

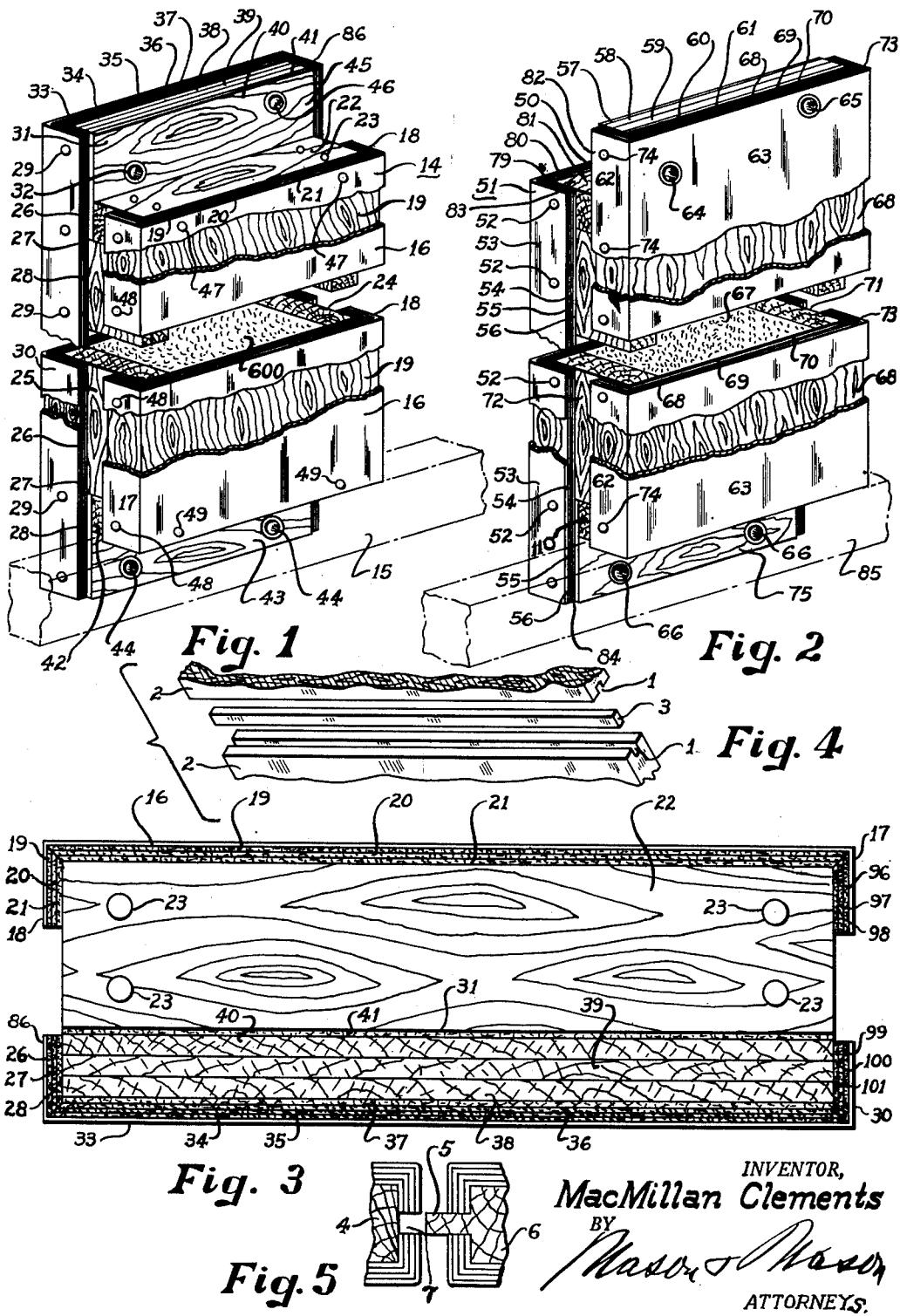
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MacM. CLEMENTS

2,629,140

## STRUCTURAL PANEL

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## UNITED STATES PATENT OFFICE

2,629,140

## STRUCTURAL PANEL

MacMillan Clements, Bethel, Conn.

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10 Claims. (Cl. 20—15)

## 1

This invention relates to structural panels and more particularly to improved hollow panel units which fit together to form both an inner and an outer wall of a building.

