United States Patent [19]

Matson

[11] **3,780,485**

[45] **Dec. 25, 1973**

[54] **STRUCTURAL PANEL**

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[21] Appl. No.: **227,883**

[52] **U.S. Cl.** ..... **52/665,** 52/585, 52/615, 287/20.92 K, 287/189.36 A

[51] **Int. Cl.** **E04c 2/42,** E04c 5/04

[58] **Field of Search** ..... 287/54 C, 56, 189.36 A, 287/209 ZK, 20.92 D, 53 TK, 53 LK; 52/585, 586, 664, 665, 666, 667

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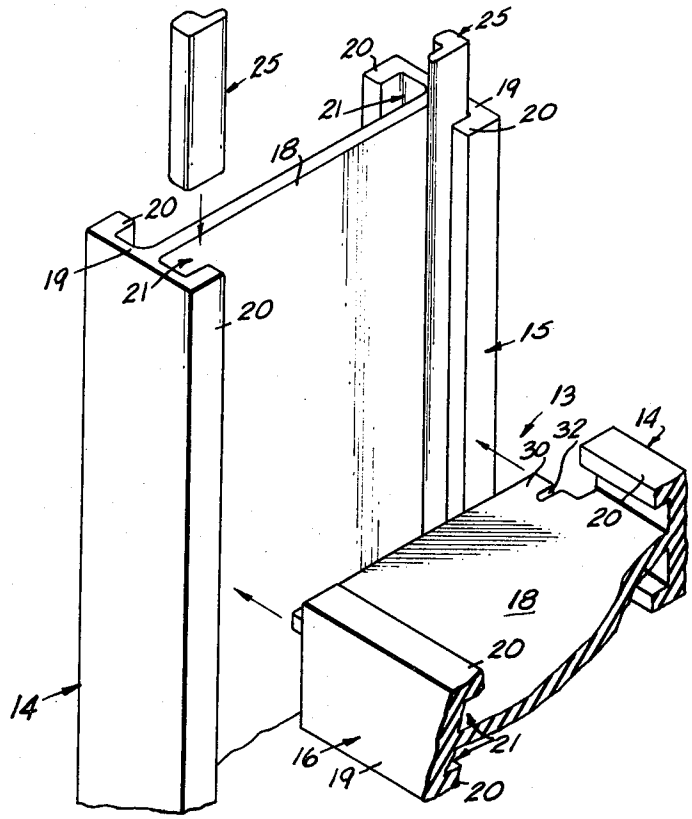
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Primary Examiner—Henry C. Sutherland
Attorney—B. J. Powell

[57] **ABSTRACT**

A structural panel including an open core frame covered by skin elements to form the panel. The frame is made up of I-beams which are connected together with an interlock to form joints. One of the I-beams in each joint has a tongue which fits between the flanges of the other I-beam and is notched to receive a retaining rib of the interlock. A lip on the flange retains the interlock in place.

