March 2, 1943. R. A. L. WEITZEL 2,312,994

CONSTRUCTION OF WALLS

Filed Jan. 28, 1938 4 Sheets-Sheet 1

Fig: 1

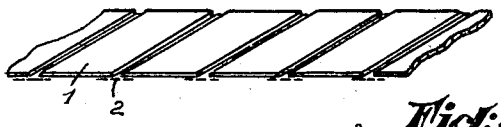


Fig: 2

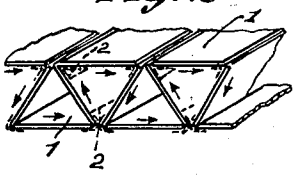


Fig: 3

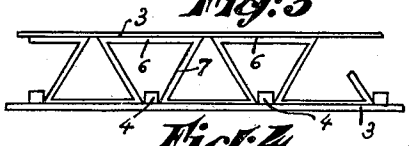


Fig: 4

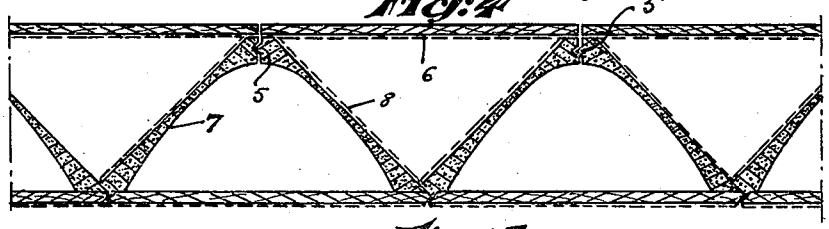


Fig: 5



Fig: 6

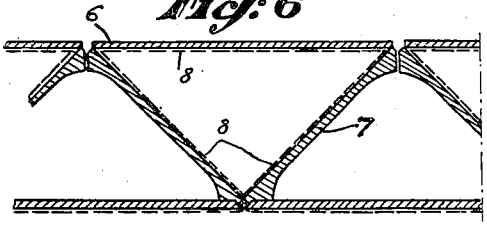


Fig: 7

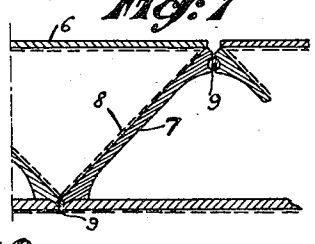


Fig: 8

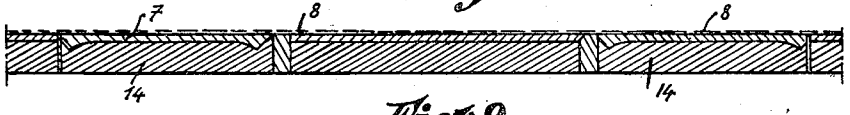
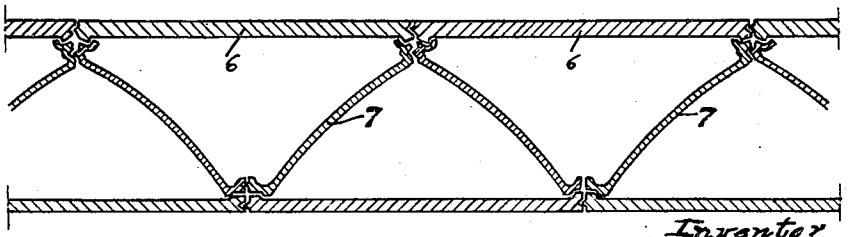