There is a distinct need in the building industry for a low cost, light weight, strong, dimensionally stable, thermal insulating, long lasting, rodent proof panel which can be used to form both an inner and an outer wall of a building, a refrigerator, or used wherever heat insulating qualities are desired in a panel of this type. In accordance with this invention there is provided a novel panel which meets these requirements. This panel is characterized by the combination of an inner frame and two flanged facing or closure members whose flanges, in cooperation with the frame form a retaining-key-receiving channel or groove for making a tight seal between the edges of adjacent panels. Other features of the panel include the metal surface skin on one or both sides thereof, and the provision of offset or overlapping portions of the panel sides which allow for attaching the panel to frame members without disturbing the vapor seal.

An object of the invention is to provide a new and improved structural panel constructed and adapted to form with other panels of like construction, a heat insulated wall, floor or ceiling.

Another object of the invention is to provide a novel strengthening and vapor sealing construction for a structural panel.

An additional object is to provide a panel having opposite faces provided with a skin having heat reflecting and heat dissipating qualities on one or both sides thereof to thereby increase the heat insulating qualities of the panel.

A further object is to provide extension panel means forming part of a side of the panel for attaching the panel to a structural support.

Another object is to provide a panel having metal skins on opposite sides thereof, in which there will be no metal to metal contact between the skins on opposite sides of the panel, and providing a space for a key to attach adjacent panels to each other.

Other objects will appear hereinafter throughout the specification.

The invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing,

Figure 1 is a perspective view of one form of a panel of this invention with parts broken away to show the interior construction,

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Figure 2 is a view similar to Figure 1 showing another form of the invention.

Figure 3 is a top or bottom plan view of the construction shown in either Figure 1 or Figure 2.

5 Figure 4 is an exploded diagrammatical view of the side edges of two panels with a locking key for joining the same, and

Figure 5 is a horizontal section through the side edges of two panels showing a modification 10 of the structure shown in Figure 4.

Referring now to the drawing and more particularly to Figure 1, the numeral 14 indicates generally the panel as a whole. Any number of these panels may be arranged side by side with 15 key means for connecting them to form the wall, ceiling and floor construction of a house, refrigerator or other structure such as refrigerating cars of railroad rolling stock, refrigerating trucks, etc. The panel is provided with a metallic skin 16 which may consist of a sheet of any suitable high tensile strength material such as, for example, 32 to 28 gauge sheet metal which may be stainless steel, aluminum, copper, magnesium, Monel metal or any other suitable material, but is preferably a metallic sheet. This skin has side flanges 17 and 18.

20 The skin forms part of the facing member that includes a relatively thick backing sheet of low tensile strength material such as plywood consisting of the three ply sheet shown having layers 19, 20 and 21 which are connected adhesively bonded to each other and to the skin 16. This laminated sheet, comprising the several layers and skin, is attached to a rectangular or other shaped frame work that may consist of an upper frame piece 22, a lower similar frame piece 42 and two side frame pieces 24 and 25. The upper frame pieces are attached to the lower frame pieces but any suitable means such as nails 23, 25 and the facing member as a whole is attached to the upper and lower frame pieces by attaching means such as nails 48.

45 The opposite face of the panel is constructed in a similar manner, but is provided with extension frame members 31 and 43 which extend beyond the upper and lower extremities of the sheet 16 and the first described or main frame. This panel face consists of a sheet of material forming a skin 33 and the backing sheet is composed preferably of three layers of plywood 34, 35 and 36 bonded by a suitable adhesive to each other and to the skin 33 the layers of material forming a laminated sheet. This skin has right angle 50 flanges 30 and 86 and the plywood layers all of 55

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which are bonded to each other and are provided with right angle flanges 26, 27, and 28.

Each extension frame member further includes the thick laminations 38, 39 and 40 bonded to each other and to the backing sheet. Preferably, laminations 38, 39 and 40 terminate at the top surface of frame member 22 and bottom surface of frame member 42, but they may be continuous sheets that are of the same length as the metal skin 33 and its backing sheet in order to add strength to the panel. Securing means, such as nails 29 are used to secure the parts together, as shown. Flanges 17 and 18 and the backing sheet are secured to the frame work by securing means such as nails 48.

Extending entirely through the upper and lower extension frame members 31 and 43 are metal lined apertures 32, 44 and 46 for the reception of lag screws or other securing means for attachment to suitable supports, such as runner 15. It will be understood that the top of frame 22 and extension frame 31 will be flush with a similar runner, not shown, when the panels are put in place.

