Oct. 22, 1968 B. HARDING 3,406,491

PANELLING ARRANGEMENTS

Filed June 20, 1966 6 Sheets-Sheet 1

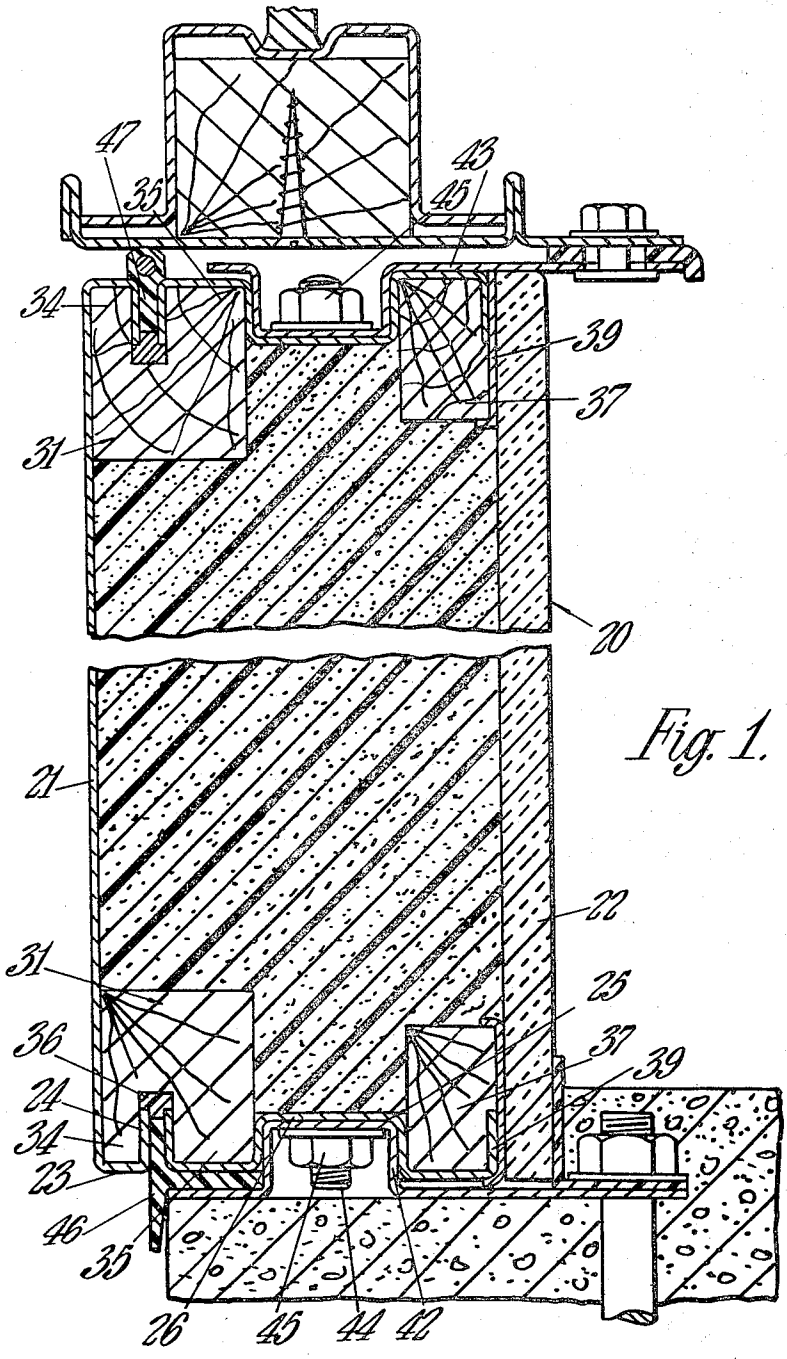

Fig. 1.

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PANELLING ARRANGEMENTS

Filed June 20, 1966 6 Sheets-Sheet 2

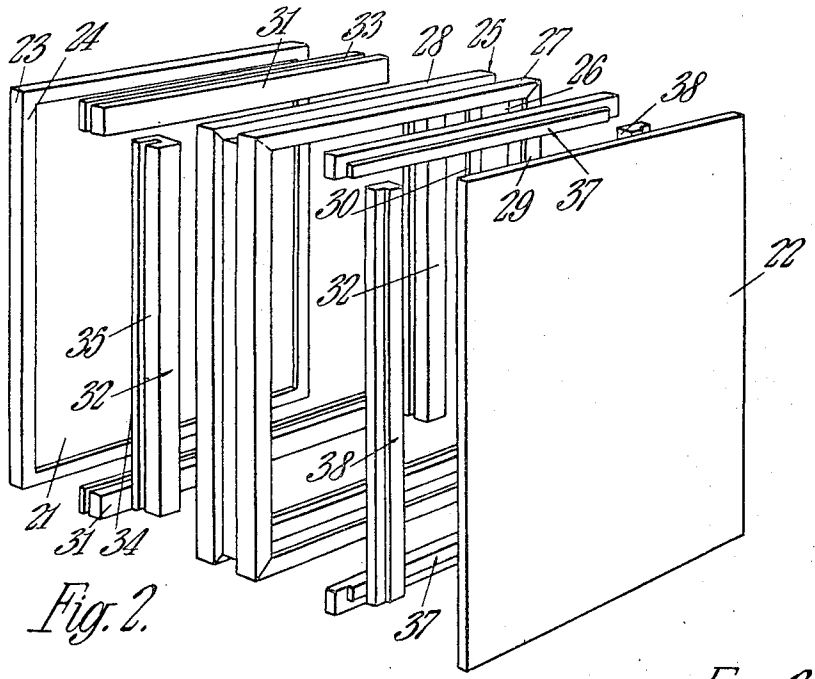

Fig. 2.

