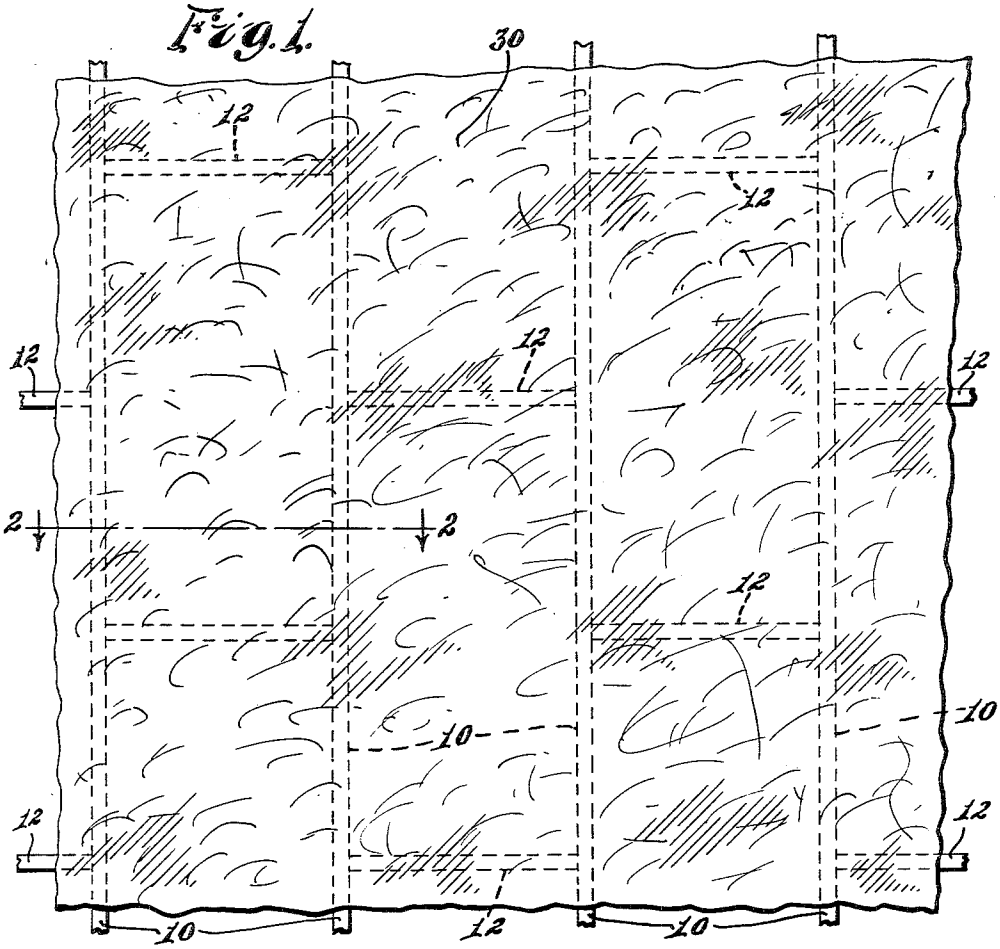
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LIGHT-DIFFUSING STRUCTURAL PANELS

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Fig. 1.



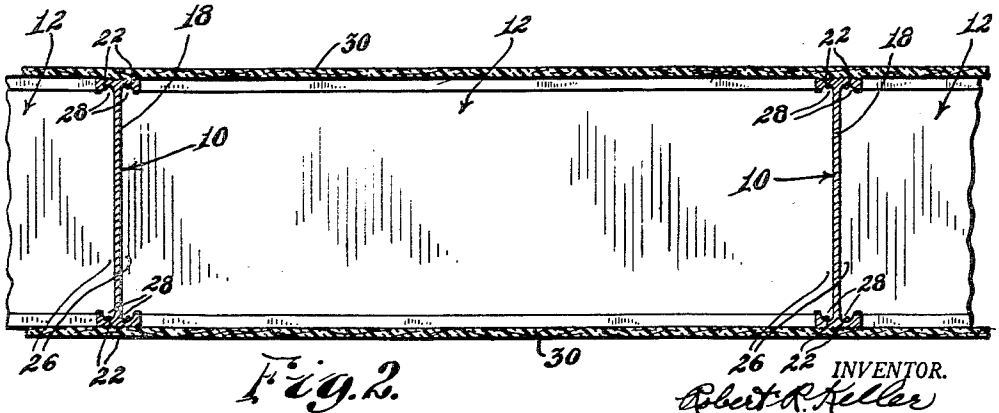


Fig. 2.