The opposite faces together with the side faces over which the flanges extend, of the several frame members, form the support for the laminated sheets. The insulated interior of the panel as defined by the frame members 22, 24, 25 and 42 provides with the laminated sheets a space which may be an air space. Preferably, however, this space is filled with a suitable insulating material 600.

By referring to Figure 1, it will be noted that the metal sheets or members and the backing layers forming the flanges on both of the side edges of the panel terminate short of each other so as to leave a space, in order that there will be no metal to metal contact or even a backing sheet contact between the sheets forming the opposite faces and side edges of the panel.

When a plurality of panels are placed side by side to form a wall, a non-heat conducting key or spline is used to fill the space between these pairs of flanges of abutting panels so as to lock the side of each panel to an adjoining panel, or a tongue may be formed integral with the parts so as to extend into the groove of the adjacent panel.

Two forms of locking means are indicated in Figures 4 and 5. In Figure 4, as diagrammatically shown, the side edges of a pair of panels is indicated by the reference numerals 2, 2. These panels may correspond structurally to the panels shown in Figures 1, 2 and 3. The grooves indicated formed in the side edges of such panels are shown at 1 and there is a locking key or spline 3 preferably of wood or other heat non-conducting material which serves to lock the side edges of each adjacent pair of panels.

It will be understood that Figure 4 merely indicates the connection between side edges of the panels, the detailed construction of the panels being shown in Figures 1 to 3. As shown in Figure 5, panels 4 and 6 are constructed in accordance with the panels above described. The side edges of the panels indicated by numerals 4 and 6 as provided with a tongue portion 5 which is adapted to enter the corresponding groove 7 in the adjacent panel. It will, of course, be understood that each panel will be provided with a groove on one side edge and a tongue on the opposite side edge so that a plurality of panels may be connected to each other to form a wall, ceiling or floor of a building, walk-in refrigerator

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or other type of refrigerator, or similar structures.

The key 3 of Figure 4 and tongue 5 of Figure 5 preferably extend the over all length of the panel 5 to thereby provide an air seal, and further, to provide an insulating layer between the inner and outer metal skins of the panels.

When either the key or the integral tongue is used it should be of the same length as the greatest longitudinal dimension of the panel including the extension frame members, and therefore extend beyond the groove at the upper and lower ends thereof, so as to form a sealing and locking connection between the adjacent sides of each pair of panels for the entire vertical distance of the panel as viewed in Figures 1 and 2.

Referring to Figure 2, it will be noted that the construction shown is the same as that shown in Figure 1 except the extension frame members, including the extensions of the skin and backing member, are on opposite faces of the sheet. In this construction, the panel is indicated generally by the numeral 51, the metal flange being indicated by 53 with the plywood sheets shown at 54, 55 and 56 of one of the facing sheets. These are attached to the opposite sides of a pair of main frame members 71, 72, and to the ends of the other pair of frame members 81 and 110 by suitable means such as the nails 52, as shown in Figure 2.

The opposite facing sheet is indicated by numeral 63 having flanges 62 and 73, the plies of the backing sheet being indicated by the numerals 68, 69 and 70. In the construction shown in Figure 2, the vertical frame members shown are at 57 and 75 and they are preferably duplicates of each other. These offset extension frame members are on opposite side edges of the panel. The lower extension frame member may be fastened to runner 85 indicated in dotted lines and the upper extension frame member may be attached to a similar upper runner, not shown, by lag screws that extend through apertures 64, 65 and 66 in said extension frame members.

The skin 50 has flanges 53 on opposite sides and the backing member that includes bonded sheets 79, 80 and 81 having flanges 54, 55 and 56 on both side edges. All of these flanges 53 to 56 are preferably attached to the main frame pieces 71 and 72, and extension 75 by nails 52.

The skin 63 has flanges 62 on opposite sides of the backing member that includes sheets 68, 69, and 70, all bonded to each other and to the skin.

The flanges 62 and 73 of the skin and flanges 55 of the backing member are held in place on the vertical frame members 71 and 72 and on the extension frame member 57 preferably by nails 74.

The extension frame member 57 preferably includes several pieces or thick plies 58, 59 and 60 bonded to each other and the backing member 60 including the flanges thereof.

Extension frame members 31 and 43 of Figure 1 are members which preferably terminate at the upper and lower frame pieces 22 and 42 respectively. It will be understood, however, that said extension members may be a single board extending the entire length of the skin 33 and backing layer.

