May 26, 1942. G. V. PALMER 2,284,229

METAL WALL BUILDING CONSTRUCTION

Filed Aug. 19, 1940 2 Sheets-Sheet 1

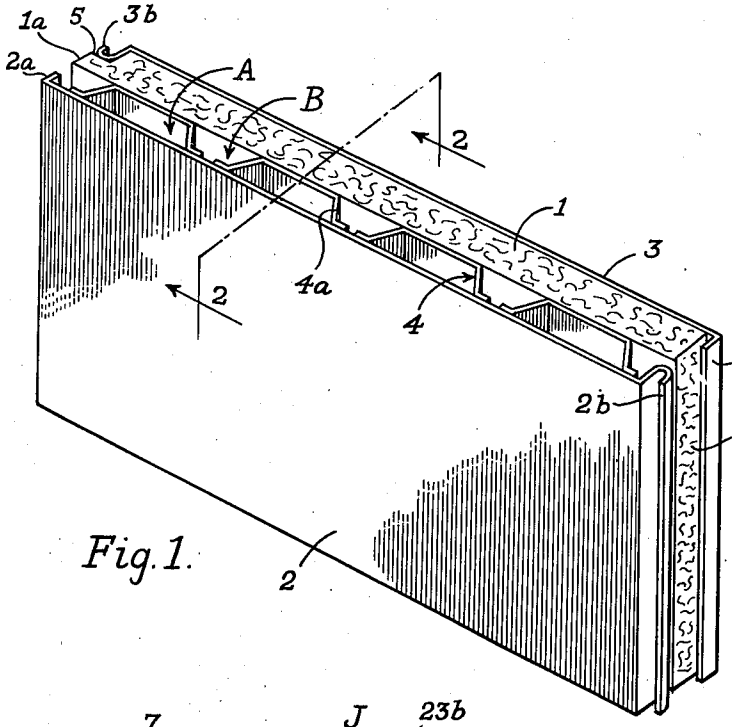
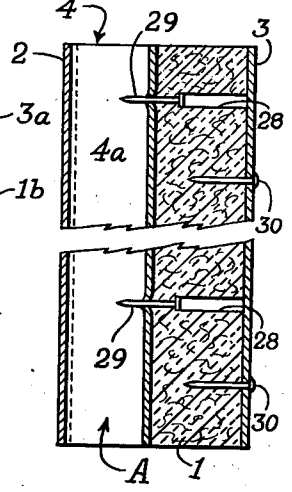


Fig. 1.

Fig. 2.



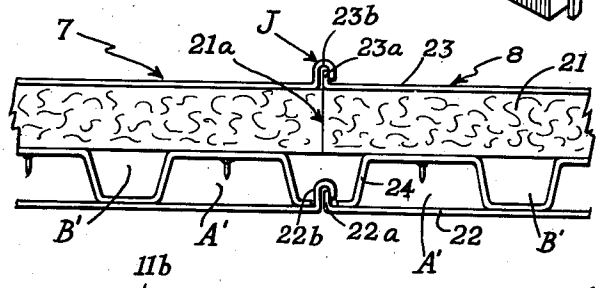


Fig. 4.

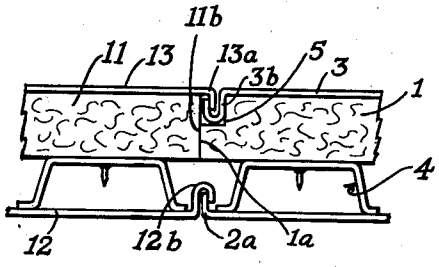


Fig. 3.

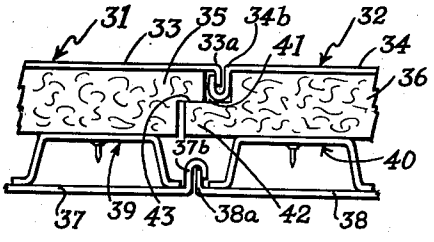


Fig. 5.

