Dec. 16, 1958 MacMILLAN CLEMENTS 2,864,324

LOGISTIC PANEL CONSTRUCTION FOR ROOFS, WALLS, ETC., OF BUILDINGS

Filed Jan. 19, 1955 2 Sheets-Sheet 1

Fig. 1.

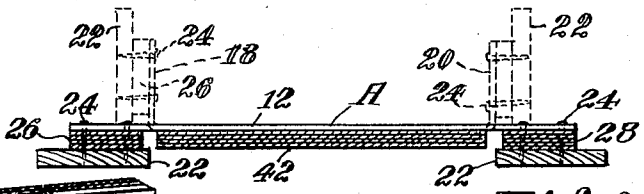


Fig. 9.

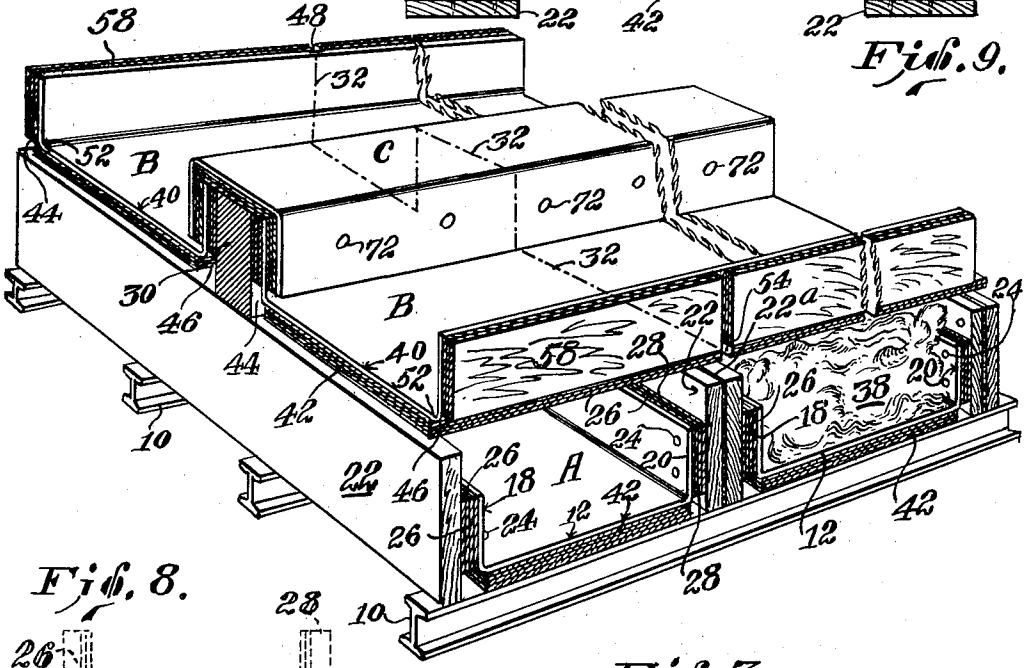


Fig. 8.

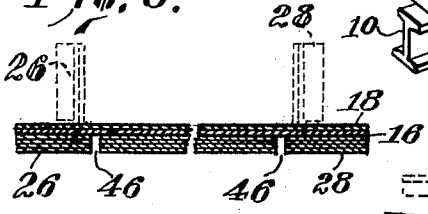


Fig. 3.