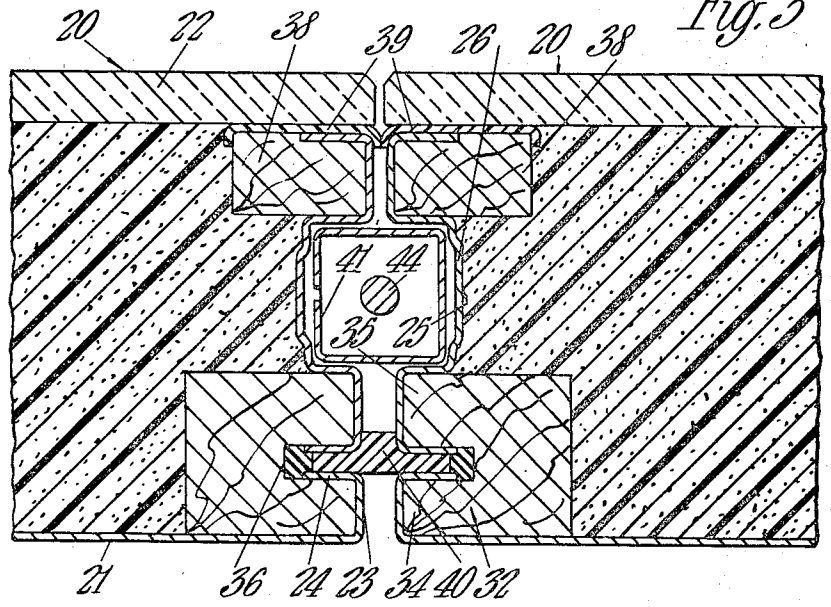

Fig. 3

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PANELLING ARRANGEMENTS

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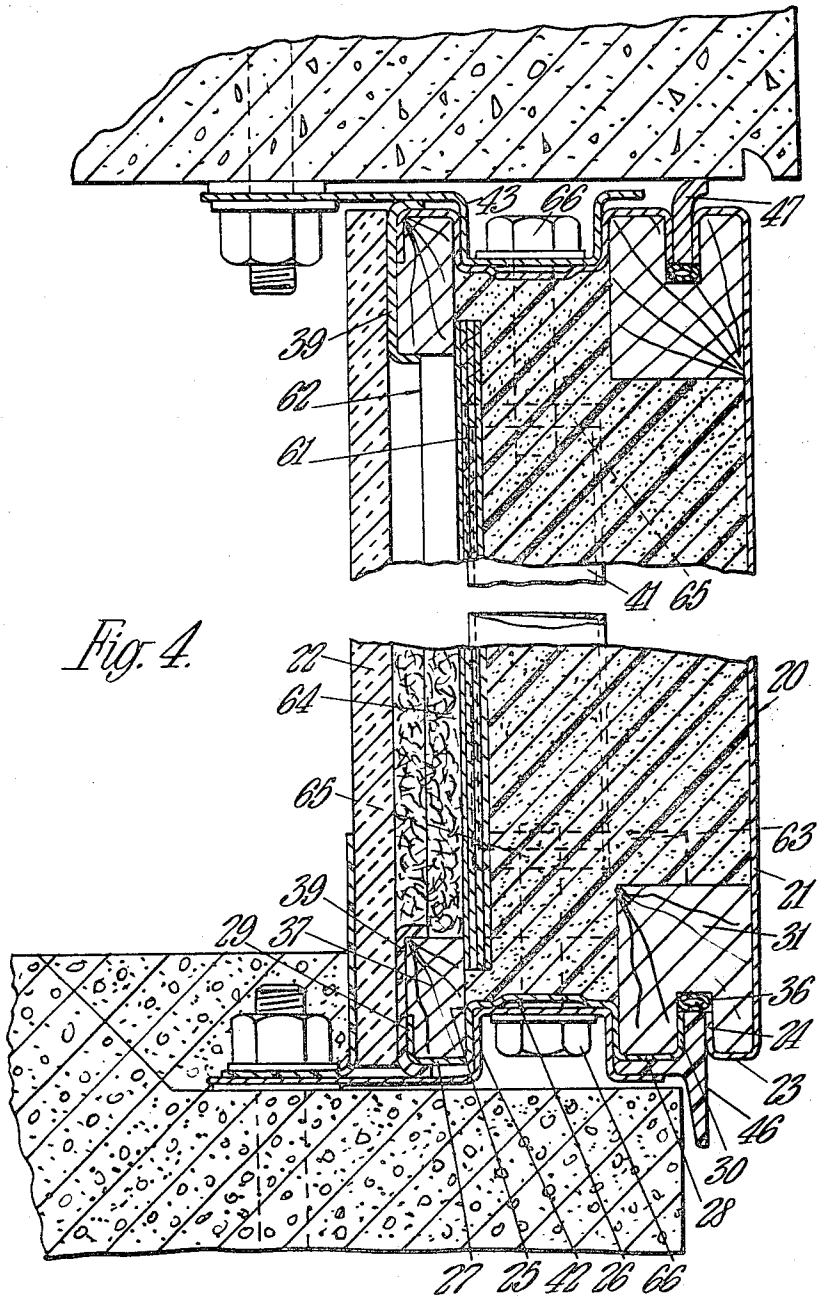
Fig. 4.