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METAL WALL BUILDING CONSTRUCTION

Filed Aug. 19, 1940 2 Sheets-Sheet 2

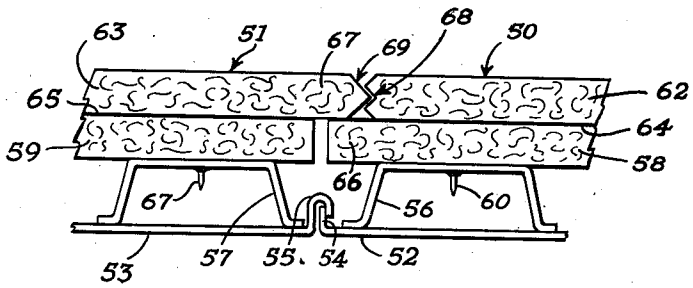


Fig. 6.

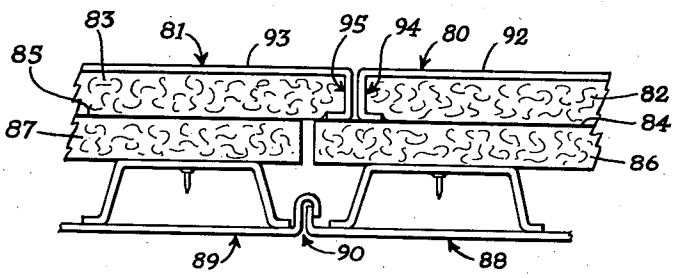


Fig. 7.

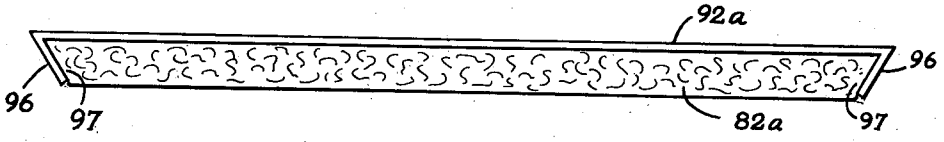


Fig. 8.

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UNITED STATES PATENT OFFICE

2,284,229

METAL WALL BUILDING CONSTRUCTION

George Vincent Palmer, Los Angeles, Calif.

Application August 19, 1940, Serial No. 353,165

5 Claims. (Cl. 189—34)

This invention relates to sectional metal wall building elements useful as panels after the fashion shown and described in my issued U. S. Letters Patent Nos. 2,049,862, 2,049,863, and 1,101,090, and pertains particularly to the construction of metal panel building elements of high heat- and sound-insulating value. This application is a continuation-in-part of my copending application Serial No. 268,266, filed April 17, 1939.

One of the principal objects of the invention is to provide a sectional wall or roof panel of a cellular type, provided with interlocking means for alined attachment to adjacent panels in the formation of a wall or roof, and comprising a main body portion formed of sheet metal and a secondary body portion formed of non-metallic heat- and sound-insulating material, said secondary body portion preferably being secured to said main body portion in such manner as to prevent direct metallic communication of heat transversely of the plane of said wall element.

A further object of the invention is to provide a sectional wall or roof panel provided with a main body portion of metal sheet material having high load-bearing characteristics, and a secondary body portion of high heat- and sound-insulating characteristics secured to the main body portion.

A further object of the invention is to provide a sectional wall element particularly adapted for external use, such as a roof element, in cooperation with a plurality of similar elements, which will provide an effective seal against the elements, as well as protection against heat transfer.

Other objects of the invention will be apparent from the following description, or will be specifically brought out therein. The accompanying drawings illustrate certain embodiments of the invention, and referring thereto:

Fig. 1 is a perspective view of a preferred form of sectional panel of the present invention;

Fig. 2 is a sectional detail thereof, taken along line 2—2 in Fig. 1;

Fig. 3 is an end view showing the joint between two abutting panel members of the type illustrated in Figs. 1 and 2;

Fig. 4 is an end view showing two abutting panel members, adapted for external use, and in the formation of a roof structure;

Fig. 5 is an end view showing the joint between two abutting panel members of a modified form of sectional panel construction;

Figs. 6 and 7 are views comparable to Fig. 5 illustrating further modifications of the construction; and

Fig. 8 is an end view of an internal layer construction of modified form, useful in connection with the form of invention shown in Fig. 7.