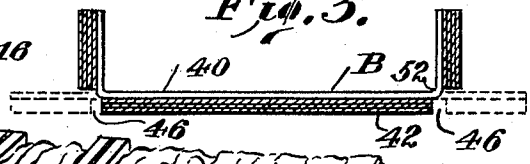
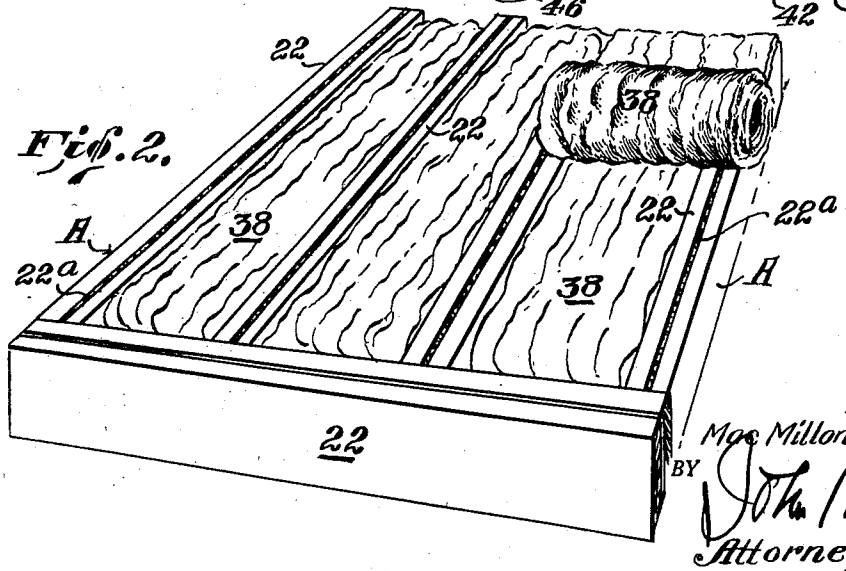


Fig. 2.



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Fig. 4.

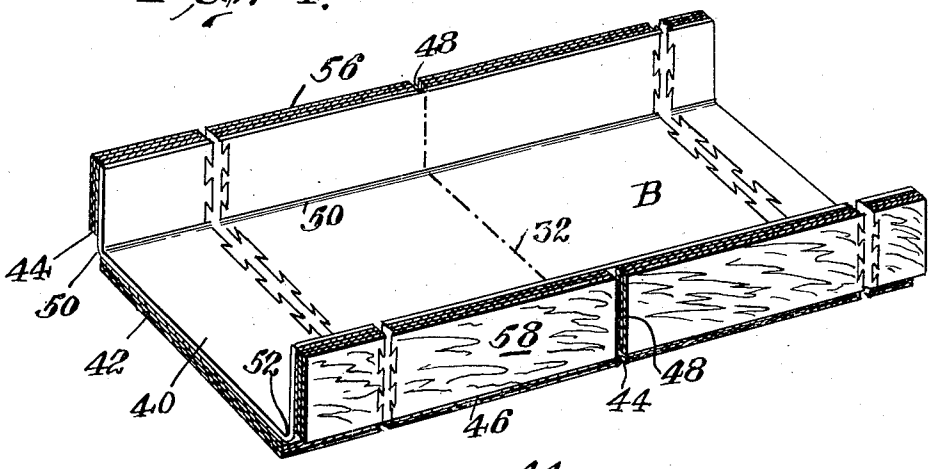


Fig. 5.

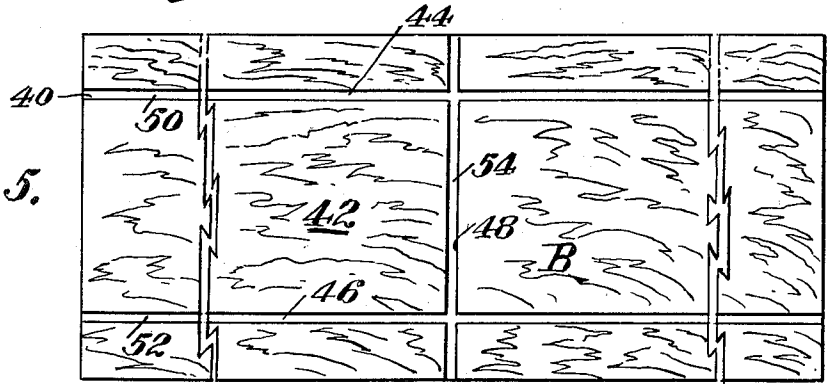


Fig. 6.

