

Aug. 27, 1957

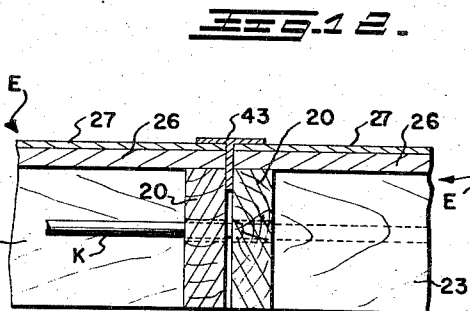
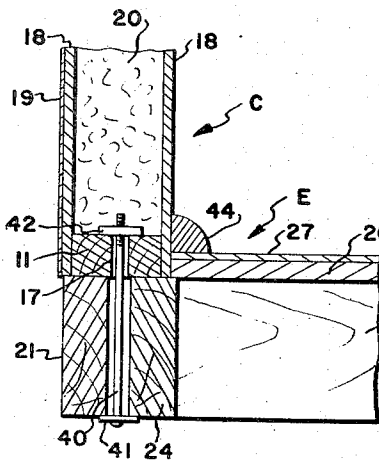
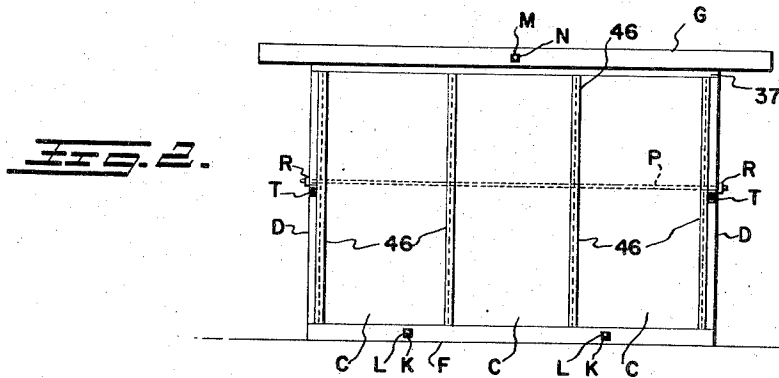
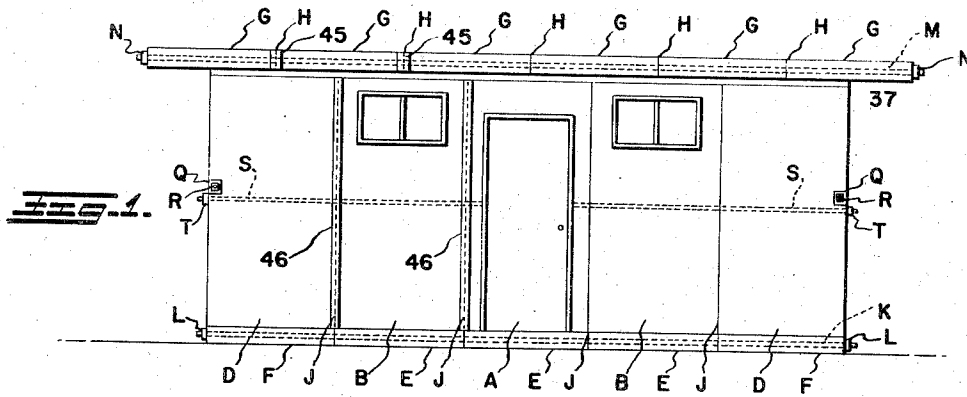
D. C. KOFAHL ET AL