Fig: 9



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CONSTRUCTION OF WALLS

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Fig. 10

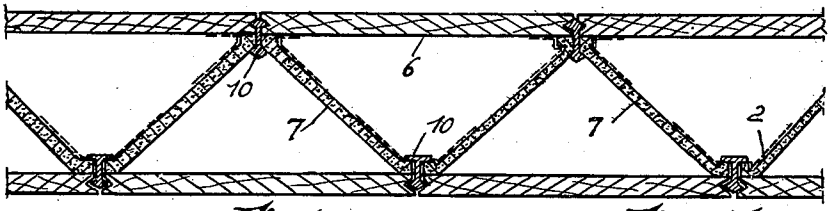


Fig. 11

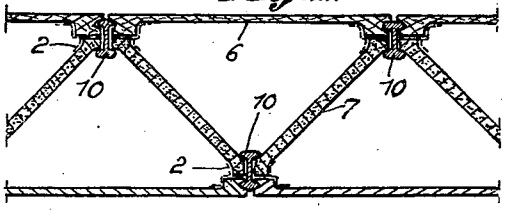


Fig. 15

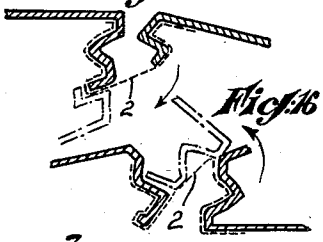


Fig. 16

Fig. 12

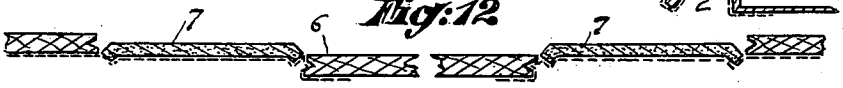


Fig. 13



Fig. 14

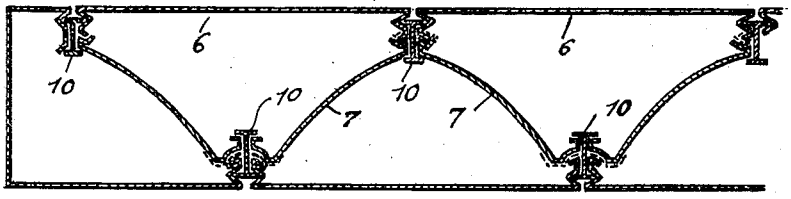


Fig. 17

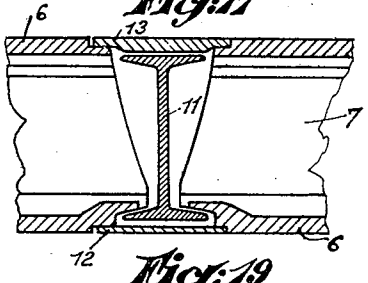


Fig. 18

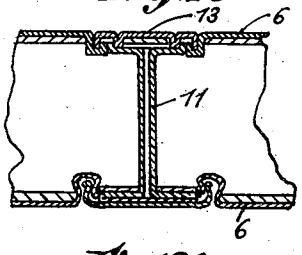


Fig. 19

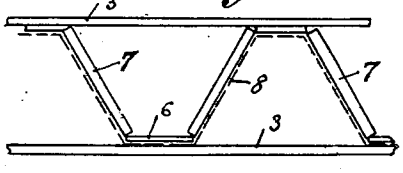
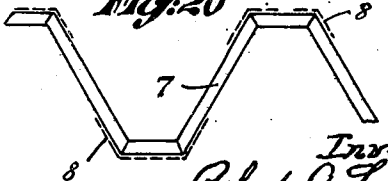