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PANELLING ARRANGEMENTS

Filed June 20, 1966 6 Sheets-Sheet 4

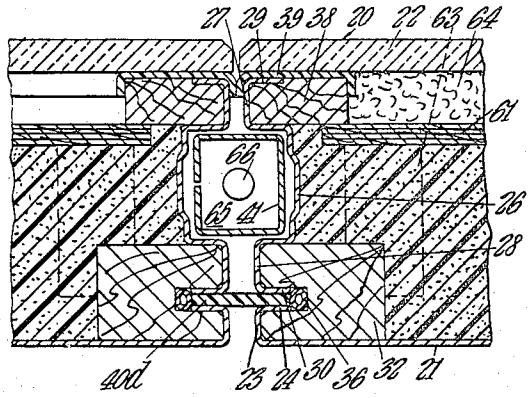

Fig. 5.

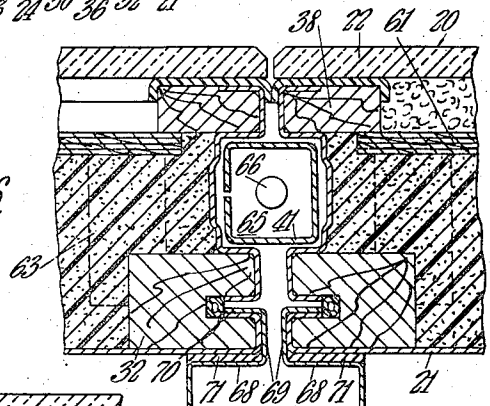

Fig. 6.

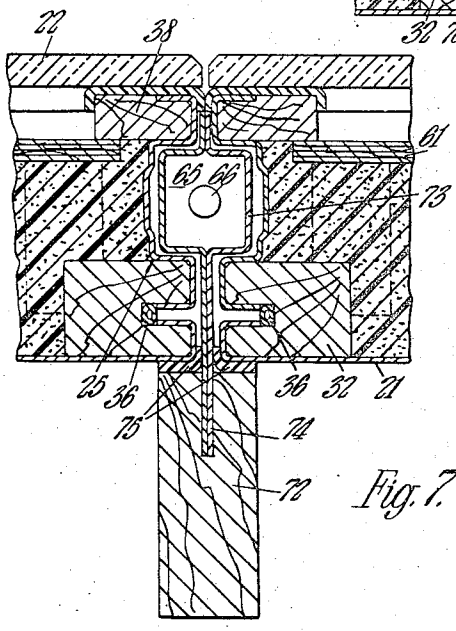

Fig. 7.

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PANELLING ARRANGEMENTS

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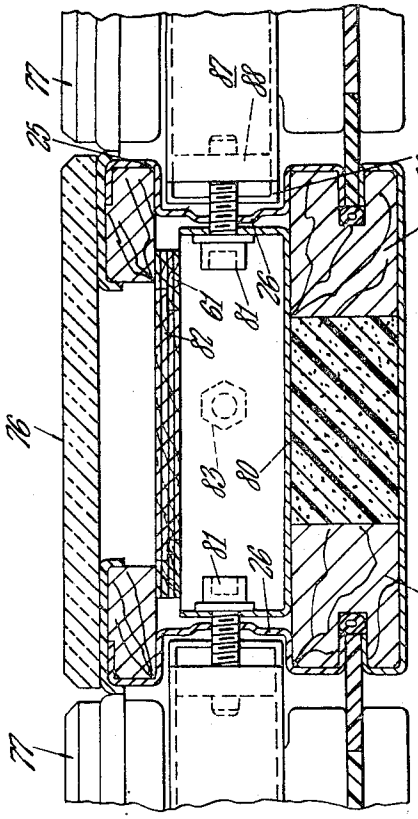

Fig. 9.