2,803,856

BUILDING FORMED OF PREFABRICATED PANELS

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3 Sheets-Sheet 1



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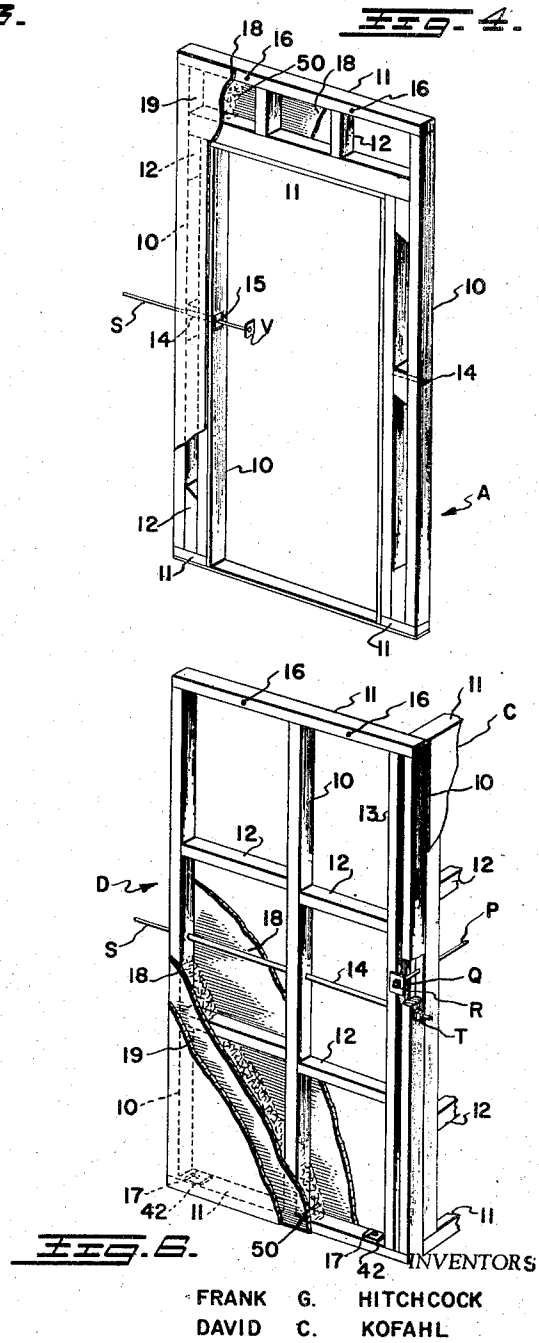
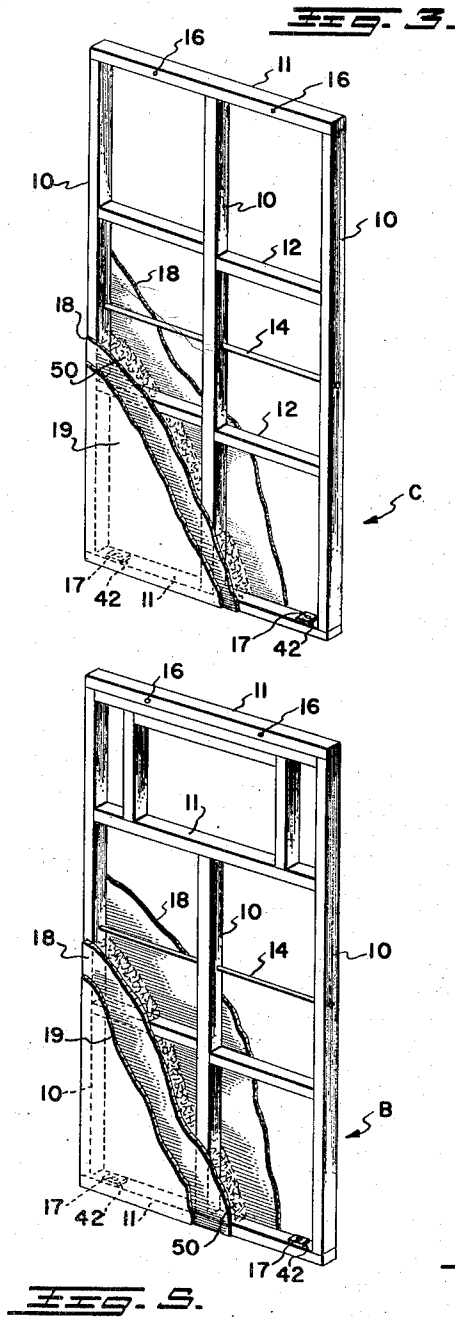