5 Claims, 6 Drawing Figures



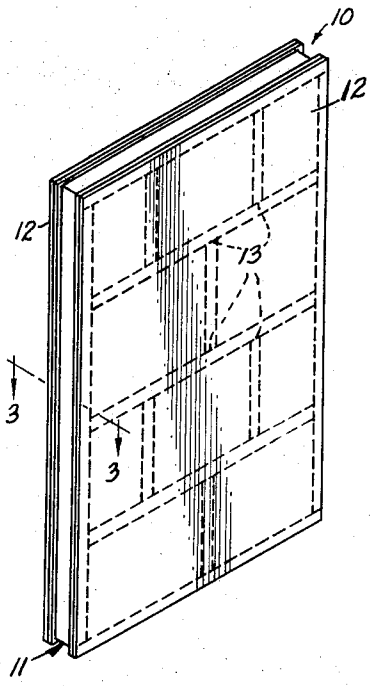


Fig 1

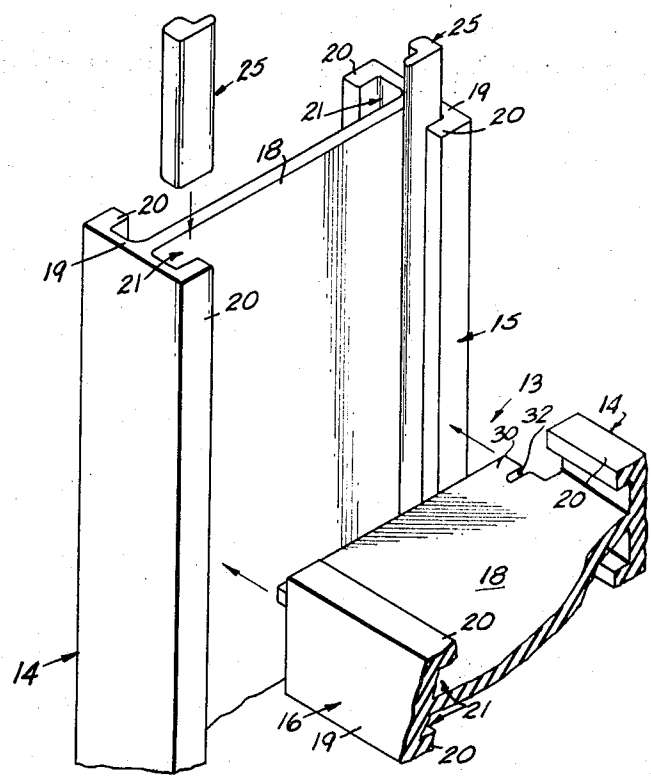


Fig 2

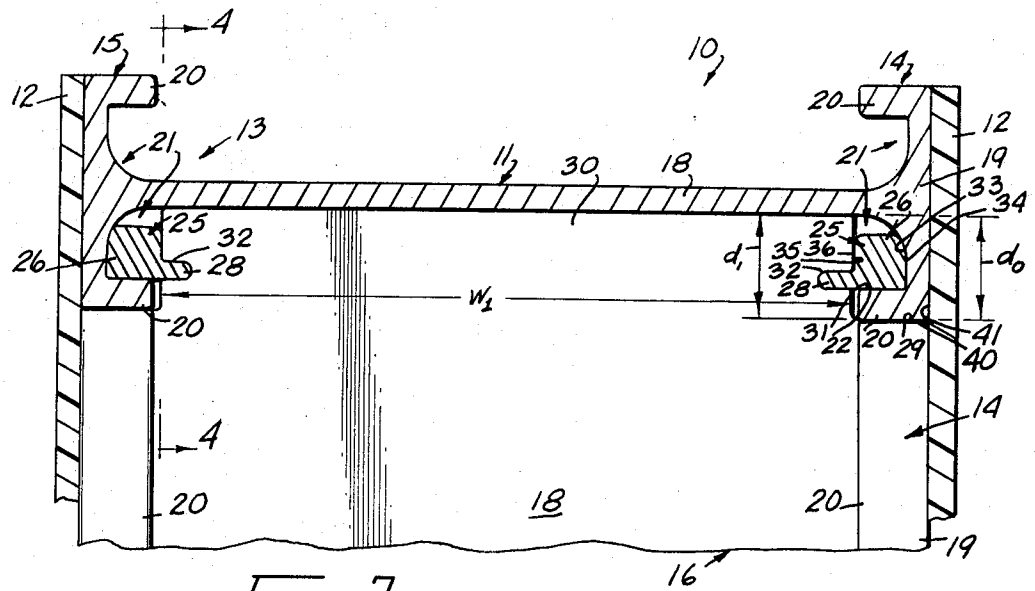


Fig 3

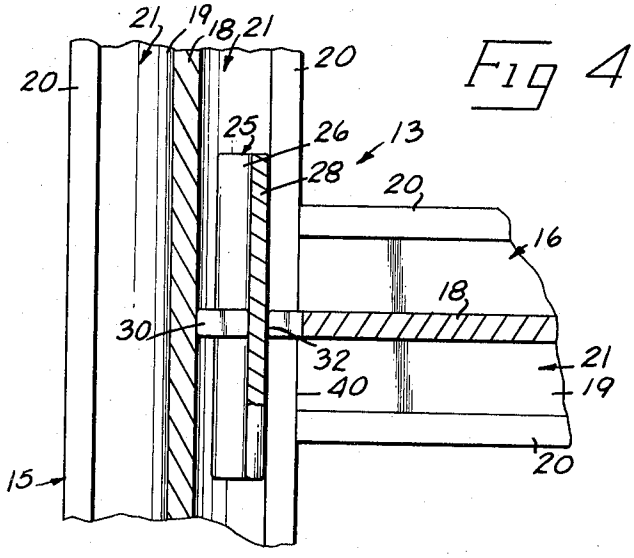


Fig 4

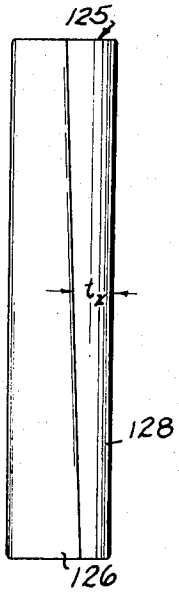


Fig 6

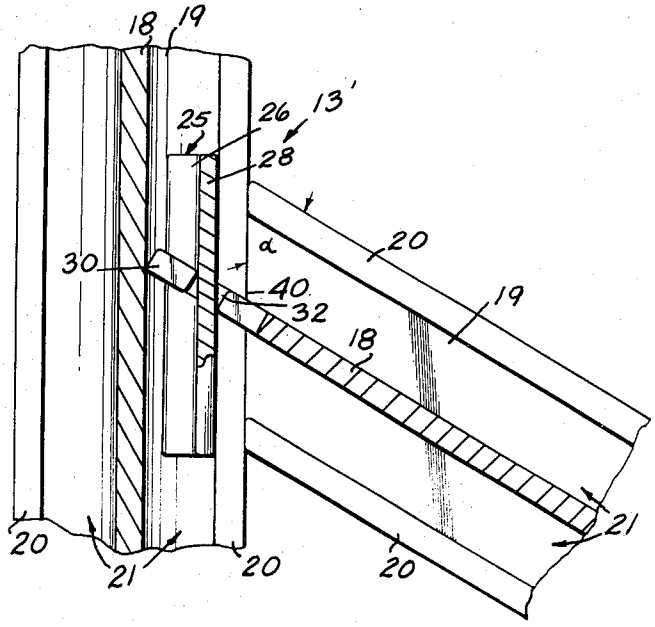


Fig 5

STRUCTURAL PANEL

BACKGROUND OF THE INVENTION

Various kinds of structural panels are available on the market today. Such panels generally have an open core framework covered by skin members on opposite sides thereof. These prior art panels have very simple joints connecting the members in the framework in an attempt to reduce the manufacturing cost of the panel. The use of these joints, however, has limited the joint strength so as to reduce the load carrying capability of the panel. Moreover, the simplicity of the joint construction has limited the versatility of the joint thereby limiting the use of the panel to relative simple structures or relative simple portions of more complex structures.

SUMMARY OF THE INVENTION

These and other problems and disadvantages associated with the prior art are overcome by the invention disclosed herein by providing a structural panel having sufficient joint strength to carry a bearing load. Moreover, the joint construction is relative simple so as to permit the panel to be economically manufactured. Because the beams forming the open grid framework of the panel can be placed in position and then locked in place without further movement of the beams relative to each other, the relative angles between beams of a particular joint can be varied to provide for panels having greater versatility as to overall shape.

The panel of the invention uses I-shaped beams for the interior open grid framework which is closed by outer sheets of material to form the panel. The open framework is provided by extending the web portions of certain of the I-beams and positioning the protruding web portion between flanges of another of the I-beams. An interlocking member is then used to lock the I-beams with respect to each other to form the joint. When the open framework is completed, the sheet material is attached to both sides of the framework to complete the panel.

These and other features and advantages of the invention will become more clearly understood upon consideration of the following specification and accompanying drawings wherein like characters of reference designate corresponding parts throughout the several views and in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a structural panel embodying the invention;

FIG. 2 is an exploded perspective view of part of the panel of FIG. 1;

FIG. 3 is an enlarged cross-sectional view taken along line 3—3 in FIG. 1;

FIG. 4 is a cross-sectional view taken along line 4—4 in FIG. 3;

FIG. 5 is a view similar to FIG. 4 showing an alternate joint construction; and

FIG. 6 is a side view of an alternate embodiment of the interlock.