Fig. 20



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Fig. 21

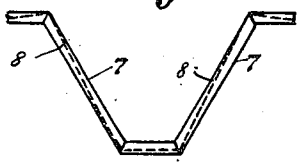


Fig. 22

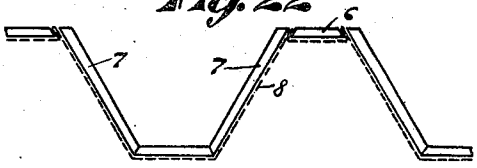


Fig. 23



Fig. 24

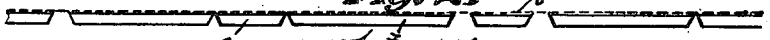


Fig. 25



Fig. 25bis

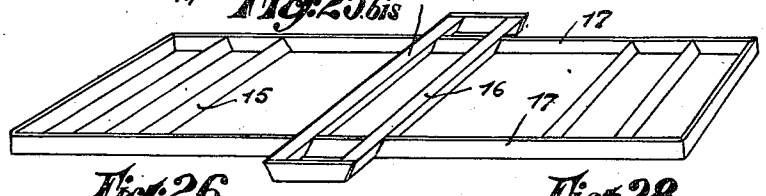


Fig. 26

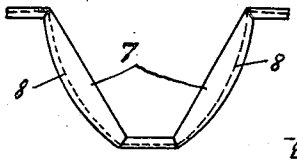


Fig. 28

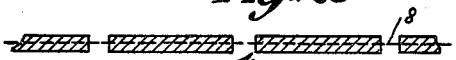


Fig. 29

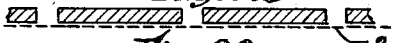


Fig. 30



Fig. 27



Fig. 32

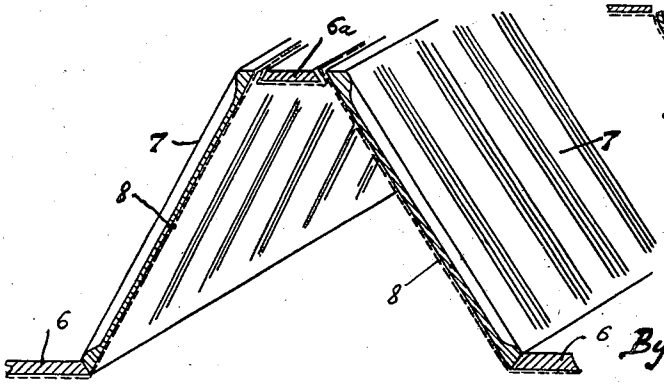
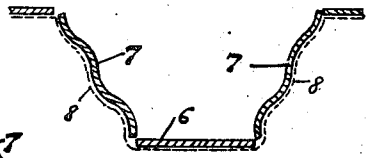


Fig. 31



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Fig. 33

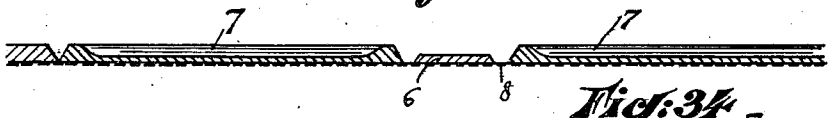


Fig. 34



Fig. 35

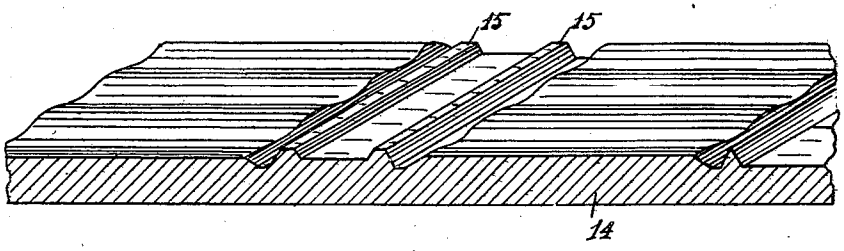


Fig. 36



Fig. 37

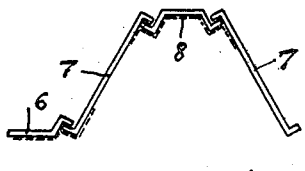


Fig. 38

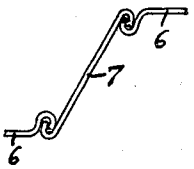


Fig. 39

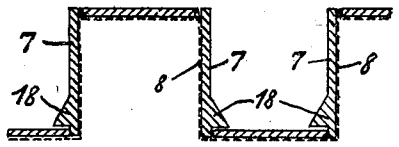
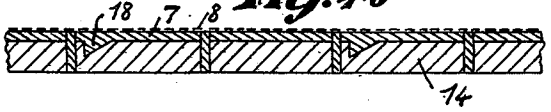


Fig. 40



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Patented Mar. 2, 1943 2,312,994

UNITED STATES PATENT OFFICE

2,312,994

CONSTRUCTION OF WALLS

Robert Auguste Louis Weitzel, Strasbourg, France; vested in the Alien Property Custodian

Application January 28, 1938, Serial No. 187,514
In Luxembourg November 6, 1937

8 Claims. (Cl. 72—46)

The present invention relates to methods and articles for the manufacture of strong and rigid light weight walls, for use in all branches of the art, for instance in architecture, for making floors, walls, linings, and so on, in shipbuilding, railroad constructions, aeronautic building, in carpentry, or cabinet-making, for the manufacture of furniture, and so on.

The chief object of the present invention is to provide a method and articles which are better adapted to meet the requirements of practice than the methods and articles used for the same purpose up to this time.

According to an essential feature of the invention, the wall is made from a jointed structure comprising the wall is made from a jointed structure comprising a plurality of rigid slats, juxtaposed with one edge of each parallel to the adjoining edge of the next slat, said adjoining edges being hingedly interconnected.

In order to form the wall, the above mentioned structure, which will be hereinafter called "jointed structure," is folded in zig-zag fashion, along the joints thereof, which constitute hinges, in such manner as to constitute a hollow wall with prismatic recesses, eventually in combination with rigid or flexible lining plates or sheets, forming stiffening elements or with sectional irons forming locking elements.