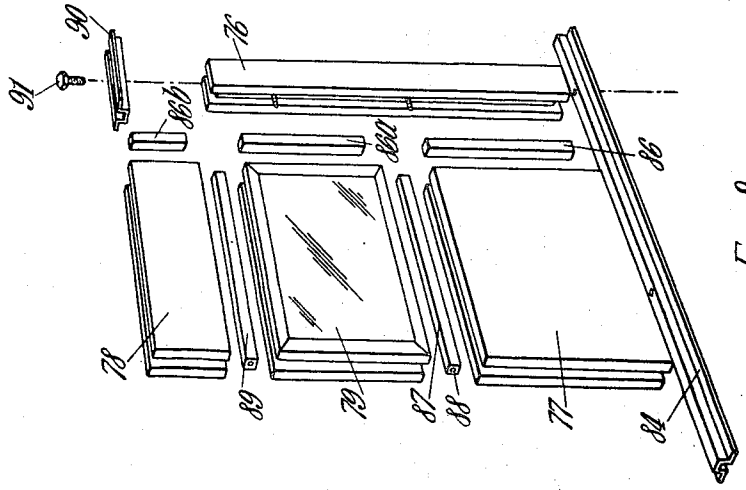

Fig. 8.

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PANELLING ARRANGEMENTS

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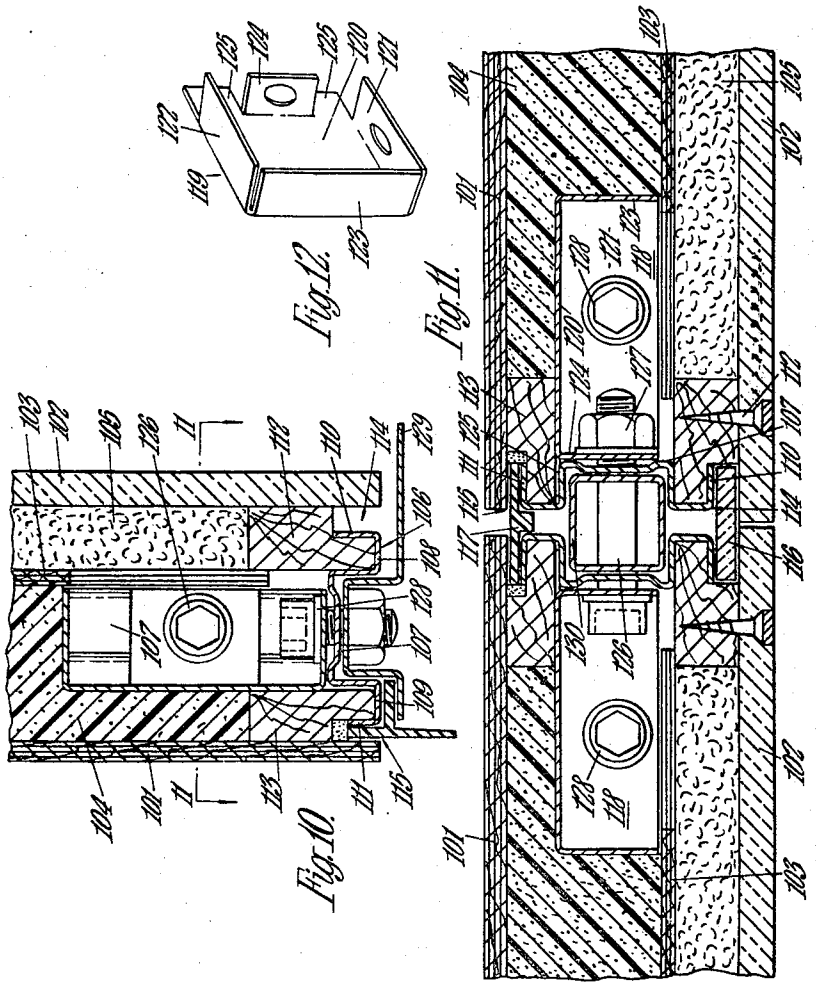

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3,406,491

PANELLING ARRANGEMENTS

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Claims priority, application Great Britain, June 25, 1965, 26,971/65; Sept. 30, 1965, 41,504/65; Dec. 1, 1965, 50,931/65

13 Claims. (Cl. 52—238)

ABSTRACT OF THE DISCLOSURE

A panel for building construction comprises two spaced parallel extended sheet members defining the inner and outer surfaces of the panel. A rigid metal edge frame defines the entire peripheral edge of the panel and is interposed between the sheet members. There is a filling of foamed thermal insulation material bonded to the sheet members and to the edge frame. The metal edge frame is connected to at least one of the sheet members by means of a plurality of timber members interposed therebetween to separate the sheet member from thermal contact with the edge frame.

This invention relates to panelling for use in building construction and has as objects to provide a convenient form of panel for use in the erection of panelling and to provide panelling assemblies making use of such panels.

A panel in accordance with the invention comprises a pair of spaced parallel sheet members, a metal edge frame, a filling of a foamed insulation material bonded to the sheet members and the edge frame and timber members spacing at least one of the sheet members from the edge frame.

The invention also resides in panelling incorporating a plurality of panels as above defined.