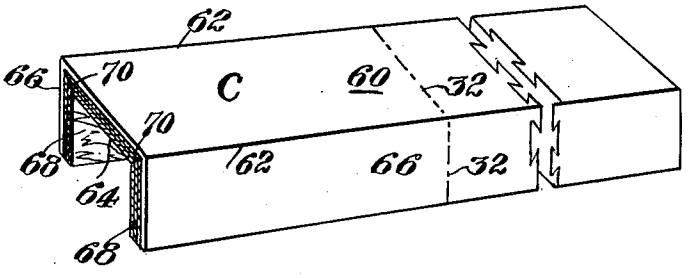
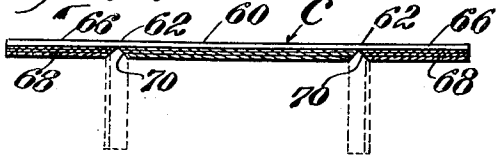


Fig. 7.



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LOGISTIC PANEL CONSTRUCTION FOR ROOFS, WALLS, ETC., OF BUILDINGS

MacMillan Clements, Ridgefield, Conn.

Application January 19, 1955, Serial No. 482,699

2 Claims. (Cl. 108—13)

This invention is addressed to a logistic panel construction, i. e., the invention particularly relates to a panel and parts adjunctive thereto which may be manufactured in quantity at a factory and shipped in knocked-down condition to the erection site, where they may be easily and quickly converted to be parts of a roof and/or the walls of a building.

A principal object of the invention is to provide a light-weight panel construction, the panel elements of which may be shipped in flat stacked relationship to the place of erection of the building, and which may be then shaped by hand to their final form, whereby to form component parts of a building such as a roof or the walls thereof.

Another object is to provide a panel construction wherein the component parts are provided with a metallic skin or outer layer that is ductile and which may be easily bent to final shape, to thereby enable certain areas of the skin and the non-metallic elements connected thereto to be bent by hand to the final shape of the panel.

A further object is to provide an insulating and water-proof panel construction which loses none of its insulating and water-proof qualities as the result of being bent or otherwise formed to proper shape at the site of erection.

Still another object is the provision of a building panel construction, that after having been originally incorporated as parts of an erected building, will permit (without the loss of its insulating and water-proofing qualities), the taking down of the building and the shipment of its parts to another erection site, where the devices of this invention may be used in the construction of another building at the new erection site. Such panel construction may there be reformed to constitute parts of the new building without danger of damage to such parts, or the impairment of the water-proofing and insulating qualities which they originally possessed.

Another object is to provide a panel structure wherein the individual panels may be readily formed into a stack.

An additional object is to provide a series of panels each of which may be folded transversely of its length to thereby reduce the length to one-half of its original length and which may be unfolded at the erection site and applied to the building without losing its water-repellant qualities.

Other objects will appear hereinafter throughout the specification.

In the drawings:

Figure 1 is a partly broken away perspective view of the panel construction of this invention in the partial erection stage of a building;

Figure 2 is a perspective view of a roof, partly broken away, and showing a plurality of panels with the insulation in place;

Figure 3 is an end elevation of one of the panel elements bent to shape for use in the erection of a wall or roof of a building;

Figure 4 is a partly broken away perspective view of another panel element in its erection form or shape;

Figure 5 is a bottom plan view of the structure shown in Figure 4, before folding;

Figure 6 is a partly broken away perspective view of a third panel element after folding;

Figure 7 is an end elevation of the structure shown in Figure 6, before folding;

Figure 8 is an end elevational view of a structure corresponding to that shown in Figure 3, but having a bi-metallic skin; and

Figure 9 shows one of the panel parts in unfolded position.

Referring to the drawings, A, B and C indicate the three panel parts, each of which is shipped in knocked-down or flat condition where the parts lie in a substantially single plane for stacking, and which may be hand-bent to their final shape or form prior to their assembly into a roof at the erection site. While the panel elements are particularly adapted for roof construction, they may be made into side and end walls, or other parts of a building.

Referring first to Figure 1, the parts are illustrated as a roof section, but should they be attached to vertical supports instead of the horizontal supports shown, a vertical wall could as easily be constructed with the ribs running vertically instead of horizontally as shown.

The supports **10** have been illustrated as I-beams, but other suitable supports may be substituted therefor, such as wooden two by twelves.

Extending transversely of the supporting beams, and laid side by side with each other are the panel parts or elements A, as shown in Figures 1 and 2. Figures 1 and 2 show a plurality of these members A assembled with caulking between the sides thereof.