The matter of which the slats are made can be chosen at will according to the application that is considered: wood, metal, agglomerates of plaster, cement, or other binders, fibro-cement, agglomerated wood fibers, plates of compressed cellulosic matter, artificial resins or other moulded matters, and so on. The juxtaposed slats may be of identical or different nature, shape, thickness and width. They may be ribbed, corrugated or perforated and, in a general manner, made and shaped according to the required properties: mechanical strength, soundproofness, fire proofness, and so on.

Other features of the present invention will be apparent from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Figs. 1 and 2 are perspective views showing the jointed structure according to an embodiment of the invention in the unfolded and folded positions, respectively;

Fig. 3 is a diagrammatic side view of the assembled wall;

Fig. 4 is a sectional view of another embodiment of the invention;

Fig. 5 is a sectional view of the structure of Fig. 4 developed on a flat surface;

Figs. 6 and 7 are sectional views similar to Fig. 4, showing modifications;

Fig. 8 is a sectional view illustrating the manufacture of the jointed structure of Fig. 6;

Figs. 9, 10 and 11 are sectional views of walls made according to other embodiments of the invention, respectively;

Fig. 12 is a sectional view showing the development of the structure of Fig. 10;

Figs. 13 and 14 show, in the developed state and after assembly, a jointed structure made of bent metal sheet;

Figs. 15 and 16 show details of this embodiment;

Figs. 17 and 18 are sectional views illustrating the assembly of the structure to floor joists;

Fig. 19 is a diagrammatical view illustrating another embodiment of the invention, in which the boxes formed in the wall are of trapezoidal section;

Figs. 20, 21 and 22 are corresponding views showing details of assembly of the elements of the jointed structure;

Figs. 23 and 24 show the development of the jointed structure, respectively in the case of Fig. 21 and in that of Fig. 22;

Figs. 25 and 25*bis* are a sectional and a perspective view respectively of a mould for the manufacture of the elements of the jointed structure;

Fig. 26 shows a modification of the structure of Fig. 21;

Fig. 27 shows the mould for the manufacture of this structure;

Figs. 28, 29 and 30 show three possible arrangements of the flexible strip through which the rigid slats are hingedly interconnected;

Fig. 31 is a diagrammatical view showing the use of corrugated elements for making the slats;

Fig. 32 is a perspective view of another embodiment in which the corrugations are in another direction;

Fig. 33 shows the development of the structure of Fig. 32;

Fig. 34 is a sectional view of a detail;

Fig. 35 is a perspective view of the mould for the manufacture of the jointed structure of Fig. 33;

Figs. 36 and 37 show, in the developed state and in the assembled state, respectively, a jointed structure according to the invention;

Fig. 38 shows a modification of the structure of Fig. 37;

Fig. 39 shows another structure according to an embodiment of the invention;

Fig. 40 shows the mould in which this structure can be made.

As diagrammatically shown by Fig. 1, the jointed structure made of slats 1 connected together by means of cloth hinges 2, for instance, can be placed flatwise before the assembly or folding. In order to constitute the wall, it suffices to fold the slats on themselves so as to obtain, for instance, the triangulated structure illustrated by Fig. 2. This hollow system can be made rigid in various manners, for instance:

a. By fixation thereon (for instance by gluing) of plates 3 having flat and parallel faces, with the eventual interposition of bars 4 (Fig. 3);

b. By gluing on the structure a flexible matter, such as cloth;

c. By insertion of holding elements some examples of which will be hereinafter described;

Finally, the structure above described can in some cases support itself without any external help if the joints are given a suitable profile.

Fig. 4 shows in section such a structure in which the upper edges of the oblique slats 7 are assembled together in tenon-and-mortise fashion, as visible at 5, whereas the lower edges of these slats bear against lower horizontal slats with which they can fit in various manners. Fig. 5 shows in section the development in a plane of the jointed structure of this embodiment. The horizontal slats forming the external lining 6 are made, for instance, of wood, whereas the underlying slats 7 are made of an agglomerated or moulded matter. In order to permit the correct assembly of the slats together, the latter are glued on cloth 8 with a slight interval from one to another.