The panel structure of the present invention may comprise two spaced substantially flat external sheet members, such as of sheet metal or the like, one or more flat sheet insulating members disposed between the spaced external sheet members, and one or more substantially rigid spacing members separating such insulating members from one side of the structure, the spacing member or members being so shaped as to provide a plurality of separate cellular air spaces interiorly of the structure and extending in the plane thereof, i. e., parallel to the flat insulating member. The panel structure is provided with means for interlocking assembly of a plurality of such panel structures in contiguous alined relationship with the adjacent edges of the flat insulating members positioned in substantial abutment with one another so that substantially uniform heat insulation is provided by such panels and no metal member extends from one face of the panel to the other to cause direct metallic thermal conduction through the panel.

Referring to Figs. 1 and 2 of the drawings, the structure of the present invention may comprise, in one embodiment, a flat sheet insulating member 1 provided at its respective sides with flat sheet-metal surfacing layers 2 and 3, each of which are shown as provided with male and female or tongue and groove interlocking members along the end edges, as at 2*a*, 2*b*, and 3*a* and 3*b*, respectively, and a spacing member 4 between the member 1 and one of the surfacing layers, such as the layer 2. The spacing member 4, in this particular embodiment, comprises a plurality of channel-shaped sections 4*a* secured to the adjacent surfacing layer 2 in any suitable manner, as by spot welding where the layers are formed of sheet steel, and serve to define a plurality of vertically extending hollow cells A with the layer 2 and a second group of interspersed hollow cells B with the insulating sheet 1.

The interlocking members are preferably arranged so that assembly of two adjacent panels may be had by moving one panel into line with the plane of the adjacent panel, to facilitate assembly, although it is entirely feasible to arrange the interlocking elements oppositely with respect to one another and to assemble the panels by sliding them together longitudinally. The inter-

locking placement of adjacent panels is so established, in relation to the position of the edge portions of the insulating layer 1, that the edge portions 1a and 1b will be positioned in substantial abutment with one another, wherefore the heat-insulating value of the assembled panels is substantially uniform over the full area of a complete wall surface. This "substantial abutment" is intended to comprehend both actual abutment, as where such edge portions are forced into actual engagement with one another, as well as such spacing of the component parts as will cause the edge portions to be brought into close proximity with one another, it being appreciated that a gap of nominal proportions between such edge portions will not detrimentally affect the heat-insulating value of the structure as a whole.

The surfacing layers 2 and 3 are preferably secured to the insulating layer by means of nails such as those obtainable under the trade name of "concrete stub nails" or by means of the so-called "self-tapping" screws, although adhesive material may be used for this purpose as will be described subsequently. The insulating sheet 1 is shown provided with bores 28 extending part way through for countersinking nails or screws 29 which are driven through the sections 4a to hold these members and the sheet 2 in place. Nails or screws 30 are shown extending through the sheet 3 into the insulating sheet 1 to secure these members together.

The nails or the like 29 and 30 are preferably positioned in staggered relation so as to be spaced from one another by the insulating sheet and maintain the insulating qualities of the panel. The countersinking of the nails or the like 29 in the bore 28 prevents direct metallic heat conduction transversely of the panel member.

In Fig. 3 I have illustrated the adjoining portions of two sectional construction elements or panels as illustrated in Figs. 1 and 2. Referring to said figures, the panel of Fig. 1 is shown joined to a similar panel comprising an insulating sheet 11 secured to surfacing layers 12 and 13. The layers 12 and 13 are provided with interlocking members 12b and 13a, corresponding to the members 2b and 3a, arranged in complementary relation to the interlocking members 2a and 3b and adapted to cooperate therewith to secure the panels together.

In Fig. 3 it will be noted that the position of the adjacent ends 1a and 11b of the insulating sheets 1 and 11 with respect to the interlocking members are such as to provide substantial abutment of such edges substantially at the position of the joint, wherefore substantially uniform heat insulation is provided for the contiguously alined panels. In this particular case where the interlocking elements are located inwardly from each of the surfacing layers, the sheet 1 is recessed as at 5 to accommodate the groove element 3b. Although this impairs the efficiency of the insulating layer to a certain extent, the abutting joint still keeps the efficiency of the joint at a high level. At the same time no metal member runs from one face of the panel to the other.