It will be noted that the frame members of each of the figures are preferably constructed of wood, as shown.

Referring to Figure 3, the top frame member 22, skin 16, 17, 19, 20, 21, 22 and attaching means 23 are the same as these parts indicated in Figure 1. The flanges consist of the metal skin flanges

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17 and 18 as shown in Figure 1 and the plies 19, 20 and 21, and 26, 27 and 28 beneath metal flanges 17, 18 and 30, 86 respectively.

The extension frame member as in Figure 1 is composed of thick sheets or plies of wood or other material bonded to each other and to skin 33. The inner surface of the extension frame member may have a face piece 41 as shown in Figures 1 and 3.

It will be understood that the construction shown in Figure 3, although the parts correspond to Figure 1, correspond to the same parts as would be shown by Figure 2.

It will be further appreciated that the various layers of the backing, as well as the extension frame, may be made of various fibrous or other materials having the desired insulating qualities.

Referring again to the structure shown in Figures 1 to 3, for instance, there may be substituted for the three-ply sheet 19, 20 and 21, or 38, 39 and 40, or 54, 55 and 56 or 58, 59 and 60 or 68, 69 and 70, a single hard board sheet in substitution of the three sheets of composite material suitable for the purpose. In fact sheets of any material may be substituted for the composite sheets which provide the requisite strengthening and heat insulating qualities.

Extension members 53 and 75 may extend for the entire longitudinal distance or height of the skins and backing members, but preferably extension member 53 does not extend beyond the lower horizontal edge of the upper frame member 81 and extension frame member 75 preferably extends no further upwardly than the upper horizontal edge of the lower frame member 110.

A typical dimension for the panel is 2 feet wide by 8 feet high for house walls and walk-in freezers, but either or both of these dimensions will vary according to specific requirements. The vapor space may be about 4½ inches across, but where high insulation requirements prevail, the width may be 12 inches or more.

In order to provide additional insulation, another layer of plywood may be bonded to the 3-ply plywood. Interposed between the plywood plies is an additional seal comprising the layers 38 and 40 to which is attached the inner layer 41 by binding material such as waterproof glue or any other adhesive material suitable for the purpose.

What I claim as new and desire to secure by Letters Patent is:

1. A panel for use in building construction and refrigerators comprising in combination, a frame having a first pair and a second pair of opposite faces, two laminated sheets of material, said laminated sheets extending across said first pair of opposite faces of said frame so as to form with said frame an enclosed space, each of said laminated sheets of material being of a larger area than the area defined by said frame over which they extend with the ends of said laminated sheets extending beyond the opposite side edges of said frame, forming right angle flanges on the second pair of opposite faces of said frame attaching means attaching each set of sheets to said second pair of opposite faces of said frame but each said pair of flanges terminating short of each other forming with said last mentioned faces, retaining key-receiving channels with the side flanges spaced from each other, said channels extending along both of said second pair of said opposite faces, each laminated sheet and its flanges comprising an outer metallic sheet and an inner non-metallic sheet of material said metallic

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sheet and non-metallic sheet of material being bonded to each other to form each sheet of laminated material.

2. A panel for use in building construction and refrigerators comprising in combination, a frame having a first pair and a second pair of opposite faces, two laminated sheets of material, said laminated sheets extending across said first pair of opposite faces of said frame so as to form with said frame an enclosed space, each of said laminated sheets of material being of a larger area than the area defined by said frame over which they extend with the ends of said laminated sheets extending beyond the opposite side edges of said frame, forming right angle flanges on the second pair of opposite faces of said frame attaching means attaching each set of sheets to said second pair of opposite faces of said frame but each said pair of flanges terminating short of each other forming with said last mentioned faces, retaining key-receiving channels with the side flanges spaced from each other, said channels extending along both of said second pair of said opposite faces, each laminated sheet and its flanges comprising an outer metallic sheet and an inner non-metallic sheet of material, at least one of said non-metallic sheets of material comprising a plywood layer said metallic sheet and non-metallic sheet of material being bonded to each other to form each sheet of laminated material.