Figs. 6 and 7 show an embodiment which is very similar to the above described one, permitting (Fig. 7) the eventual insertion of metallic or other reinforcements 9 in the upper and lower joints. Fig. 8 shows in what manner the jointed structure of Fig. 6 can be made when all the slats are made of the same material. On a mould of the suitable outline for producing the necessary spacings and bosses, I pour the material, for instance cement, and I incorporate in the surface a continuous piece of cloth 8, after which this surface is smoothed with a scraper in such manner as to remove the excess of material.

Fig. 9 shows a modification in which, on the one hand, the inner slats 7 are of arcuate shape, and, on the other hand, the edges of the slats have a tenon and mortise profile permitting a particularly strong assembly.

Figs. 10 and 11 show examples of locking bars constituted by sectional irons 10 which engage in corresponding recesses provided in the joints. Fig. 11 shows, in particular, the arrangement of the cloth bands 2 forming hinges (these bands are shown in dotted lines). Fig. 12 shows the development of the jointed structure shown by Fig. 10. Sectional irons 10 may be embedded in insulating matter or felt-lined in order to render the wall sound-proof.

Figs. 13 and 14 show, respectively in flatwise development and after assembly, an all metal wall made by means of a jointed structure of bent iron sheets. The general arrangement is the same as in the example of Fig. 3, but the sectional irons 10 are fitted in the joints the details of which are given by Figs. 15 and 16, respectively for the upper joint and the lower joint.

It is clear that, when use is made of sectional irons or other locking bars, the hinges of cloth or any other matter do not any longer play any mechanical part after the assembly. They serve merely to facilitate this assembly and act as insulating elements when the parts have been brought into their respective positions.

For the construction of a floor, the assembly of the jointed structure to the metallic joists 11 in the shape of a double T involves no difficulty. Figs. 18 and 17 show arrangements adapted to be used in connection with the structures of Figs. 9 and 14. In Fig. 17, the slats of the structure bear through suitable notches on the lower wings of the sectional iron joist 11, which is hidden by small plates 12 and 13, added subsequently. In Fig. 18, relating to an all metal floor, the upper and lower slats 6 are folded in such manner as to engage in the iron sheets, also bent, which constitute joist 11. The cover plate 12 has edges 12^a which act as springs, which permits of forcing it on the corresponding edges 12^b of slats 6.

When, after assembly, the slats are kept in position by plane and parallel plates 3, it may be advantageous to make use of the arrangement of Fig. 19, which permits of saving material. The boxes formed in the wall are then no longer of triangular section but of trapezoidal section. Instead of the open joints shown by this example, it is then advantageous to give the slats bevelled edges, through which they are applied against one another (Figs. 20 to 22). The arrangement of Fig. 20 involves the necessity of placing alternately on one side and the other of the slats bands of cloth or any other material 8, which does not present any difficulty for practical purposes. However, in the case of Fig. 22, the band of cloth 8 can be continuous on the same face of the jointed structure. Figs. 23 and 24 diagrammatically show, respectively, the development of the jointed structure in the case of Fig. 21 and in that of Fig. 22.

When the slats are made of a moulded matter, it is possible to make use of the arrangement of Fig. 21, as shown by Figs. 23 and 25.

I make a shallow mould (Fig. 25) the bottom 14 of which is provided with projecting ribs 15 corresponding to the joints which are all in the same direction. I place on this mold the cloth or other continuous connecting material 8. I pour the material of which the slats are to be made. Then the other joints are formed in this matter in the following manner: I drive into the material small parallel bars 16, of a section corresponding to the shape of the joints and the correct position of which is marked by means of corresponding notches provided in the lateral wall 17 of the mould (Fig. 25*bis*). Then it suffices to pass a scraper along these lateral edges for removing the eventual excess of material.

Fig. 26 shows a pugging analogous to that of Fig. 21 but in which the oblique slats 7 have a special section, that is to say a thickness substantially proportional at any point to the bending moment they have to support. This jointed structure can be made exactly in the same manner as that of Fig. 21 (see Fig. 27).

Figs. 28, 29 and 30 show three possible arrangements of the continuous connecting element in the case of a structure with open joints: This element 8 may be embedded in the slats (Fig. 28), glued to the slats on one side thereof, the same

for all of them (Fig. 29) or alternately on one side and the other (Fig. 30).

The inner slats 7 may be corrugated, either in the longitudinal direction (Fig. 31) or in the transverse direction. Fig. 32 shows in perspective a floor pugging the inner slats 7 of which are corrugated in this last mentioned direction, which permits of obtaining a pugging which is very rigid and of very light weight.