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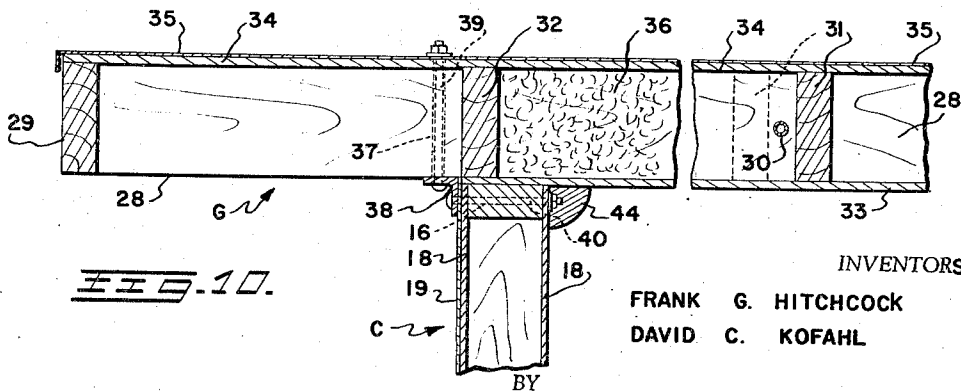
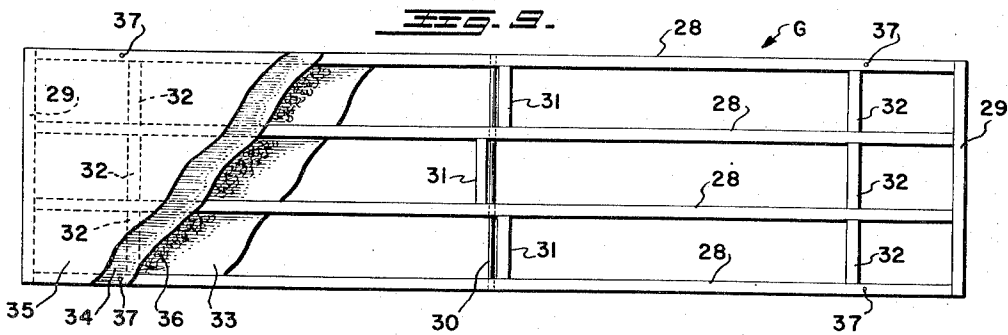
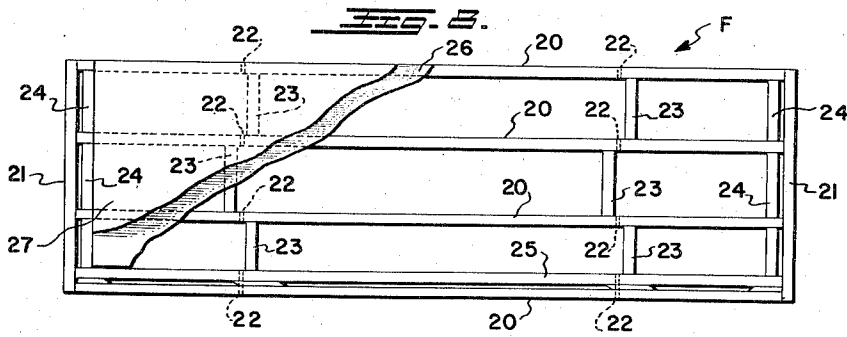
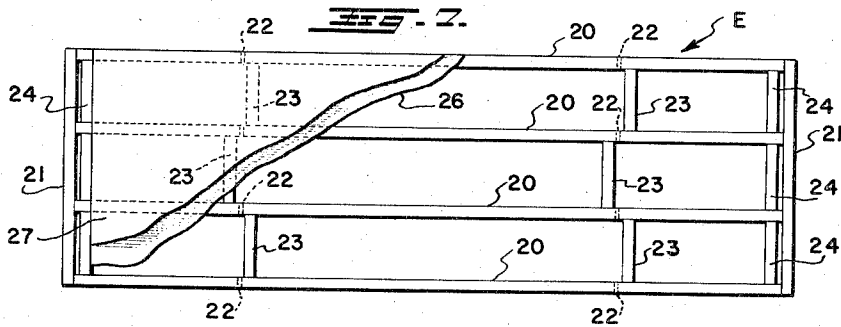
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BUILDING FORMED OF PREFABRICATED PANELS