In Fig. 4 I have illustrated the adjoining portions of two sectional construction elements 7 and 8, comprising a different embodiment of the invention, particularly adapted for use in a roof construction, in which a sheet insulating member 21 corresponding to the member 1 above is secured to an upper surface layer 23 (corresponding to 3 above), and to a separating member 24 at its lower surface (corresponding to the member 4 above), and a lower surface layer 22 (corresponding to the layer 2 above). The tongue and groove interlocking members in the layers 22 and 23 correspond in function to the members 2a—2b and 3a—3b above, the interlocking members 22a and 22b in the lower surface layer 22 corresponding directly. However, the members 23a and 23b in the upper surface layer 23 are extended above the plane of the layer 23 to form an upstanding joint J which is substantially weather-tight as long as water is not allowed to accumulate on the surface 23 to a depth greater than the upstanding height of the tongue 23a above the plane of the layer 23, as will be apparent to one skilled in the art. The member 24 in this form of the structure is shown as formed of a single sheet bent into successive channel shapes and spot welded or otherwise secured to the adjacent layer 22, and serves to define hollow cells A' and B' extending in the plane of the structure. In this case the edge of the insulating sheet 21 is shown in substantial abutment with the adjacent insulating sheet as at 21a.

In Fig. 5 I have shown a form of construction quite comparable to that shown in Figs. 1–3. Two panels 31 and 32 are shown as comprising facing sheets 33 and 34 suitably secured to insulating sheets 35 and 36 respectively and opposing facing sheets 37 and 38 secured to spacing members 39 and 40 which are in turn suitably secured to the sheets 35 and 36. The panels are each provided with interlocking members for attaching adjacent panels in contiguous alined relationship.

Thus the panel 32 is provided with inwardly extending tongue and groove members 38a and 34b, respectively, which are adapted to engage respective complementary groove and tongue members 37b and 33a on the panel 31. In this connection it may be stated that the construction of the end of the panel 32 omitted from the drawing corresponds to the end of the panel 31 which is shown and vice versa.

The member 36 is recessed as at 41 to accommodate the interlocking member 34b. The sheet 36 extends beyond the member 34b to form a tongue 42 which extends into a complementary recess 43 in the adjacent insulating sheet 35. In the joint so formed the adjacent edges of the sheets are substantially abutting, wherefore substantially uniform heat insulation is provided for such contiguously alined panels.

With the embodiments illustrated in Figs. 3 and 5, the adjacent panels may be disjointed by moving them oppositely to one another in a direction normal to their planes to disengage the interlocking members and thence away from one another in their planes. The reverse procedure is used to interlock the panels.

Referring to Fig. 6, the ends of two interlocked panels are shown at 50 and 51. These panels comprise outside sheet members 52 and 53 provided with complementary interlocking members 54 and 55 respectively. Channel-shaped sections 56 and 57 are attached to the inner faces of the sheets 52 and 53 and are secured to flat insulating sheets 58 and 59 as by means of nails 60 and 61 extending through the sheets into the sections 56 and 57. Finish layers 62 and 63 of insulating material, such as "Celotex" or an asbestos cement material such as "Cemestos", are shown secured to the outer faces of the layers 58 and 59 through the agency of suitable adhesive layers 64 and 65, such as layers of asphaltic cement.

In this embodiment of my invention the ends

of each of the surfacing sheets are spaced from the ends of the insulating sheet so as to provide a projecting tongue **66** of insulating sheet at one end and to extend beyond the insulating sheet as at **67**. The portion of the panel **51** shown may be considered as the end of the panel **50** which is not shown. The surfacing layers are shown provided with cooperating interlocking means such as groove **68** and tongue **69**.

When the panels are assembled in contiguous alined relation as shown, the tongue **66** is in a position of substantial abutment with the inner surface of the overlapping portion **67** of the surfacing member **63** and the adjacent ends of the insulating sheets **58** and **59** are in a position of substantial abutment. With such an arrangement, the heat-insulating value of the panels is substantially unimpaired at the position of the joint.