Each panel member A is composed of a bendable, preferably ductile sheet or skin of bright metal **12**, such as polished aluminum, stainless steel or a composite sheet, as shown in Figure 8, wherein the lower or outer facing sheet of which may be a thin stainless steel or other bright metal, and an integral backing of copper or some other non-rusting cheaper type of metal.

This alternative construction of the metal skin has been diagrammatically shown in Figure 8, wherein the bright, more expensive type of metal layer is illustrated at **14**, and is bonded to the backing layer shown at **16**.

It will be understood that this bi-metal or clad-metal skin may be used in place of any of the metal skins of the panel members A, B or C, but all such skins must be of readily bendable metal, to allow for stacking in flat condition.

It is to be further understood that the lengths of any of these panel members can be such as to extend along one entire side if a peak roof is to be fabricated, or from one side to the other, should a flat roof be fabricated. However, panel elements A need not be of full length, inasmuch as they will be entirely protected from the entrance of rain or snow by the overlying elements B and C, as shown in Figure 1.

In any event, the lengths of the panel elements A, B and C are determined by the architect or construction engineer, at the manufacturing site, and all of these elements are cut to proper length, preferably bent to one-half length, stacked and crated before shipment from the factory site.

These elements are shown to be in proper condition for stacking and crating in Figures 5, 7 and 8, although a transverse fold may also be made in elements A, B or C, as described hereinafter.

Referring again to Figures 1 and 2, the metal skin **12** is provided with side edges **18** and **20**. Extending along the side edges are the non-metallic insulating strips **26**

and **28** that are bonded to the skin **12** by known bonding materials such as shown in my prior patents. Attached to the strips and side edges are longitudinal runners or supporting beams **22**. These parts are secured to each other by nails, screws or other attaching means indicated by reference numeral **24**. The space between the abutting side edges of these beams is sealed by caulking **22***a*. The preferable non-metallic material used to make the strips **26** and **28** is plywood, but other strips may be substituted such as hardwood and various other non-metallic materials. Plywood is preferable because of its non-warping and other characteristics which favor its use in the erection of buildings that are subjected to arctic temperatures.

The space between the non-metallic strips has been shown for only one of the panel parts A to be filled with insulation **38**, for clarity of illustration, but it will be understood that such insulation will be used with each of the panel parts that rest upon the supports **10**. Such insulation may consist of fiber glass, or it may be composed of any other suitable insulating material. The insulating material held by each panel member A serves with the adjacent pairs of insulating strips **26** and **28** to prevent the transmission of cold or heat from one panel A to another panel A.

Mounted upon and attached to the panels A by any suitable attaching means, not shown, are the transversely extending panels B shown in Figures 1, 4 and 5, which panels are shipped in flat condition, as shown in Figure 5.

Each panel is provided with a metallic layer or skin **40**, as previously described, and a non-metallic layer **42**, which has been bonded to the metallic layer. As shown at **44**, **46** and **48**, material has been removed from the non-metallic layer to provide cut-out portions, and the metallic material beneath the cut-out portions is grooved or scored at **50**, **52** and **54**, respectively, to facilitate folding along the lines of the cut-out portions.

The grooved portions **54** and the cut-out portions **48** enable this panel to be folded along its length for shipment so that when long panels are used, say panels of over fifteen feet, and some of these panels extend as long as thirty-two feet or longer, such panels, as folded, will be only one-half the length as when unfolded and applied as parts of a building.

The portions of the non-metallic material and the portions of the metallic skin, all of which are turned up after uncrating of the stacked panel elements B, are indicated by numerals **56** and **58**, respectively.

The panel parts B are spaced from each other, as shown in Figure 1, to accommodate the filler blocks **30** and the cap pieces C, as shown in Figures 1, 7 and 8. These cap pieces each comprise a metallic skin **60** having score portions or crease lines **62**, and a non-metallic layer **64**. The turned down sides each comprise metallic flanges **66** and non-metallic flanges **68**. All metallic and non-metallic surfaces are bonded to each other, as described in connection with the description of the other forms. The non-metallic flanges are separated from the main body by V-grooves **70** to permit folding, as shown in Figures 6 and 7.