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5 Claims. (Cl. 20—2)

This invention relates to building construction and more particularly to an improved portable building structure of the sectional knock-down type formed of prefabricated sections or units.

There has long been a need for a completely insulated, portable building to house persons with reasonable comfort in areas, such as oil fields, where permanent housing does not exist and climatic conditions may be extreme. The "Dalas Hut" has been used for a number of years to house persons in such areas; however, the "Dalas Hut" is merely an uninsulated shell which can be insulated in the field only at considerable expense and cannot be easily dismantled for transportation to another area.

We have now devised an insulated building composed of inexpensive, insulated, prefabricated, paneled sections or units attached together in end-abutting relation by rods, which building can be assembled and dismantled quickly and easily by unskilled labor. The prefabricated units of which our building is formed, are, because of their unique construction, extremely strong and rigid so that the individual units are not deformed although subjected to various forces, as for example, compression forces resulting from assembling the units by means of rods. The assembled building is sturdy enough to be moved as a unit by being winched upon a truck, skidded, or moved by a crane. The prefabricated units are preferably all made of sizes according to a module system. In other words, the sections or units have a height or length which is a multiple of a width, preferably four feet, which is common to all sections. Thus, the sections of an unassembled building can be stacked in packages of uniform size for shipment. By using different combinations of wall units, the buildings are capable of a wide variety of uses.

A preferred embodiment of the invention is illustrated by way of example in the accompanying drawings, in which:

Figures 1 and 2 are a front elevation and an end elevation, respectively, of a sectional building constructed in accordance with this invention,

Figure 3 is a perspective view of a blank wall unit with a part of the facing broken away to show the construction of the supporting framework.

Figure 4 is a perspective view of a door unit and of preferred means by which a rod is secured to the unit,

Figure 5 is a perspective view of a window unit with a portion of the framework broken away to show the supporting structure,

Figure 6 is a perspective view of an end wall unit and of preferred means by which wall units are secured to each other to form a corner of the building,

Figures 7 and 8 are plan views of floor units with a part of the flooring broken away to show the supporting structure,

Figure 9 is a plan view of a roof unit with a portion of the roofing broken away to show the supporting framework,

Figure 10 is a sectional view illustrating the preferred means by which roof units are attached to wall units,

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Figure 11 is a sectional view illustrating the preferred means by which wall units are attached to floor units, and

Figure 12 is a sectional view of a portion of two abutting floor members illustrating a preferred form of a weatherproof seal between adjacent floor units.

Referring to the drawings in detail, and wherein similar reference characters designate corresponding parts throughout, my improved sectional building has been shown as comprising a door unit A, window units B, blank wall units C, corner blank wall units D, central floor units E, end floor units F and roof units G. Of course, combinations of wall units other than the arrangement illustrated in Figures 1 and 2 are within the scope of this invention.

All of the wall units, whether door, window or blank wall units, have substantially like dimensions as to height, width and thickness. Wall units should be of a height generally necessary for comfortable use of the completed building by humans; however, they should not be of such height as to substantially reduce their structural strength. Preferably, their height should be about the same as the ceiling height of a large percentage of modern dwellings, which is about 8 feet. The wall units can be of any suitable width, and should be large enough for a single unit to form a frame for a door permitting human ingress and egress or a window of sufficient size to provide adequate air and light within the completed structure. A preferable width is about 4 feet, which width insures that the units have adequate structural strength and are not unwieldy in size.

Floor units, whether central or end units, are all of the same width and preferably have substantially the same width as wall sections. They are preferably any length which is a multiple of the width of wall units plus about twice the thickness of wall units. The purpose for having the length of the floor units so related to the width and thickness of wall units is illustrated in Figures 1 and 2. The floor, composed of floor units E and F, supports the several wall units along its peripheral edge. Each of the floor units has a wall unit resting upon and attached to each transverse end so that the exterior facing or paneling of each wall unit is substantially flush with a transverse end. For example, end wall units D (Fig. 2) rest upon and have their exterior facing substantially flush with the transverse ends of floor unit F. Thus, wall units C, attached along the longitudinal edge of end floor unit F so that each wall unit C has its exterior facing substantially flush with the longitudinal edge of end floor unit F, extend between the inner facing of end wall units D. This arrangement of wall units with respect to floor units obviates the necessity of corner posts or the like for intersecting walls forming a corner to abut against. Corner blank wall units D are preferably of the reinforced construction indicated in detail in Figure 6 thereby insuring rigidity of each corner of the building. Means by which wall units are attached to form a corner of the building are also illustrated in detail in Figure 6.