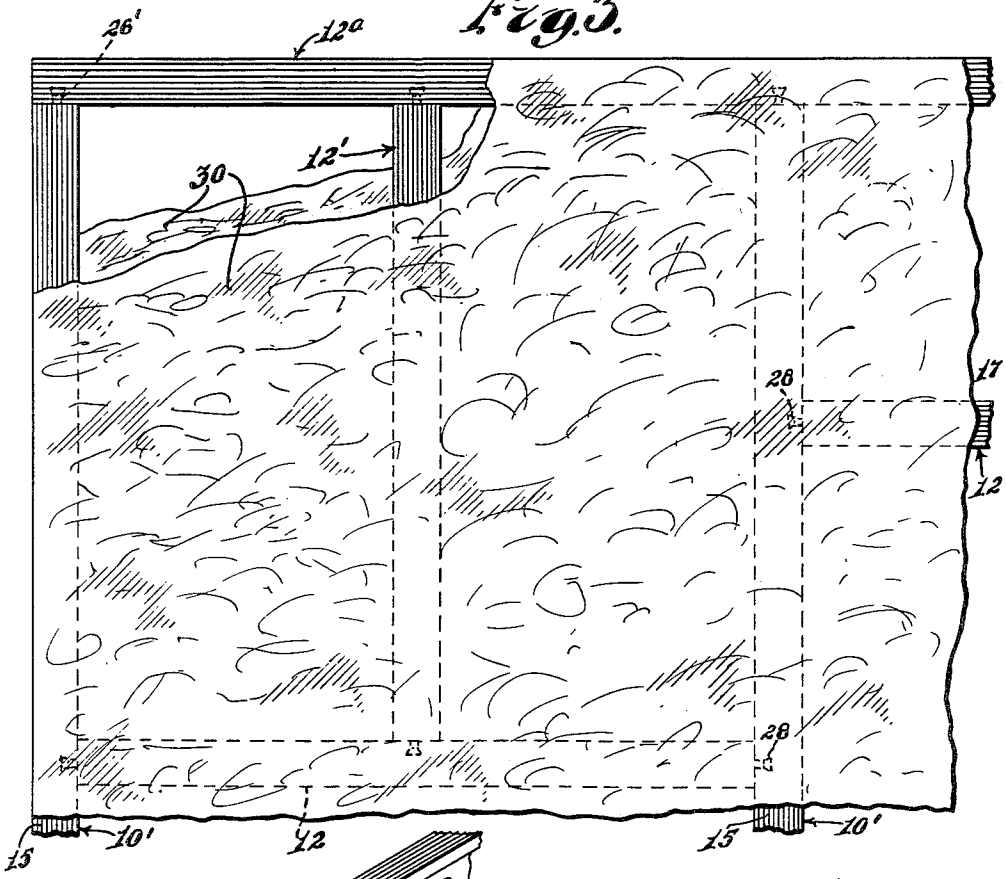
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Fig. 3.



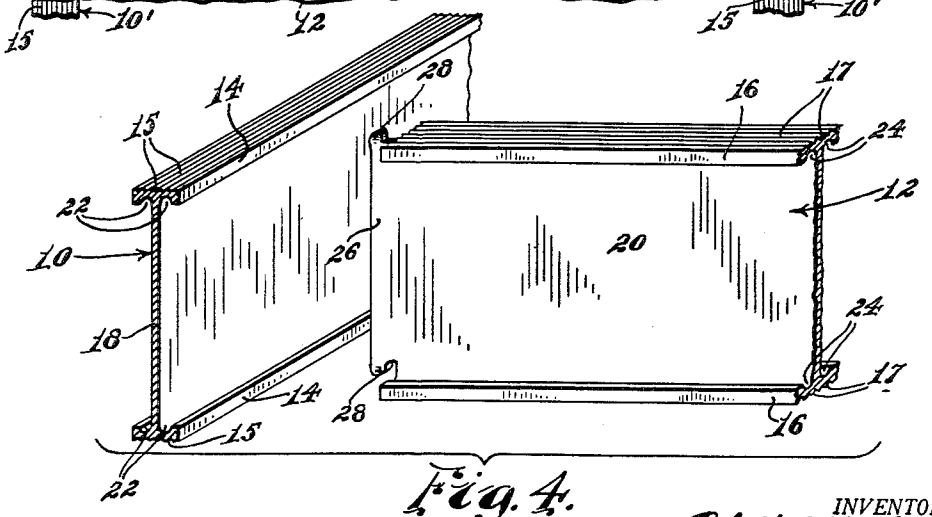


Fig. 4.