In Fig. 7 I have illustrated a construction which may be quite comparable to the construction illustrated in Fig. 6, except that a modified form of surfacing layer is utilized. Surfacing layers **82** and **83** of insulating material are shown adhesively secured as at **84** and **85** to insulating sheets **86** and **87** which are comparable to the sheets **58** and **59** of Fig. 6. The sheets **86** and **87** are suitably secured to outer panel structure **88** and **89** in the same manner as illustrated in Fig. 6, the structure being provided with suitable interlocking means as at **90**.

The sheets **82** and **83** are provided with outer finishing layers **92** and **93** of metal, for example, which are suitably secured thereto by being clinched over the ends of the sheets as at **94** and **95**. In this embodiment no interlocking is provided for the inner surface of the panel, although the overlapping relation of the members **86** and **83** acts to a certain extent as an interlock. In this connection the insulating quality of the joint is substantially the same as that of Figs. 3, 5, and 6.

I have illustrated in Fig. 8 an advantageous construction for attaching the finishing layer to the insulating layer in a construction of the type illustrated in Fig. 7. Referring to Fig. 8, an insulating layer **82***a* of "Celotex" or the like, comparable to the layer **82**, is provided with a finishing layer **92***a*, comparable to the layer **92**, of metal or the like. In this case the ends of the sheet **92***a* are crimped over at **96** to form an acute angle with the inside surface of the sheet **92***a*. This compresses the sheet **82***a* at **97** and forms a tight connection. At the same time the compressional forces set up produce a turning moment on the portions **96** which tends to keep the finishing layer **92***a* in tight engagement with layer **82***a* at positions removed from the portions **96**.

The constructions illustrated in Figs. 6–8 utilizing two layers of insulating material suitably intersecured, as by adhesive, may be employed in the previously described embodiments of my invention. Particularly, such construction may be employed where the insulating sheet is recessed as in Figs. 1, 3, and 5. In such cases, the one insulating sheet is used which is equal to the depth of the recess, for example, the recess **5** or **41**, and a second sheet is used below the recess to give the desired total thickness to the insulating body.

All of the forms are intended for use as paneling in wall and roof constructions, providing effective heat insulation, and due to the provision of the cell-defining separating member the panels are adapted for use as roof panels, wall panels, or partition panels, inasmuch as the cell-defining separating member contributes both to the strength of the panel in the carrying of roof loads, etc., for example, and to the longitudinal load-bearing strength of the panel in resisting normal wall loads.

Adhesive such as shown in connection with joining two layers of insulating material in Figs. 6 and 7 may be used for attaching the inner surfacing layer to the insulating sheet. For example, it may be used to attach the layer **3** to the layer **1** in Figs. 1 and 2. In general, adhesive attachment may be used in the place of nails or the like, as long as the temperature changes or the temperatures encountered at the adhesive layer are not too great. Thus on the sides of panels which are on the inside of a structure, adhesive attachment between insulating surfaces or insulating and metal surfaces is usually satisfactory.

The assembly of the panel through the agency of adhesive layers or through the use of suitably positioned screw or bolt members and the type of joint between panels serves to prevent direct conduction of heat through the plane of the wall panel, making the panel particularly useful in the formation of roofs and walls in excessively hot or cold climates.

In roof structures, the structure shown in Fig. 4 is particularly effective, in that adequate protection against the elements is had at a minimum expenditure of time and labor for assembly. The upstanding joint or seam shown at J in Fig. 4 has been found to be fully effective in keeping out the elements, even in the absence of caulking of any kind. It should be obvious that the upstanding joint shown in Fig. 4 may be substituted for the inwardly extending joint shown in the other figures, if desired.

Other modifications of the panel structures will occur to those skilled in the art, and I do not choose to be restricted to the specific embodiments herein delineated and described, but rather to the scope of the subjoined claims. Further, the panels may be made in any convenient width, length and thickness, depending upon the particular use to which the same are directed.