Roof units G of our building have a length at least as great as the length of units forming the floor of the building. Preferably, the roof units are somewhat longer than floor units thereby providing an overhang to protect windows and doors from the weather. The number of roof units of my building is preferably one greater than the number of floor units utilized. As illustrated in Figure 1, by such use of an additional roof unit, the abutting longitudinal edges H of adjacent units of the roof lie intermediate abutting edges J of adjacent wall units. Such an arrangement of roof sections produces two desirable results. First, the building is given considerable added strength by staggering the abutting edges of roof units with respect to abutting edges of wall or

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floor units. Second, a roof overhang is provided at both ends of the building.

Like units of the sectional building of this invention are fastened together in edge-abutting relation by means of one or more rods which pass through each unit. For example, floor units can be attached by one or more rods K (Fig. 1) which pass transversely through each of the units and which are screw threaded at each end to receive screw threaded rod engaging means, such as nuts L. Thus, by tightening the rod engaging means floor units are compressed together in end-abutting relation to form a strong floor. Roof units are attached in like fashion by rod M and rod engaging means such as nuts N. Wall units are also held rigidly together by rods S and nuts T and rod P, plates Q and nuts R (Figs. 1 and 2). Roof and floor units are attached to wall units by suitable means such as the preferred means illustrated in Figures 10 and 11 and described in greater detail below.

In Figures 3 to 6 inclusive, the construction of the several types of double paneled, stud-supported wall sections or units are illustrated in detail. As was previously indicated, all wall units, regardless of type, have substantially the same dimensions as to height, width, and thickness. Wall units comprise vertical studs 10, horizontal studs 11 and blocks 12. In Figures 4 and 5, the horizontal and vertical studs and blocks are so disposed as to provide a door and window frame, respectively. The opening in a window unit can be suitably proportioned for holding an air conditioning unit. In such case, it may be desirable to provide the window unit with additional vertical studs to support the weight of the air conditioning unit.

Corner wall unit D, Figure 6, has an additional vertical stud 13 which is in contiguous or slightly spaced relation to stud 10 forming a vertical edge of the unit. These two adjacent studs provide a rigid support at each corner of the building and also a structurally strong stanchion to which wall units C along the longitudinal edge of an end floor unit (Fig. 2) can be rigidly attached as by rod P which passes transversely through units C and the small space between studs 10 and 13. Each end of rod P passes through a pressure plate Q and threadedly engages a nut R. Pressure plate Q serves to distribute compressive force equally on studs 10 and 13. Pressure plate Q can be placed against the outer facing of end wall unit D as illustrated in Figure 1, or under the facing directly against studs 10 and 13. In the latter case, the plate should be secured to the studs. Wall units forming the front or rear of the building are maintained in edge-abutting relation by rod S having threaded ends which extend slightly beyond end wall unit D and threadedly engage nuts T.

The wall units illustrated in Figures 3, 5, and 6 are provided with a tube 14 of material such as metal, which extends completely through the units to receive a tie rod. Since rods of two intersecting walls should not meet, rod receiving tubes 14 should be placed higher in some units than in others. Thus, rods extending through an end wall unit D do not intersect, as is indicated for example by the respective positions of rods P and S, Figure 6, and their ends are freely accessible for engaging nuts.

Door unit A, illustrated in Figure 4, can be provided with two relatively short sections of such tube indicated by dotted lines 14 which extend from each exterior vertical edge of the unit into each interior vertical surface of the door frame. The height of the tubes corresponds to that of other wall units with which the door units are assembled. The interior vertical surfaces of the door frame are provided with recessed areas 15 which receive rod engaging means in the form of a face plate V fixedly or threadedly attached to the tie rod, which means for securing the end of a rod does not interfere with the installation and operation of a door.

Horizontal studs 11 forming the upper edge of each

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section are provided with holes 16 which pass there-through for receiving bolts or the like for connecting roof sections and wall sections (Fig. 10). Also, the horizontal studs forming the lower edge of the wall sections are provided with holes 17 which pass therethrough for receiving suitable securing means (Fig. 11) by which wall sections are attached to floor sections.