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LIGHT-DIFFUSING STRUCTURAL PANELS

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7 Claims. (Cl. 189—34)

This invention relates to improvements in light-diffusing structural panels. More particularly the invention provides improved structural panels wherein substantial insulating air space intervenes between relatively colored translucent panel-facing elements, and wherein the facing elements are secured on opposite sides of a multi-element frame whose elements initially may be variously combined and arranged to attain, with the facing elements, any of a variety of shadow effects and light-reflecting and light-diffusing effects.

It is among the objects of the invention to provide structural insulating and light-diffusing panels which may be produced in any desired sizes and which are readily combinable with other panels to procure various color and light-diffusing effects in building walls and ceilings, or portions thereof.

Another object of the invention is to provide a structural insulating panel wherein multiple frame elements initially are slidably inter-locked and relatively movable into various inter-locked relationships and become permanently fixed in selected relationships by translucent facing elements on opposite sides of the multiple-element frame.

A further object of the invention is to provide a structural panel having a translucent facing element on each of two opposite sides of a metallic frame, with substantial insulating air spaces between the facing elements and with light reflecting transverse surfaces of the frame disposed to provide substantial shadow effects which change with changes in the general direction of approach of rays of light to the panel.

Yet another object of the invention is to provide a structural insulating panel wherein metal core elements are combinable into inter-locked frame relationships which, selectively, may be variously modified to produce any of a variety of core-frame effects, and wherein translucent facing sheets of selected color or tone maintain the core elements in a selected relationship and coact with the said core elements to produce distinctive color and shadow effects.

It is, moreover, my purpose and object generally to improve insulating structural panels and especially to improve the light diffusing and color effects attainable with structural panels of the mentioned general description.

In the accompanying drawings:

Fig. 1 is a face view of a section of a structural panel embodying features of the invention;

Fig. 2 is a cross-sectional view on line 2—2 of Fig. 1 on a larger scale;

Fig. 3 is a face view of a panel section generally similar to that of Fig. 1 but having a modified arrangement of the panel core frame elements, the structure of Fig. 3 being approximately on the scale of Fig. 2; and

Fig. 4 has isometric representations of portions of frame elements which are adapted to be fitted together into inter-locked relationship, with permissible adjustability of the inter-locked elements.

Referring to the Figs. 1, 2 and 4, my improved panels are made up of a multiplicity of frame elements **10, 12,** and in Fig. 3 frame elements **10', 12'** and **12*a*** which are adapted to be inter-fitted and inter-locked with the shorter elements **12** in any of numerous spaced relationships between the elements **10**. They may, for example be positioned as in Fig. 1, or as in Fig. 3, or they may be arranged variously with or without a set pattern arrangement over the entire area of a panel.

As best seen in Figs. 2 and 4, the elements **10, 12** are in the nature of I-beams, but are made of relatively light material such as aluminum. Preferably, elements **10, 12** are extruded aluminum elements, although they might be cast aluminum or castings or extrusions or rolled shapes of other relatively light weight metals or alloys. Also, they may be molded or extruded from suitable varieties of available plastic materials.

Each I-beam element **10** has a web portion **18** extending from end to end thereof, and each web portion **18** has flanges **14, 14** extending along its opposite edges and projecting at each side of web portion **18**. The projecting portion of flanges **14, 14** at each side of web portion **18**, are channeled at **22** along the inner surfaces of the flanges, whereby the channels **22** in each flange **14** of each element **10** are open toward similar channels **22** in the other flange **14** of the same element **10**.

Similarly, each I-beam element **12** has a web portion **20** extending from end to end thereof, and each web portion **20** has flanges **16, 16** extending along its opposite edges and projecting at each side of the web portion **18**, with the inner surfaces of the flanges channeled at **24** generally the same as the flanges **14, 14** of elements **10**.

The outer surfaces of flanges of elements **10** and **12** preferably are minutely grooved longitudinally at **15** and **17**, respectively, and all of the elements **10** are arranged in spaced general parallelism, and the elements **12** are in general parallelism with each other but generally perpendicular to the elements **10**.

Interlocking of the elements **10, 12** is attained by means of web-projections **26** and tongues **28** on the ends of particular elements **10** and **12**. In Fig. 4, a web-projection **26** is shown extending beyond the flanges **16, 16,** and tongues **28, 28** are shown located on the projection **26** and adapted to be slidably engaged in channels **22, 22** of the adjacent element **10**. Hence, in Fig. 2, the central element **12** has its projection tongues **28**, at one end, engaged in the adjacent channels **22**, of the element **10** which is to the left in Fig. 2, and has its projection tongues **28**, at the other end, engaged in the adjacent channels **22** of the element **10** which is to the right in Fig. 2. The tongues **28** of projections **26** of other elements **12** are shown in Fig. 2 engaged in grooves **22** of the same elements **10** but at the other sides of the webs **18** of the elements **10**.