These figures and the following detailed description disclose specific embodiments of the invention, however, it is to be understood that the inventive concept is not limited thereto since it may be embodied in other forms.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

Referring to FIGS. 1–4, the structural panel 10 embodying the invention includes an open grid framework 11 covered on opposite sides by sheets of material 12. This produces a strong lightweight panel.

The framework 11 is formed of I-beams 14, some of which extend through the panel as stringers 15 and some of which extend betwen stringers 15 as connectors 16 to form joints 13. All of the I-beams 14 have the same cross-sectional shape with a central web 18, and a pair of flanges 19 along opposite edges of web 18 and extending outwardly therefrom generally perpendicular to web 18. The outermost edges of each flange 19 is provided with an integral inwardly turned lip 20 to form a longitudinally extending recess 21 between the web facing surface 22 of lip 20 and the web 18.

For locking the connectors 16 to the stringers 15 in any selected location to form joint 13, an interlock 25 is provided. The interlock 25 has an elongated main body 26 with a cross-sectional shape adapted to be slidably received in the recess 21 between the lip 20 and web 18 of the stringer 15. A retaining rib 28 is integral with the body 26 along its length and protrudes within the opening 24 between the innermost edges of opposite lips 20 when the body 26 is received in the recess 21.

The end of each connector 16 is formed to fit within the opening 24 betwen the lips 20 and to be engaged by the interlock 25 to be held in place. This is done by removing the flanges 19 from the end of the connector 16 a prescribed distance d_1 equal to the depth d_o of the opening 24 from the outer surface 29 of lip 20 to the surface of web 18 and notching the edges of web 18. This provides a tongue 30 on web 18 which protrudes the distance d_1 beyond the ends of flanges 19 on connector 16 and which has a width w_1 to allow passage of the tongue 30 into opening 24 and abut web 18. A notch 32 is provided in the opposite edges of the tongue 30 which receives the rib 28 therethrough.

When the interlocks 25 are holding the tongue 30 and connector 16 in place, it will be seen that the abutment surface 31 of the body 26 abuts the web facing surface 22 of lip 20, the outer locking surface 33 of body 26 engages the inner surface 34 of flange 19 in recess 21, and the inner surface 35 of body 26 engages the outer side edge 36 of the tongue 30. The engagement of the surfaces of the body 26 with the lip 20, flange 19 and tongue 30 maintains the interlock 25 in place while at the same time causing the connector 16 to be held in place by the rib 28.

The connectors 16 may be joined with the stringers 15 using the interlocks 25 by first positioning the interlock in the recess 21 of stringer 15 and twisting the connector 16 about its longitudinal axis to cause the notches 32 in the tongue 30 to be engaged by rib 28. Also, the tongues 30 of connectors 16 may be first located in the opening 24 and then the interlocks 25 inserted in recesses 21 so that the ribs 28 thereof engage the notches 32.

When the connector 16 has a longitudinally directed external force exerted therethrough so as to tend to pull the tongue 30 out of opening 24, a moment of force will be exerted on the bodies 26. This causes the inner surfaces 35 of bodies 26 to exert opposed forces on the edges 36 of tongue 30 to tightly clamp the

tongue **30** therebetween and relieve the shear forces on rib **28.** This effectively distributes the bearing load over a larger area with a corresponding reduction in the material stress level of the joint **13.**

The interlock **25** is illustrated in FIGS. **3** and **4** as having constant dimensions along its length which is approximately the total thickness of beam **14** including the flanges **19.** It is to be understood the length may be varied as shown in FIG. **2** without departing from the scope of the invention. Further, the location of the rib **28** across the width of the surface **35** may be changed without departing from the scope of the invention.

