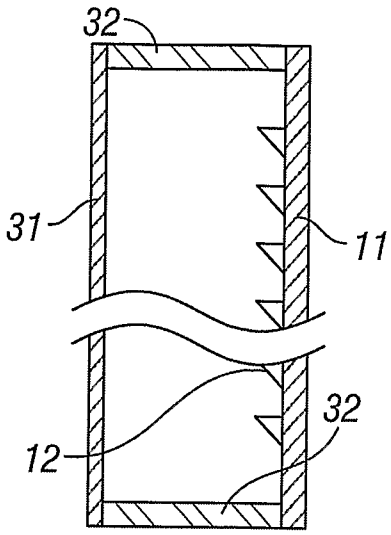


FIG. 10

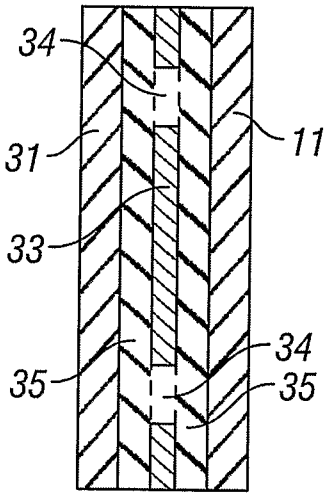


FIG. 11

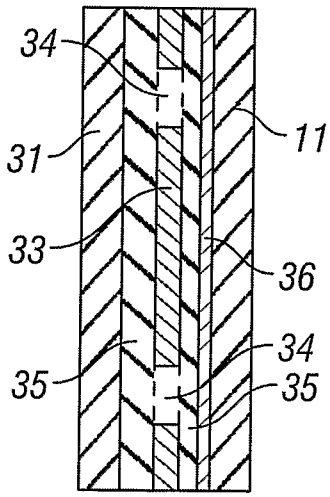


FIG. 12

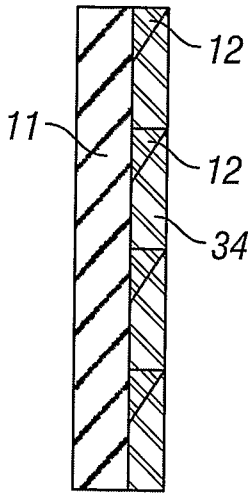


FIG. 13

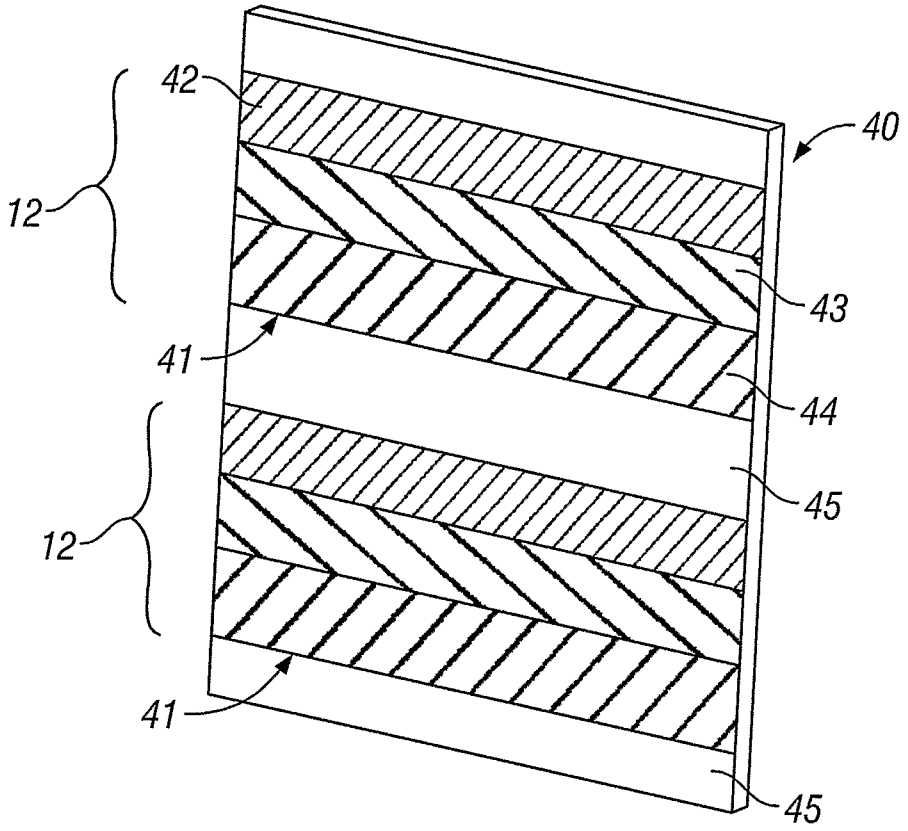


FIG. 14

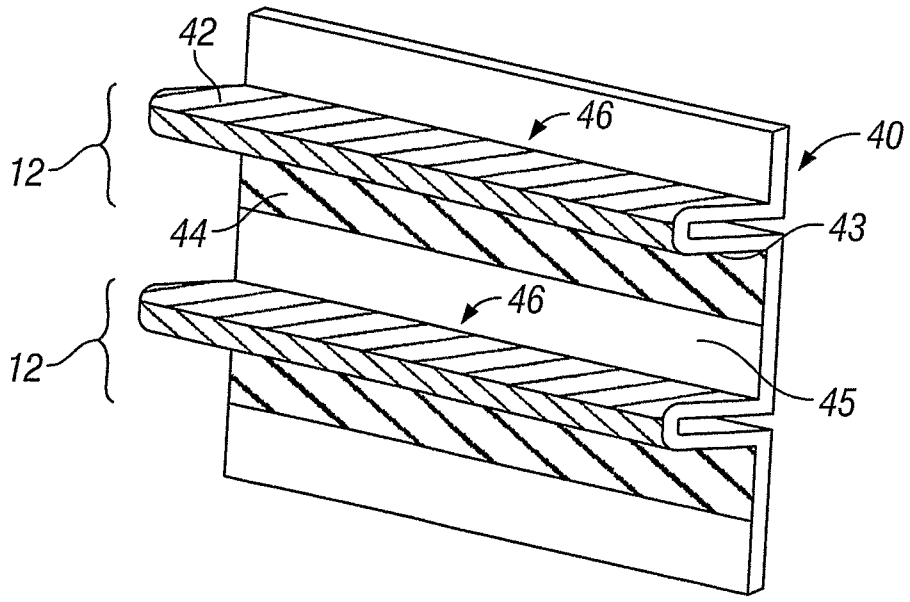


FIG. 15

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2008/050078

A. CLASSIFICATION OF SUBJECT MATTER
INV. E06B9/24 E06B3/67 F24J2/40 B41M3/00
ADD. F21S11/00 F21V5/02 B32B17/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E06B G02B F24J F21S F21V B32B B41M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 673 609 A (HILL GEORGE ROLAND [GB]) 16 June 1987 (1987-06-16) column 4, line 13 - line 37 column 6, line 51 - column 14, line 65; figures 1-5,6D,6F,7-17 column 18, line 11 - line 31; figure 18 -/--	1,2,4-6, 9,11, 16-21, 24-26, 28-30, 37,39

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
6 June 2008	13/06/2008

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lindner, Thomas

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2008/050078

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	US 5 830 529 A (ROSS GREGORY E [US]) 3 November 1998 (1998-11-03) column 1, line 7 - line 14 column 4, line 7 - line 61 column 20, line 1 - column 21, line 