The cap pieces are held in place on the upwardly extending flanges by nails or rivets indicated by the numeral **72** in Figure 1.

It will be appreciated that all of the illustrated panel elements, i. e., omitting the supports **10** and the insulation **38**, may be manufactured in large quantities in sheet form, stacked and crated, and then shipped to the erection site and there bent along the fold lines of the panel parts to the configurations shown in Figure 1. Even the insulation may be made up into rolls and cut to size as shown in Figures 1 and 2, either at the factory or the erection site. Buildings constructed of these units may be easily taken down, with the individual elements bent to the shape shown in Figures 5, 7 and 8, after which they may be crated and shipped to another erection site, where they are again bent to proper shape and used as construction units as shown in Figures 1 and 2.

Because of the fact that the units are of exceptionally light weight and occupy a very small space by comparison with other building units, units B and C may be flown to the erection site.

When assembled into buildings, they have exceptionally good head insulating qualities, and are especially adaptable as housing units in very cold climates such as the arctic regions. Additionally, such buildings are possessed with exceptionally high wind resistance. In tropical climates they may be readily adaptable as air conditioned housing units. The highly polished metal skin outer surfaces reflect the sun's rays. It will be noted by referring to the drawings, particularly Figure 1 thereof, that none of the metallic parts of the unit A contacts the metallic parts of the unit B, and that none of the metallic parts of the unit B contacts the metallic parts of the unit C. This construction prevents the transmission of either heat or cold to the interiors of the buildings.

It will be appreciated that the units A, with the beams attached thereto, may be shipped in flat condition, and where either the units B, C, or both, need be of exceptional length in order to provide a solid metal surface from one end to the other of a roof, such construction is feasible because of the fold lines such as shown at **54** in Figure 4 and the cut-out portions **48**. By reference to Figures 1 and 6, it will be noted that the panel elements C are provided with fold lines **32** that extend on three sides. Beneath these fold lines are cut-out portions, not shown, corresponding to cut-out portions **48** so that these cap elements may be of any length, and when they are of great length, they may be folded back upon themselves along the fold lines **32**, which will permit them to occupy a space one-half the length they would otherwise occupy in the hold of a ship or in a truck or other conveyance.

The above description and drawings disclose a single embodiment of the invention, and specific language has been employed in describing the several figures. It will, nevertheless, be understood that no limitations of the scope of the invention are thereby contemplated, and that various alterations and modifications may be made such as would occur to one skilled in the art to which the invention relates.

I claim:

1. A roof construction comprising a series of substantially parallel primary panel elements arranged in side by side juxtaposed relation, each primary element being of channel shape and having upwardly extending sides and adapted to be mounted on suitable supporting means, a plurality of spaced adjacent substantially parallel secondary panel elements supported on said primary panel elements at right angles thereto, each of said secondary elements being of channel shape and having upwardly extending sides and a bottom wall, a plurality of cap elements of channel shape, each cap element substantially covering the adjacent sides of two secondary elements and having downwardly extending sides and a top wall, the lower edges of each cap element being spaced from the bottom walls of the adjacent primary elements, said cap elements each having a metallic outer layer and an inner non-metallic layer bonded together, said primary and secondary elements each including a metallic layer and a separate non-metallic strip bonded to the outer face of each of the sides and bottom wall of each of said primary and secondary elements, said strips on said side walls being spaced from the strip on said bottom wall, and filler blocks between said adjacent sides of said secondary elements, the metallic layers of said primary elements, said secondary elements, and said cap elements facing upwardly, and the non-metallic layers thereof be-

ing underneath said metallic layers except for the side portions thereof, the metallic portions of the upwardly extending sides of the primary panel elements being interposed between the upwardly extending non-metallic portions of said sides and the non-metallic portion of the downwardly extending sides of the cap elements, whereby to prevent heat exchange between the upwardly extending metallic layer of each primary element and the downwardly extending metallic layer of each cap element.

2. A roof construction as defined in claim 1, wherein the sides of said primary elements each comprise a plank secured to the outer face of the adjacent non-metallic strip, said secondary elements being supported directly on the upper edge of said plank, and insulating material in the channels of said primary elements.

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