3. A panel for use in building construction and refrigerators comprising in combination, a frame having a first pair and a second pair of opposite faces, two laminated sheets of material, said laminated sheets extending across said first pair of opposite faces of said frame so as to form with said frame an enclosed space, each of said laminated sheets of material being of a larger area than the area defined by said frame over which they extend with the ends of said laminated sheets extending beyond the opposite side edges of said frame, forming right angle flanges on the second pair of opposite faces of said frame attaching means attaching each set of sheets to said second pair of opposite faces of said frame but each said pair of flanges terminating short of each other forming with said last mentioned faces, retaining key-receiving channels with the side flanges spaced from each other, said channels extending along both of said second pair of said opposite faces, each laminated sheet and its flanges comprising an outer metallic sheet and an inner non-metallic sheet of material, each of said non-metallic sheets of material comprising a plywood layer said metallic sheet and non-metallic sheet of material being bonded to each other to form each sheet of laminated material.

4. A panel for use in building construction and refrigerators comprising in combination, a frame having a first pair and a second pair of opposite faces, two laminated sheets of material, said laminated sheets extending across said first pair of opposite faces of said frame so as to form with said frame an enclosed space, each of said laminated sheets of material being of a larger area than the area defined by said frame over which they extend with the ends of said laminated sheets extending beyond the opposite side edges of said frame, forming right angle flanges on the second pair of opposite faces of said frame attaching means attaching each set of sheets to said second pair of opposite faces of said frame but each said pair of flanges terminating short of each other forming with said last mentioned

faces, retaining key-receiving channels with the side flanges spaced from each other, said channels extending along both of said second pair of said opposite faces, each laminated sheet and its flanges comprising an outer metallic sheet and an inner non-metallic sheet of material, said metallic sheet and non-metallic sheet of material being bonded to each other to form each sheet of laminated material, said fastening means for attaching said laminated sheets to said second pair of opposite faces of said frame members extending through the flanges of both the outer metallic sheet and the inner non-metallic sheet of each laminated sheet.

5. A panel for use in building construction and refrigerators comprising in combination, a frame having a first pair and a second pair of opposite faces, two laminated sheets of material, said laminated sheets extending across said first pair of opposite faces of said frame so as to form with said frame an enclosed space, each of said laminated sheets of material being of a larger area than the area defined by said frame over which they extend with the ends of said laminated sheets extending beyond the opposite side edges of said frame, forming right angle flanges on the second pair of opposite faces of said frame attaching means attaching each set of sheets to said second pair of opposite faces of said frame but each said pair of flanges terminating short of each other forming with said last mentioned faces, retaining key-receiving channels with the side flanges spaced from each other, said channels extending along both of said second pair of said opposite faces, each laminated sheet and its flanges comprising an outer metallic sheet and an inner non-metallic sheet of material, at least one of said non-metallic sheets of material comprising a plywood layer, said fastening means for attaching said sets of sheets to said second pair of opposite faces of said frame members extending through the bent-over ends of both the outer metallic sheet and the inner non-metallic sheet of each set of sheets.

6. A panel for use in building construction and refrigerators comprising in combination, a frame having a first pair and a second pair of opposite faces, two laminated sheets of material, said laminated sheets extending across said first pair of opposite faces of said frame so as to form with said frame an enclosed space, each of said laminated sheets of material being of a larger area than the area defined by said frame over which they extend with the ends of said laminated sheets extending beyond the opposite side edges of said frame, forming right angle flanges on the second pair of opposite faces of said frame attaching means attaching each set of sheets to said second pair of opposite faces of said frame but each said pair of flanges terminating short of each other forming with said last mentioned faces, retaining key-receiving channels with the side flanges spaced from each other, said channels extending along both of said second pair of said opposite faces, each laminated sheet and its flanges comprising an outer metallic sheet and an inner non-metallic sheet of material, said metallic sheet and non-metallic sheet of material being bonded to each other to form each sheet of laminated material, said frame having an extension means whereby to provide a stepped structure, said extension means providing an extension for attaching said panel to a structural support.

7. A panel for use in building construction and refrigerators comprising in combination, a frame

having a first pair and a second pair of opposite faces, two laminated sheets of material, said laminated sheets extending across said first pair of opposite faces of said frame so as to form with said frame an enclosed space, each of said laminated sheets of material being of a larger area than the area defined by said frame over which they extend with the ends of said laminated sheets extending beyond the opposite side edges of said frame, forming right angle flanges on the second pair of opposite faces of said frame attaching means attaching each set of sheets to said second pair of opposite faces of said frame but each said pair of flanges terminating short of each other forming with said last mentioned faces, retaining key-receiving channels with the side flanges spaced from each other, said channels extending along both of said second pair of said opposite faces, each laminated sheet and its flanges comprising an outer metallic sheet and an inner non-metallic sheet of material, each of said non-metallic sheets of material comprising a plywood layer, said metallic sheet and non-metallic sheet of material being bonded to each other to form each sheet of laminated material, said frame having an extension means whereby to provide a stepped structure, said extension means providing a plurality of extensions for attaching said panel to structural supports, said extension means further including a metallic sheet and a non-metallic sheet forming part of each laminated sheet.