Fig. 33 shows the jointed structure corresponding to the pugging of Fig. 32, developed flatwise, in section by a plane at right angles to the slats.

Fig. 34 shows the section of a corrugated slat by a plane parallel to the hinges.

Fig. 35 is a perspective view of a mould permitting to obtain the jointed structure of Fig. 33.

In Figs. 32, 33 and 35, the upper slats 6a are thinner than the lower slats 6 and the oblique slats 7.

The slats can also be ribbed instead of being corrugated.

Fig. 36 shows a jointed structure consisting of metallic slats of bent sheet metal having their edges engaged into one another, this structure being placed flatwise. Fig. 37 shows the same structure in the assembled state. Fig. 38 shows a modification of the engagement of the elements with one another.

Finally, Fig. 39 shows a pugging the slats of which are mounted at right angles. The vertical slats 7 are provided with bearing shoulders 18. Fig. 40 is a sectional view of the mould 14 which permits of manufacturing the corresponding jointed structures.

The gluing of the flexible connecting element which constitutes the hinges and that of the plates which eventually maintain the slats in the assembled state can be obtained by means of any strong glue, for instance by means of a glue consisting chiefly of an alkaline silicate and magnesium carbonate, with the addition of glass powder and asbestos fibers, or by means of a glue consisting chiefly of casein and lime.

The recesses provided in walls made according to the method above described may be left empty or they may be wholly or partly filled with any suitable material, either insulating or not, such for instance as slag or slag-wool, granular cork, glass sponge, fiber of asbestos, cement, concrete, plaster, etc. In the case of metallic walls, it may be of advantage to provide the interposition of felt in the joints so as to render the wall sound-proof.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

It is also to be understood that the novel structure is applicable not only to wall constructions but to floor and ceiling arrangements as well, and in order to cover all of such hollow building partition areas, the generic term "hollow panel constructions for buildings" will be employed to cover all embodiments of which the invention is susceptible.

What I claim is:

1. In a hollow panel construction for buildings, a jointed structure comprising, in combination, a plurality of rigid slats juxtaposed with one edge of each of them parallel to the adjacent edge of the next one, and at least one band of flexible material secured to adjacent edges of adjoining slats for hingedly connecting said edges to one another, the structure constituted by said slats and flexible material being folded at the hingedly connected edges so that alternate ones of said slats are positioned alternately in the planes of the opposite surfaces of said panel construction to provide the oppositely disposed facing areas of said panel construction, and the intervening slats extending transversely of the construction from one facing area to the other to provide bracing and spacing elements therefor, certain of the adjoining edges of the slats disposed in abutting relationship, and means on the edges of each one of said abutting slats which interfit with corresponding means on the next adjacent slat.

2. In a hollow panel construction for buildings, a jointed structure comprising, in combination, a plurality of rigid slats juxtaposed with one edge of each of them parallel to the adjacent edge of the next one, and at least one band of flexible material secured to adjacent edges of adjoining slats for hingedly connecting said edges to one another, the structure constituted by said slats and flexible material being folded at the hingedly connected edges so that alternate ones of said slats are positioned alternately in the planes of the opposite surfaces of said panel construction to provide the oppositely disposed facing areas of said panel construction, and the intervening slats extending transversely of the construction from one facing area to the other to provide bracing and spacing elements therefor, certain of the adjoining edges of the facing slats disposed in abutting relationship, and means on the edges of each one of said abutting facing slats which interfit with corresponding means on the next adjacent facing slat.

3. In a hollow panel construction for buildings, a jointed structure comprising, in combination, a plurality of rigid slats juxtaposed with one edge of each of them parallel to the adjacent edge of the next one, and at least one band of flexible material secured to adjacent edges of adjoining slats for hingedly connecting said edges to one another, the structure constituted by said slats and flexible material being folded at the hingedly connected edges so that alternate ones of said slats are positioned alternately in the planes of the opposite surfaces of said panel construction to provide the oppositely disposed facing areas of said panel construction, and the intervening slats extending transversely of the construction from one facing area to the other to provide bracing and spacing elements therefor, certain of the adjoining edges of the bracing slats disposed in abutting relationship, and means on the edges of each one of said abutting bracing slats which interfit with corresponding means on the next adjacent bracing slat.