Reference is now made to the accompanying drawings in which:

FIGURE 1 is a vertical section through panelling including examples of panels in accordance with the invention,

FIGURE 2 is an exploded perspective view of a panel as shown in FIGURE 1,

FIGURE 3 is a horizontal section through a joint between two panels in the panelling shown in FIGURE 1,

FIGURE 4 is a vertical section through panelling incorporating modified panels,

FIGURE 5 is a horizontal section like FIGURE 3 but showing the modified panels,

FIGURES 6 and 7 are horizontal sections like FIGURE 5 but showing alternative joint constructions,

FIGURE 8 is an exploded perspective view illustrating a construction utilizing the panels shown in FIGURE 4,

FIGURE 9 is a horizontal section through a joint in the construction shown in FIGURE 8,

FIGURE 10 is a fragmentary vertical cross-section through panelling incorporating panels of different construction,

FIGURE 11 is a horizontal section on line **11—11** in FIGURE 10, and,

FIGURE 12 is a perspective view of a part of the panels shown in FIGURES 10 and 11.

Referring firstly to FIGURES 1 and 3 of the drawings, the panelling is made up of rectangular panels **20**. Each panel **20** comprises a pair of spaced parallel sheet members **21** and **22**. The member **21** is formed of sheet metal and is provided around its entire periphery with a web portion **23** projecting towards the sheet member **22** and flanges **24** bent back parallel to the sheet member **21**.

The sheet member **22** is formed of any convenient material such as chip-board, fibre-board, or asbestos.

The panel **20** also includes an edge frame **25** made by mitre-jointing four lengths of a suitable sheet metal section. This section includes a channel portion **26** provided with co-planar flanges **27**, **28** which terminate in inwardly-turned flanges **29**, **30**. As shown the channel portion **26** opens outwardly and thus provides a groove extending around the entire periphery of the panel.

The edge frame is arranged with its flanges **30** lying close to the flanges **24** on the sheet member **21** and with its flanges **29** lying close to the sheet member **22**.

The edge frame **25** is connected to the sheet members **21**, **22** by means of timber members. For joining the frame **25** to the sheet member **21** there are provided two pairs of timber members **31**, **32**. Each of these members is formed with a longitudinal groove **33** so that there is provided on one side of the groove **33** a tongue **43** adapted to fit into the space between a flange **24** and the sheet member **21**. On the other side of the groove **33** the timber member **31** or **32** has a tongue **35** to fit into the channel formed between the channel portion **26** and the flange **30** of the edge frame **25**. The timber members **31** fit along the whole lengths of the upper and lower edges of the panel (in the orientation depicted by the drawings) whilst the members **32** fit along the vertical edges between members **31**. Thus the edge frame **25** can be assembled to the sheet member **21** by engaging the members **31** first and then sliding in the members **32** and securing in position, for example, by means of staples. As shown, a sealing strip **36** is seated in the bottom of the groove **33** and engages the edges of flanges **24** and **30**.

Timber members **37** and **38** are employed for mounting the sheet member **22** on the edge frame **25**. Each of these is rebated to allow the tongue portion thus formed to fit into the channel formed between the channel portion **26** and the flanges **29** on the edge frame **25**. As shown, the outer face of the flange **29** is flush with the outer face of the members **37**, **38**. As before, the members **37** are inserted first and the members **38** are slid into position afterwards. The sheet member **22** is carried on the timber members **37**, **38** and may be secured in place by means of nails or screws which do not touch the edge frame **25**. Such nails or screws are not, however, essential since the foam filling is bonded to the sheet members and holds these firmly in position. A sealing gasket **39** is interposed between the sheet **22** and the timber members **37**, **38**, and project all round the edge of the panel for the purpose mentioned below.

When the panels have been assembled as described above, the entire interior space is filled with insulating material such as foamed polyurethane which becomes bonded to the sheet members **21**, **22** and to the edge frame. This serves both to reduce heat losses through the panel and to make the metal sheet member **21** more rigid. In addition it prevents subsequent movement of the timber members **31**, **32**.

The use of the timber members **31**, **32**, **37** and **38** to connect the sheet members **21**, **22** to the edge frame **25** gives rise to many advantages. Firstly, it allows a relatively simple construction technique to be employed. The whole structure is self-jigging so that no temporary supports are required to hold the various parts in their correct relative positions as the insulation foam is introduced. In addition, there is no direct heat conductive path from the external metal sheet member **21** to the interior of the building of which the panelling forms the external wall.

Furthermore the outer layer is secured to the edge frame without screws or fasteners of any kind. With a metal outer sheet this is important. It will also be noted that the screws or nails securing the inner sheet **22** in position are not chilled by contact with the edge frame and thus do

not make condensation marks on the finished internal surface of the inner sheet member **22**.

Finally, the combination of the rigid metal edge frame and the timber members makes the panelling more resistant to fire damage than would be the case if the inner sheet member **22** where attached directly to the metal edge frame. A panel with an asbestos inner sheet member **22** directly attached to a metal edge frame and of thickness to give a fire rating of half of an hour, would be improved by the provision of the timber members to increase the fire rating to at least one hour. Not only is the transmission of heat to the edge frame reduced considerably, but the timber members also retain their structural strength at temperatures which would cause the metal edge frame to soften and collapse. The timber members can char extensively without significantly weakening. The resistance of the timber to charring can, of course, be further improved by treating it by any of the known processes which have been devised for this purpose.