8. A panel for use in building construction and refrigerators comprising in combination, a frame having a first pair and a second pair of opposite faces, two laminated sheets of material, said laminated sheets extending across said first pair of opposite faces of said frame so as to form with said frame an enclosed space, each of said laminated sheets of material being of a larger area than the area defined by said frame over which they extend with the ends of said laminated sheets extending beyond the opposite side edges of said frame, forming right angle flanges on the second pair of opposite faces of said frame attaching means attaching each set of sheets to said second pair of opposite faces of said frame but each said pair of flanges terminating short of each other forming with said last mentioned faces, retaining key-receiving channels with the side flanges spaced from each other, said channels extending along both of said second pair of said opposite faces, each laminated sheet and its flanges comprising an outer metallic sheet and an inner non-metallic sheet of material, said fastening means for attaching said sets of sheets to said second pair of opposite faces of said frame members extending through the flanges of both the outer metallic sheet and the inner non-metallic sheet of each laminated sheet, said metallic sheet and non-metallic sheet of material being bonded to each other to form each sheet of laminated material, said frame having an extension means whereby to provide a stepped structure, said extension means providing a plurality of extensions for attaching said panel to structural supports, said extension means further including a metallic sheet and a non-metallic sheet forming part of each laminated sheet.

9. A panel for use in building construction and refrigerators comprising in combination, a frame having a first pair and a second pair of opposite faces, two laminated sheets of material, said laminated sheets extending across said first pair of opposite faces of said frame so as to form with

said frame an enclosed space, each of said laminated sheets of material being of a larger area than the area defined by said frame over which they extend with the ends of said laminated sheets extending beyond the opposite side edges of said frame, forming right angle flanges on the second pair of opposite faces of said frame attaching means attaching each set of sheets to said second pair of opposite faces of said frame but each said pair of flanges terminating short of each other forming with said last mentioned faces, retaining key-receiving channels with the side flanges spaced from each other, said channels extending along both of said second pair of said opposite faces, each laminated sheet and its flanges comprising an outer metallic sheet and an inner non-metallic sheet of material, each of said non-metallic sheets of material comprising a plywood layer, said fastening means for attaching said laminated sheet to said second pair of opposite faces of said frame members extending through the flanges of both the outer metallic sheet and the inner non-metallic sheet of each set of sheets, said metallic sheet and non-metallic sheet of material being bonded to each other to form each sheet of laminated material, said frame having an extension means whereby to provide a stepped structure, said extension means providing a plurality of extensions for attaching said panel to structural supports, said extension means further including a metallic sheet and a non-metallic sheet forming part of each laminated sheet, said extension means extending below and above said frame and on the same side thereof.

10. A panel for use in building construction, and for refrigerator walls and floors comprising in combination, a rectangular frame having a first pair and a second pair of opposite faces, two laminated sheets of material, said sheets extending across said first pair of opposite faces of said frame so as to form with said frame an enclosed space, insulating material in said enclosed space, each of said laminated sheets of material being of larger area than the area defined by said frame

over which they extend whereby the ends of said laminated sheets extend beyond the opposite side edges of said frame, said ends extending beyond the frame side edges extending at right angles to the first pair of opposite frame faces and parallel to said second pair of opposite frame faces and forming right angle flanges, said laminated sheet ends terminating short of each other on said second pair of opposite frame faces so as to form 5 with said last-named frame faces retaining key-receiving channels between each pair of opposed sheet ends of each sheet, said channel extending along both said opposite frame faces, each laminated sheet and its flanges comprising an outer metallic skin having heat reflecting and dissipating qualities and an inner supporting sheet of non-metallic material, and means for attaching said sheet ends to said second pair of opposite frame faces, said metallic sheet and non-metallic sheet of material being bonded to each other to form each sheet of laminated material, said frame having a plurality of extension means whereby 10 to provide a stepped structure, one extending upwardly on one side of said frame and the other 20 extending downwardly on the opposite side of said frame.

MACMILLAN CLEMENTS.

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