4. In a hollow panel construction for buildings, a jointed structure comprising, in combination, a plurality of rigid slats juxtaposed with one edge of each of them parallel to the adjacent edge of the next one, and at least one band of flexible material secured to adjacent edges of adjoining slats for hingedly connecting said edges to one another, the structure constituted by said slats and flexible material being folded at the hingedly connected edges to that alternate ones of said slats are positioned alternately in the planes of the opposite surfaces of said panel construction to provide the oppositely disposed facing areas

of said panel construction, and the intervening slats extending transversely of the construction from one facing area to the other to provide bracing and spacing elements therefor, certain of the adjoining edges of the slats disposed in abutting relationship, and means on the edges of each one of said abutting slats which interfit with corresponding means on the next adjacent slat, said interfitting means including interlocking elements which aid in retaining the slats in final assembled position.

5. In a hollow panel construction for buildings, a jointed structure comprising, in combination, a plurality of rigid slats juxtaposed with one edge of each of them parallel to the adjacent edge of the next one, and at least one band of flexible material secured to adjacent edges of adjoining slats for hingedly connecting said edges to one another, the structure constituted by said slats and flexible material being folded at the hingedly connected edges so that alternate ones of said slats are positioned alternately in the planes of the opposite surfaces of said panel construction to provide the oppositely disposed facing areas of said panel construction, and the intervening slats extending transversely of the construction from one facing area to the other to provide bracing and spacing elements therefor, certain of the adjoining edges of the slats disposed in abutting relationship, means on the edges of each one of said abutting slats which interfit with corresponding means on the next adjacent slat the bracing slats being curved in a direction transversely of said panel construction, alternate ones of said bracing slats being oppositely bowed whereby they cooperate to provide an arched supporting unit.

6. In a hollow panel construction for buildings, a jointed structure comprising, in combination, a plurality of rigid slats juxtaposed with one edge of each of them parallel to the adjacent edge of the next one, and at least one band of flexible material secured to adjacent edges of adjoining slats for hingedly connecting said edges to one another, the structure constituted by said slats and flexible material being folded at the hingedly connected edges so that alternate ones of said slats are positioned alternately in the planes of the opposite surfaces of said panel construction to provide the oppositely disposed facing areas of said panel construction, and the intervening slats extending transversely of the construction, from one facing area to the other to provide bracing and spacing elements therefor, certain of the adjoining edges of the slats disposed in abutting relationship, means on the edges of each one of said abutting slats which interfit with corresponding means on the next adjacent slat, the bracing slats being of non-uniform cross-section, the cross-section area at any point corresponding to the shearing stress sustained by said slat at that point.

7. In a hollow panel construction for buildings, a jointed structure comprising, in combination, a plurality of rigid slats juxtaposed with one edge of each of them parallel to the adjacent edge of the next one, and at least one band of flexible material secured to adjacent edges of adjoining slats for hingedly connecting said edges to one another, the structure constituted by said slats and flexible material being folded at the hingedly connected edges so that alternate ones of said slats are positioned alternately in the planes of the opposite surfaces of said panel construction to provide the oppositely disposed facing areas of said panel construction, and the intervening slats extending transversely of the construction from one facing area to the other to provide bracing and spacing elements therefor, certain of the adjoining edges of the slats disposed in abutting relationship, means on the edges of each one of said abutting slats which interfit with corresponding means on the next adjacent slat, the flexible bands of material being continuous throughout the sinuous length of said structure and secured to said slats by embedment therein, whereby the edges of the slats may abut without interference by said connecting bands.

8. In a hollow panel construction for buildings, a jointed structure comprising, in combination, a plurality of rigid slats juxtaposed with one edge of each of them parallel to the adjacent edge of the next one, and at least one band of flexible material secured to adjacent edges of adjoining slats for hingedly connecting said edges to one another, the structure constituted by said slats and flexible material being folded at the hingedly connected edges so that alternate ones of said slats are positioned alternately in the planes of the opposite surfaces of said panel construction to provide the oppositely disposed facing areas of said panel construction, and the intervening slats extending transversely of the construction from one facing area to the other to provide bracing and spacing elements therefor, certain of the adjoining edges of the slats disposed in abutting relationship, means on the edges of each one of said abutting slats which interfit with corresponding means on the next adjacent slat, said band of flexible material being continuous throughout the sinuous length of said structure, said slats being secured to said band so that every fourth slat, which is one of the facing slats, is secured to the opposite side of the band from that to which the three intervening slats are secured whereby all facing slats are exposed upon both sides of said structure and the bands concealed.

ROBERT AUGUSTE LOUIS WEITZEL.