It is a feature of the invention that the elements **12** may be adjusted to any desired locations along the elements **10** to create any of numerous relationships of the elements **12** relative to each other and as regards their locations and arrangements along the elements **10**. Fig. 3 shows another preferred arrangement of particular elements wherein elements **10'** which are abutted by abutting element **12**, are in turn abutting elements with regard to abutted element **12*a***. A great variety of core-frame effects may be attained, selectively, by adjustment and arrangement of the elements. Also, as will be apparent, the lengths of some or all of the elements may be varied to provide still other core-frame effects.

After the core-frame elements **10, 12** have been assembled to provide a desired relationship of the elements, translucent facing members **30** are applied to opposite sides of the core-frame to complete a structural panel which will have substantial insulating air space between

the facing members 30. A suitable adhesive preliminarily may be spread over and along the grooved edge surfaces at 15, 17 of all of the frame elements 10, 12 to effect securement of members 30 to the frame with the members 30 maintaining the frame elements fixed in their said desired relationship.

Facing members 30 may be of any suitable translucent sheet material but, presently, I prefer to employ members 30 made from fibre-reinforced resin having a predetermined amount of a selected pigment added to give color and tone to the members. Resins of the polyester family reinforced with promiscuously disposed glass fibres have been found satisfactory for the facing members 30, colored to suit particular tastes and desires. Similarly reinforced facing members made from resins of the epoxy family also will be found suitable. Obviously, the panels may be of any desired size, and, if desired, adjacent panels in a wall or ceiling may have different colors to attain striking color effects. The panels may be mounted by any suitable means (not shown) such as available clamping and sealing means which may engage the adjacent edge margins of the panel facing members 30 of adjacent panels.

The spacing of the facing members 30 of any particular panel may vary to some extent, but the spacing desirably should be substantial to attain varying light diffusing and color effects. Highly effective panels may have core-frame elements which space the facing elements 30 apart approximately 2½", for example, so that intervening core webs have substantial transverse extent for deflecting and reflecting light rays passing through a facing member 30 in directions other than at right angles to the plane of the member 30. Hence, substantial deflection and reflection of light rays occurs with diffused light effects which vary with variations in the directions of approach of the light rays to a panel. Also, substantial shadow effects from the interior relatively deep core-frame webs provide varying modification of the diffused color effects. Panels having maroon or coral color or tone combined with associated panels which may be yellow or green or blue, for example, produce notable color effects and color harmonies which change with travel of the sun on its course from east to west due to variation of the effects of the core-frame walls on the light diffused through a panel into a room. Still other color effects and harmonies are attained in response to switching on of artificial light in the room.

The facing members 30 may be relatively thin as compared with the total thickness of a panel. For example, facing members having thickness of the order of .045" to .090" presently are considered preferable.

Use of aluminum for the core-frame elements 10, 12 has the advantages of lightness with adequate strength and rigidity, and the interior frame surfaces naturally have light-reflecting character without need for special treatment.

It will be obvious from the foregoing description that my improved panels may have core-frames initially assembled and adjusted to provide any of numerous constructional effects which become permanent in any particular panels with the completion of the panels by securement of the facing members on the core-frames.

Any or all of the frame elements 10, 12 may have web projections 26 and oppositely disposed tongues 28 as illustrated on the element 12 of Fig. 4. Hence, in the Fig. 3 embodiment, a panel corner may be formed by interlocking engagement of tongues on a web projection 26' of the element 10' which is to the left in Fig. 3, in channels in an edge element 12^a which may extend throughout the extent of the panel.

Panels embodying the herein disclosed structural features are relatively light in weight as compared to prior comparable panels, yet they may have strength and rigidity for constituting true load-bearing structural panels in walls and ceilings of buildings.

It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty exist in the invention disclosed.