The use of a metal edge frame is very much more convenient than the use of timber alone, since it is relatively simple to make welded mitre-joints between two sheet metal sections than it is to make a satisfactory joint between two lengths of timber. In addition, the metal edge frame section can, as shown, be made symmetrical about its longitudinal centre line so that mitre-jointing is still further simplified. The construction also allows a groove to be formed around the entire periphery of the panel for locating adjacent panels together along the whole length of the joint as will be explained hereinafter. Additional grooves can also be formed at the juncture of the metal edge member with the timber members to house seals for weather-sealing joints between panels. In the example shown in FIGURES 1 to 4, only one such groove is formed and that is on the external side of the channel **26**.

In a simple vertical joint as illustrated in FIGURE 3, these outer seal grooves receive a T-shaped seal element **40** and an inner weather-seal is provided by the gaskets **39** abutting together. A square tube **41** is inserted into the passageway formed by the opposed channels **26** of the two edge frames and thus, as mentioned above, forms a continuous key along the joint.

As FIGURE 1 shows, the panels are mounted between two rails **42, 43** each of which has a channel portion projecting into the grooves at the top and bottom of each panel. Tie rods **44** extending through the tubes **41** are provided with nuts **45** which clamp the rails **42, 43** and the panels together to make them into a solid wall which can, if desired, be transported whole and erected quickly on site.

In the wall mentioned the outer seal grooves at the tops and bottoms of the panels are aligned and a single T-shaped seal **46** is engaged, on erection, in the bottom groove and a strip **47** is inserted into the top groove. As shown, these coact respectively with floor and roof parts.

Turning now to the panelling illustrated by FIGURES 4 and 5, the individual panels are substantially the same as those used in the panelling illustrated in FIGURES 1 to 3. In this case, however, there is provided an additional sheet member **61** intermediate the external and internal sheet members **21** and **22**. This sheet member **61** can be formed of hardboard, chip-board, asbestos or any other convenient material, and serves to provide a space **62** behind the internal sheet member **61** which is free of polyurethane foam.

In assembling a panel including the additional sheet member **61**, the external sheet member **21** is joined to the edge frame **25** as before, using timber members **31, 32**. Spacing pieces **63** are then placed on the timber members **31, 32** and the additional sheet **61** is placed on these pieces **63**. The depth of the pieces **63** is chosen so that the upper face of the additional sheet member **61** in flush with the upper sides of the channels **26** of the edge frame. Thus, when the timber members **37, 38** are inserted, the sheet member **61** will be locked into position.

The space between the sheet members **22** and **61** may be left empty and will then serve to attenuate sound transmission through the panelling. Improved sound attenuation can be obtained by inserting into this space a blanket **64** of sound insulation material (such as "Rocksil") as show in the lower half of FIGURE 4 and on the right hand side of FIGURE 5. Where sound attenuation is important the external seal **40***a* (corresponding to seal **40** of FIGURES 1 to 3) can be formed of a sound damping material such as lead-loaded polyvinylchloride extrusion.

FIGURES 4 and 5 also show an alternative arrangement for mounting the panels. Instead of using both a tube **41** and a tie rod **44** at each vertical joint, the ends of the tube are provided with end plates **65** each of which has a screw threaded central hole. Bolts **66** are used to secure the rails **42, 43** to these end plates so that the tubes **41** are held in tension and act as tie rods.

An H-shaped seal may be used instead of the seal **40***a* and provides two weather-seal lines.

FIGURE 6 shows one arrangement for incorporating a shadow line feature in panelling as shown in FIGURES 5 and 6. The feature consists of a thin sheet metal section **67** of basically channel shaped form with inturned flanges **68** at its mouth. The flanges **68** terminate in spaced parallel webs **69** extending into the gap between adjacent panels **20**. The webs **69** have outwardly directed flanges **70** which enter the seal grooves in the adjacent edges of the panels. A weather-seal is obtained by means of a pair of gasket strips **71** interposed between the external faces of sheet members **21** and the flanges **68**.

FIGURE 7 illustrates another type of shadow line feature utilizing a timber section **72**. In this case the tube **41** is replaced by a pair of unsymmetrical top-hat sections **73** identical to those used to form the rails **42, 43**. These sections are arranged with their channel portions projecting outwardly and with their flanges lying face-to-face. The longer flanges **74** project beyond the external faces of the panels and into a narrow groove in the section **72**. Gasket strips **75** are interposed between the section **72** and the external faces of the panels to form a weather-seal.

In the panelling construction illustrated by FIGURES 8 and 9 the idea of using the locating tubes as tie rods is extended for multi-tier constructions. A wall is to be constructed using stanchions **76** which are merely long, narrow panels substantially similar to those shown in FIGURES 5 and 6. The panels **77** in the lower tier and the panels **78** in the upper tier are again of the same construction. In the middle tier, however, there may be a window **79**, as shown, or another panel like panel **77**. The window frame, which may be wooden, is formed with a peripheral groove like those formed in the panel edges.