FIG. **6** shows an alternate embodiment of the interlock and is designated **125.** The interlock **125** is wedged into position and includes a body **126** like body **26** as well as a locking rib **128.** The rib **128** is tapered with respect to its thickness t_x but not with respect to its width. Thus, when the interlock **126** is inserted into recess **21,** the rib **128** is wedged into the notch **32** in tongue **30** to lock the joint **13** together.

The joints **13** illustrated in FIGS. **1–4** locate the stringers **15** and connectors **16** normal to each other. The use of the interlocks **25** or **125** allow the joint to be made when the connectors **16** and stringers **15** are not perpendicular. Such a joint is shown in FIG. **5** and designated **13'.** Joint **13'** is identical to joint **13** except that the angle α of the end surface **40** of flange **19** is not 90° as is the case with joint **13.** Also, the notch **32** in tongue **30** is either wider as shown or cut through tongue **30** at the same angle α as the surface **40** of flange **19.** Thus, the versatility of the joint and panel **10** is greatly increased.

After all of the joints **13** have been made to complete the framework **11,** the sheets **12** are attached to the outermost surfaces **41** of flanges **19** by known means such as an adhesive or bonding agent. The sheets **12** may be made of any materials such as wood, metal or plastic and serve to complement the frame **11** to form a strong lightweight panel **10.**

While specific embodiments of the invention have been disclosed herein, it is to be understood that full use of modifications, substitutions and equivalents may be made without departing from the scope of the inventive concept.

I claim:

1. A structural building panel comprising a plurality of beam elements interlocked together to form an open grid frame, all of said elements having substantially the same cross-sectional configuration including a central web having opposed longitudinally extending edges, at least one longitudinally extending flange integral with each opposed edge of said central web and extending outwardly therefrom substantially perpendicular to said central web, said flanges opposed to each other and projecting outwardly from the same side of said central web, and a retaining lip integral with each projecting edge of said flanges and extending longitudinally therealong substantially parallel to said central web, said lips extending inwardly toward each other over said central web to define a prescribed opening between the innermost edges thereof, an inwardly opening longitudinally extending recess defined between the opposed surfaces of said central web and each of said lips and the inside surface of each of said flanges, said lip defining an outer abutting surface along the length thereof, a cutout defined in opposite corners of the ends of certain of said beam elements defining a projecting tongue in said central web, said cutouts having a length substantially equal to the distance from said central web to the outer abutting surface of said lip and a width substantially equal to the distance between the innermost edge of said lip and the outside surface of said flange so that the projecting end of said tongue is just slidably received through said opening between said lips on another of said beam elements and the ends of said flanges at said cutouts on said certain beam element abuts said outer abutting surface of said lips of said when the projecting end of said tongue substantially abuts said central web of said, an inwardly extending notch defined in opposite sides of said tongue and opening into said cutout, each of said notches spaced from the ends substantially said flanges at said cutout a distance substantailly equal to the thickness of said lip; and, an interlock received through each of said cutouts in said certain beam element and within said recess of said another beam element to lock said certain beam element onto said another beam element, each of said interlocks including an elongate main body having a generally square cross-sectional shape and slidably received within said recess with that side of said main body facing said tongue abutting the edge of said tongue at said cutout, and a retaining rib integral with said main body at that corner adjacent said notch and extending into said notch so that as a separation force is applied to said beam elements to pull said tongue from between said lips, said retaining lip rotates said main body of said interlock into binding engagement with said tongue and the inside surface of said flange of said another beam element to lock said beam elements together.

2. The panel of claim **1** wherein said retaining rib tapers in thickness along its length with one end thinner than the width of said notch and one end thicker than the width of said notch.

3. The panel of claim **1** wherein that surface of said flanges and said lips at said cutout defines a prescribed included angle with said central web of said certain beam element.

4. The panel of claim **3** wherein said prescribed included angle is substantially 90°.

5. The panel of claim **1** further including a skin element covering opposed sides of said open grid frame.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,780,485 Dated December 27, 1973

Inventor(s) Robert P. Matson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, lines 21 and 22, "when the projecting end of said tongue substantially abuts said central web of said" should read -- another beam element --.

Column 4, line 25, "substantially" should read -- of --.

Column 4, line 26, "substantailly" should read -- substantially --.

Signed and sealed this 30th day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.