I claim as my invention:

1. A structural panel comprising a multiplicity of generally right-angularly related metallic frame elements, all of said elements having substantially identical cross-sectional shape and each having a relatively thin web of substantial depth and substantially straight extent substantially from end to end of the element, each said element having a flange portion of substantial width extending along each longitudinal edge of the element substantially from end to end thereof, each said flange portion of each said element being longitudinally grooved along its inner surface at opposite sides of said relatively thin web thereof whereby two generally parallel channels extend along the inner surfaces of said flange portions with the channels in the flange portion at one edge open toward the channels in the flange portion at the opposite edge of the same element, means at end portions of particular frame elements slidably engaging in opposite channels of flange portions at opposite edge portions of frame elements disposed generally perpendicular to said particular elements, whereby said particular elements automatically inter-lock with said generally perpendicular elements at any selected locations along the latter, corresponding outer surfaces of said flanges of all of said elements being in two generally parallel planes, and a translucent sheet-form facing element rigidly secured to said outer flange surfaces of all of said frame elements in each of said two planes and having unitary continuous extent in said planes over the said junctures of the inter-locked frame elements, said facing sheets having fibrous material distributed therein and visible when light is diffused through the said translucent facing elements, said flanges of all of said inter-locked frame elements providing relatively narrow opaque areas creating a pattern of opaque areas extending around the margin of the panel and in the midst of said translucent sheet when light is diffused through the panel.

2. A structural panel comprising a multiplicity of frame elements including a first plurality of rigid I-beam elements disposed in spaced parallelism and a second plurality of rigid I-beam elements spaced apart and disposed in generally perpendicular relationship, all of said elements having substantially the same cross-sectional shape, and each having a web portion of substantial depth extending from end to end of the element and a flange extending along each edge of the web portion and projecting at opposite sides of the web portion, said second plurality of elements abutting elements of said first plurality of elements, the inner surfaces of the flanges of each element of said first plurality of elements being longitudinally channelled with the channels oppositely disposed in the two flanges of the element, means at end portions of said second plurality of elements slidably engaging in oppositely disposed channels of the elements of said first plurality of elements between which said second plurality of elements extend, whereby said elements initially may be selectively positioned along said channels in inter-locked relationship to elements of said first plurality of elements, corresponding outer surfaces of the flanges of all of said I-beam elements being in two generally parallel planes, and a translucent sheet-form member rigidly secured to said outer surfaces of the flanges of all of said elements in each of said two planes and having unitary continuous extent in said planes substantially throughout the area of the panel, said flanges of all of said I-beam elements providing a pattern of substantially right-angularly related relatively narrow opaque areas at the opposite faces of the panel, said pattern being in substantial part predetermined by the said initial selective positioning of said elements.

3. A structural panel as defined in claim 2 wherein the said means at end portions of said second plurality of

elements comprises, at each end of each, a projection of its said web portion beyond its said flanges, and a pair of tongues on said projection for interlocking sliding engagement in said channels of the two said flanges of a said element of said first plurality of elements.

4. A structural panel as defined in claim 2 wherein the said web portions of I-beam elements have light-reflecting surfaces, and said translucent sheet-form members have glass fibres therein producing a magnified light-diffusing effect in conjunction with said reflecting surfaces.

5. A structural panel comprising a multiplicity of frame elements including a first plurality of rigid beam elements disposed in spaced parallelism and a second plurality of rigid beam elements spaced apart and disposed in generally perpendicular relationship, each of said beam elements having a web portion of substantial depth extending from end-to-end of the element and flanges extending along opposite edges of the web portion and presenting two oppositely directed outer surfaces, each surface having a width substantially greater than the thickness of said web, said second plurality of elements abutting elements of said first plurality of elements, said abutted elements provided with seating portions extending along their length, projection means at end portions of each of said abutting elements for slidably engaging said seating portions, whereby said abutting elements initially may be selectively positioned along said seating portions in inter-engaged relationship to said abutted elements, a first light-transmitting sheet-form member rigidly secured to one of the outer flange surfaces of each of said rigid beam elements and having a unitary continuous extent substantially throughout the area of the panel, and a second, opposed sheet-form member rigidly secured to

the other outer flange surface of each of said rigid beam elements and having a unitary continuous extent substantially throughout the area of the panel, said flanges of all of said elements providing a pattern of substantially right-angularly related relatively narrow substantially opaque areas at the opposite faces of the panel, said pattern being in substantial part predetermined by the initial selective positioning of said elements.

6. The structural panel of claim 5 wherein the abutted rigid beam elements each further provides an additional longitudinal portion parallel with and spaced apart from said seating portion, and said means at end portions of said abutting elements comprises a projection for insertion in the space defined between said seating portion and said additional longitudinal portion whereby said first plurality of elements and said second plurality of elements are interlocked.

7. The structural panel of claim 6 wherein at least one of said longitudinal portions on each of said abutted beam elements and a portion of the projection of each of said abutting elements are shaped to provide mated groove and projection interlock against endwise movement of said abutting element from said abutted element.

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