27; figures 2A-2Q column 34, line 21 - line 44 column 37, line 1 - line 25 column 45, line 42 - line 56; figure 22 column 53, line 22 - line 45; figure 30A column 66, line 13 - column 68, line 37	1,2,4-6, 9,11, 16-21, 24-26, 28-30, 37,39
A	EP 1 316 416 A (CURVADOS CRISTALES SA [ES]) 4 June 2003 (2003-06-04) paragraph [0022] - paragraph [0028]; figures 1,2	1,4-6,9, 14-22, 30,39
A	US 3 257 486 A (FERRIS LUBOSHEZ SERGIUS N) 21 June 1966 (1966-06-21) column 1, line 9 - column 3, line 33; figures	40-44
A	US 2005/068630 A1 (NITZ PETER [DE] ET AL) 31 March 2005 (2005-03-31) paragraph [0013] - paragraph [0019] paragraphs [0009], [0033], [0034]; figures 2-4	1,3,7,9
A	claims	45-49
A	US 6 467 935 B1 (SCHWAB ARMIN [DE]) 22 October 2002 (2002-10-22) column 3, line 25 - column 5, line 27; figure 1 column 6, line 7 - line 65; figures 3,4	1,3-7, 9-11, 16-21
A	US 3 603 670 A (KIM SANGBONG) 7 September 1971 (1971-09-07) column 3, line 38 - line 50; figure 3	1
A	US 4 498 455 A (GRAMM RONALD J [US]) 12 February 1985 (1985-02-12) column 3, line 39 - column 4, line 32; figures 2,7,8 column 6, line 11 - line 49	1,5

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Information on patent family members

International application No
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