The stanchion **76** is provided in its interior with a pair of sheet metal trays **80** which abut against the timber members and which contain no polyurethane foam. Each of these trays may have its side walls formed from a short length of square section tube of appropriate size and have a separate base welded to one end of the tube length. Alternatively, the tray **80** may be formed as a pressing. In either case the width of the tray would be such that a pair of opposite side walls lie against the channel portions **26** of the edge frame **25**. Aligned bores are formed in these side walls and the bases of the channel portions **26** to allow socket headed bolts **81** to be inserted from inside the tray **80**.

To allow access to the interior of the tray **80** during erection of the panelling, the internal sheet member **22** is not initially secured in position. In addition a hole is made in the intermediate sheet member **61** to open into the interior of each tray **80** and each such hole may have a cover **82**. One tray **80** is disposed at the horizontal level of the joint between panel **77** and window **79** and the other at the level of the joint between panel **78** and window **79**.

There are also provided at the top end of the stanchion

76 a nut 83 welded or otherwise secured to the channel 26 of the short end portions of the edge frame 25. The bottom end has another tray having a hole opening into the channel 26. Thus, the stanchion 76 can be secured to a foot rail 84 by means of a bolt passed from the tray through a hole in the rail and engaged with a nut secured to the rail. The panel 77 is then positioned besides the stanchion 76 and a length of square tube 86 is inserted into the opposed grooves in the edges of the stanchion 76 and the panel 77. A length of square tube 87 is laid along the groove in the top of panel 77. This tube 87 has end plates 88 formed with tapped holes and the appropriate bolt 81 is loosely engaged with one of these end plates to retain the tube 87.

The window 79 is now placed over the panel 77 located by a tube 86*a* and a second tube 89 is laid in the groove in its upper edge. Tube 89 is identical to tube 87 and is again loosely engaged by the appropriate one of the bolts 81 in the upper tray. The panel 78 is placed on the top of window 79 located by a tube 86*b* and a second stanchion 76 (not shown) is then positioned next to the panels 77, 78 and the window 79 and is loosely bolted to the foot rail 84. The bolts 81 of this second stanchion 76 are engaged with the tubes 87, 89 and a locking plate 90 projecting in both directions from the top of the stanchion 76 is secured in position by means of a bolt 91. The various bolts can then be tightened placing the tubes 87 and 89 in tension and tensioning the stanchion 76 longitudinally. The forces applied by the bolts 81 do not distort the stanchion 76 since the trays 80 take substantially all the stress imposed by these bolts and thus may be considered as acting as bracing elements for the stanchions.

The construction may alternatively employ a single tube 86 extending along the full height of the stanchion and drilled to take the bolts 81.

The panelling just described is suitable for erection on site rather than the method employed with other panelling described herein of assembling the panels into wall units for transport complete to the building site.

Turning now to FIGURES 10 to 12, the panels shown are of considerably modified construction and the arrangements for joining panels together and making up walls are also modified.

The external sheet member 101 of each panel is formed of suitably treated weather-resistance boarding instead of sheet metal as in the previously described examples. The internal sheet member 102 is formed of relatively thick asbestos board. The intermediate sheet member 103 is formed of thin hardboard. The space between the external sheet member 101 and the intermediate sheet member 103 is filled with polyurethane foam 104. The space between the internal sheet member 102 and the intermediate sheet member 103 contains a blanket 105 of sound deadening material, such as "Rocksil."

The edge frame 106 is sunbstantially the same design as those employed in the above described examples of the invention, consisting of a channel portion 107, a pair of co-planar webs 108, 109 on the sides of the channel portion, and a pair of turned-back flanges 110, 111 on the webs 108, 109 respectively. The timber members are again used for attaching the external and internal sheet members 101, 102 to the edge frame 106. In each case however, the timber members 112, 113 are merely rebated to receive the appropriate flange 110, 111 of the edge frame, and inner seal groove 114 being left between the flange 110 and the internal sheet member 102 and an outer seal groove 115 being left between the flange 111 and the external sheet member 101.

The inner seal groove is employed to contain a strip 116 of asbestos board at joints between panels. This serves to increase the fire rating of the panelling considerably since the strip 116 effectively prevents hot gasses entering the gaps between panels and prematurely heating up the edge frames. The outer seal grooves 115 receive inter-panel sealing strips 117 and top and bottom seals as before.

For the purpose of joining panels together and to top and bottom rails, foam free spaces 118 are left at the corners of each panel. To form these spaces 118, metal trays 119 are included in the construction of the panels. As shown in FIGURE 12, each tray 119 comprises a base 120 with sides 121, 122 and 123 bent up from three of its edges. At the remaining edge a lug 124 is bent up leaving tongues 125 projecting in the plane of the base 120 beyond the lug 124. The lug 124 and an adjacent side 121 are formed with holes aligned with holes in the web of the channel portion 107.