I claim:

1. A panel structure for use in building construction, which comprises: two spaced substantially flat external sheet members defining surfacing layers; a flat insulating member disposed between said flat sheet members and secured to one of said members; and a spacing member disposed between said insulating member and the other of said sheet members, said external sheet members being provided with tongue and groove interlocking elements at opposed edges thereof for interlocking assembly of a plurality of such panel structures in contiguous alined relationship, said tongue and groove interlocking elements in one of said external sheet members being extended outwardly to form a projecting overlapping joint between such contiguous alined panels, the ends of said insulating member being so positioned with respect to said interlocking elements as to produce substantial abutment of the adjacent edges of insulating sheets in adjacent panels when such panels are disposed in such contiguous alined relationship, and said spacing member being bent to form with said insulating member a plurality of elongated hol-

low cells extending parallel to the plane of said insulating member.

2. A panel structure for use in building construction, which comprises: a main panel portion comprised of a metallic flat sheet member provided along one face thereof with a plurality of channel-shaped metal sheet elements integrally secured thereto and defining a plurality of longitudinally extending hollow cells cooperating with said flat sheet member to impart load-bearing characteristics to said panel portion; a sheet of insulating material extending parallel to said one face of said flat sheet member and having an inner face secured to said channel-shaped elements in spaced relation to said flat sheet member; and a metal surfacing sheet secured to said insulating sheet at the outer face thereof, said flat sheet member of said main panel portion and said metal surfacing sheet each being provided with tongue and groove interlocking elements at two opposed edges thereof for interlocking assembly of a plurality of such panel structures in contiguous alined relationship, the tongue and groove interlocking elements in said surfacing sheet being extended outwardly to form a projecting joint between such contiguous alined panels, and said insulating sheet being extended toward the opposing edges of said panel structure an amount sufficient to effect a substantial abutment of adjacent edges of such insulating sheets at the position of such projecting joint, wherefore substantially uniform heat insulation is provided for such contiguous alined panels.

3. A panel structure for use in building construction, which comprises: a main panel portion comprised of a metallic flat sheet member provided along one face thereof with a plurality of channel-shaped metal sheet elements integrally secured thereto and defining a pluraltiy of longitudinally extending hollow cells cooperating with said flat sheet member to impart load-bearing characteristics to said panel portion; a sheet-like body of insulating material extending parallel to said one face of said flat sheet member and having an inner face secured to said channel-shaped elements in spaced relation to said flat sheet member; and a surfacing sheet secured to said insulating sheet at the outer face thereof, said flat sheet member of said main panel portion being provided with tongue and groove interlocking elements at two opposed edges thereof for interlocking assembly of a plurality of such panel structures in contiguous alined relationship, said insulating body being provided with a recess in the face thereof at the edge adjacent the groove element of said interlocking elements, said recess being so positioned with respect to said interlocking elements that substantial abutment of the adjacent insulating bodies in two such panels is established when said panels are arranged in such contiguous alined relationship, wherefore substantially uniform heat insulation is provided for such contiguously alined panels.

4. A panel structure for use in building construction, which comprises: a main panel portion comprised of a metallic flat sheet member provided along one face thereof with a plurality of channel-shaped metal sheet elements integrally secured thereto and defining a plurality of longitudinally extending hollow cells cooperating with said flat sheet member to impart load-bearing characteristics to said panel portion; a sheet of insulating material extending parallel to said one face of said flat sheet member and having an inner face secured to said channel-shaped elements in spaced relation to said flat sheet member; and a surfacing sheet secured to said insulating member at the outer face thereof, said sheet metal member and said surfacing sheet being each provided with tongue and groove interlocking elements at two opposed longitudinal edges thereof for interlocking assembly of a plurality of such panel structures in contiguous alined relationship, said insulating sheet being extended toward the opposing edges of said panel structure an amount sufficient to effect a substantial abutment of adjacent edges of such insulating sheets at the position of such interlocking elements, wherefore substantially uniform heat insulation is provided for such contiguous alined panel structures.

5. A structure as set forth in claim 4, said insulating member being provided with complementary recesses in the faces thereof at the edges adjacent said interlocking elements, said recesses being so positioned with respect to said interlocking elements that they provide substantial abutment of the adjacent insulating members in two such panels when said panels are arranged in such contiguous alined relationship, wherefore substantially uniform heat insulation is provided for such contiguously alined panels.

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