As shown in FIGURE 11, the tongues 125 of each tray 120 are inserted between the timber members 113 and the sides of the channel portion 107. The trays are thus firmly held in position during assembly of a panel and also act as spacers for the intermediate layer 103. When it is required to join two panels together as shown in FIGURE 12, a bolt 126 is inserted through the aligned holes in the channels 107 and the lugs 124 and a nut 127 is engaged with the bolt. Thus, the head of the bolt 126 is within one tray 120 and the nut 127 is within the other. As before, a loose square section tube 130 is engaged in the two opposed channels 107 to provide a continuous key along the adjacent edges of the panels. Bolts 128 are likewise employed for securing the panels to the bottom rail 129 and to the top rail (not shown).

In a wall made up as shown in FIGURES 10 to 11, the panels are thus rigidly secured together at their corners and are located together along adjacent edges by the tubes 130. Thus, a very strong and rigid wall structure is provided. It will be appreciated, of course, that the internal sheet members 102 cannot be fastened to the timber members 112 until after the bolts 127, 128 have been inserted and tightened. The panels are therefore most conveniently assembled into walls in the factory and delivered complete to the building site.

In all of the panelling arrangement in which an intermediate sheet member 61 or 103 is employed, there is a space which is free from the polyurethane foam. As described, this space can be left empty or filled with a fibrous or other sound insulation material. The space can also be employed for various services such as electric cables and gas or water pipes. In addition, part of the internal sheet member could, if desired, be cut away to enable an electric fire or a central heating radiator to be mounted in the recess left.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A panel for building construction comprising first and second spaced parallel extended sheet members, a metal edge frame interposed between said sheet members and defining the entire peripheral edge of the panel, a filling of foamed thermal insulation material bonded to said sheet members and to said metal edge frame, and a plurality of timber members interposed between at least one of said sheet members and the edge frame, so as to separate said one sheet member from thermal contact with said edge frame.

2. A panel as claimed in claim 1 in which there are a plurailty of timber members interposed between each of said sheet members and said edge frame.

3. A panel or use in building construction comprising a metal edge frame made up of a plurality of lengths of a metal section joined together at their ends to form a rigid polygon, said frame providing first and second channel portions extending around said polygon and having mouths opening into the interior of said polygon; a first plurality of elongated timber members having tongue portions fitting into said first channel portions of the frame; a second plurality of timber members having tongue portions fitting into said second channel portion of the frame, a first sheet member overlying said first plurality of timber members; a second sheet member over-

lying said second plurality of timber members; the edge frame, the timber members and the sheet members forming between them a closed space; and foam insulation material filling said space and bonded to the sheet members, the timber members, and the edge frame.

4. A panel as claimed in claim 3 in which each of the timber members of said second plurality of timber members is formed with a second tongue portion disposed beside the tongue portion fitting into the channel portion of the edge frame, and said second sheet member is provided around its periphery with a reversed flange behind which said second tongue portions fit.

5. A panel as claimed in claim 3 in which the metal section from which the edge frame is constructed also forms a channel having an open mouth directed outwardly to provide around the entire periphery of the panel a groove.

6. A panel for use in building construction comprising a metal edge frame formed from a plurality of lengths of a metal section joined together at their ends to form a rigid polygon, the section providing first and second spaced channel portions extending around the entire periphery of the polygon and having open mouths directed into the interior of the polygon; a plurality of first elongated timber members having tongue portions fitted into said first channel portion of the edge frame; a plurality of second timber members each having a tongue portion fitted into the second channel portion of the edge frame; a first sheet member overlying said first timber members and attached thereto; a second sheet member overlying the second timber members; spacing members supported on the second timber members and extending towards the first sheet member; an intermediate sheet member lodged between said spacing members and the first timber members; said intermediate sheet member, said second sheet member, said timber members and said edge frame defining a closed space; and a filling of a foamed insulation material occupying said closed space and bonded to said intermediate sheet member, said second sheet member said edge frame and said timber members.

7. A panel as claimed in claim 6 including a mat of sound insulation material disposed between said intermediate sheet member and said first sheet member.

8. A panel as claimed in claim 6 in which the channel portions of the edge frame have outer sides which are spaced from the first and second sheet members to form inner and outer seal grooves respectively, said seal grooves extending around the entire periphery of the panel,

9. A panel as claimed in claim 8 in which the channel portions of the edge frame have sides opposite the sides defining the seal grooves and forming the sides of a locating groove having an open mouth directed outwardly and extending around the entire periphery of the panel.

10. Panelling comprising a plurality of panels as claimed in claim 9 arranged in a side-by-side relationship, secured to top and bottom rails and located relative to one another by means of lengths of square section tubular material, each length of which is engaged in the locating groove of a pair of adjacent panels.

11. Panelling as claimed in claim 10 in which the panels are secured to the top and bottom rails by means of tie bolts extending through the locating tubes and engaged at their ends with the top and bottom rails.

12. Panelling as claimed in claim 10 in which the locating tubes are provided at their ends with end plates each of which is formed with a tapped bore, the panels being secured to the top and bottom rails by means of bolts inserted through holes in the top and bottom rails and engaged with the end plates of the locating tubes.

13. Panelling as claimed in claim 10 in which the first sheet member of each panel consists of an asbestos sheet and a strip of asbestos board is inserted in the inner seal grooves of adjacent panels to protect the metal edge frames thereof against hot gases entering the space between adjacent panels in the event of a fire.

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