Each double paneled unit is provided with interior and exterior paneling 18 of plywood, fibre board or the like. The edges of the facing material are substantially flush with the outer edges of the horizontal and vertical studs forming the rectangular frame of the wall sections. The exterior panel of each section is covered by a metallic sheet 19 of any suitable corrosion-resistant material such as aluminum and galvanized steel. Each section is also provided with suitable insulating material such as a rock-wool blanket 50 which, for example, can be stapled to the interior surface of the paneling.

Figures 7 and 8 illustrate central and end floor units, respectively. Each of the floor units has a structural framework consisting of a plurality of spaced, substantially parallel, longitudinal members, such as joists 20, having their ends attached to a transverse end member or plate 21, the periphery of floor units being formed of the longitudinal members and end members or plates. The floor units are provided with a rod receiving means which passes transversely through the longitudinal members intermediate the ends of the floor units, which rod receiving means takes the form of holes 22 in joists 20. Of course, the rod receiving means can take the form of tubes similar to tube 14 of wall units, Figures 3, 5 and 6; if desired. Floor units are preferably provided with means for receiving at least two rods, said means being located toward the proximate end of each unit thereby providing a floor of greater rigidity. Between adjacent longitudinal members or joists 20 and contiguous with rod receiving means 22 are blocks 23. Blocks 23 abutting on a common longitudinal member preferably lie on each side of the rod receiving means as indicated in the figures. This arrangement of blocks 23 with respect to rod receiving means 22 prevents deformation of floor units when subject to considerable compression forces by rods and rod end-engaging means utilized to maintain several floor sections in edge-abutting relations to form a single rigid floor. Blocks 24 are in contiguous or slightly spaced relation with respect to transverse end plate 21 so as to underlie wall units (Fig. 11). End floor unit, F, is also provided with an additional longitudinal member such as joist 25 which is in slightly spaced or contiguous, substantially parallel relation with a longitudinal member or joist forming an edge of the floor section so as to underlie wall sections in the same manner as blocks 24. Suitable bracing means can be employed to provide greater rigidity between joist 25 and a joist 20 forming an edge of the floor unit. When the floor units are assembled to form a floor, the peripheral edge thereof has great structural strength to support wall units by reason of their unique structure.

Joists, transverse end plates, and blocks are preferably of seasoned Douglas fir or like building material, and should be of sufficient size to give the floor sections adequate strength to support that weight which is incident to the use for which a particular building is designed. Floor units are provided with a sub-floor 26 of plywood and the like over which is placed a floor 27 of Masonite, asphalt tile, or similar material. The flooring is preferably not coextensive with the structural framework of floor units, but extends over central floor units between blocks 24, that is, to within a distance from the transverse ends of the units about equal to the thickness of the wall sections so that the transverse edges of the flooring rest on blocks 24 (Fig. 11). In the case of end floor units, three edges of the framework are not covered with flooring for a width from the edges equal to about the width of wall sections, the outer edges of the flooring resting on blocks 24 and joists 25. Thus, when the floor

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units are assembled to form a floor, the flooring attached to the structural framework of the units extends between blocks 24 which are contiguous with end plates 21 and between longitudinal members 25 of end floor units forming the end edges of the floor. Thus, the periphery of the floor is provided with a recessed area (Fig. 11) for receiving and supporting the lower edges of wall units.

Roof unit G, Figure 9, has a structural framework similar to floor units and consists of a plurality of spaced, substantially parallel and longitudinal members or rafters 28 having their ends attached to transverse members or end plates 29, the periphery of these units being formed of longitudinal members and end plates. A rod receiving means such as tube 30 passes transversely through rafters 28 intermediate the ends of the unit. Blocks 31 lie between adjacent rafters and are contiguous with tube 30 so that blocks abutting on a common rafter are on opposing sides of tube 30. Thus, roof units as well as floor units are advantageously constructed so as to be substantially noncompressible when assembled by means of rods to form a completed roof. As was indicated above, roof units are preferably of a length sufficient to overhang supporting wall units. Roof units of such length are provided with blocks 32 which are equally spaced from and parallel to end plate 29, so that their outermost surfaces are substantially flush with supporting wall units (Fig. 10). The roof units are provided with interior and exterior panels 33 and 34, respectively, which are preferably of plywood or the like. Outer panel 34 is substantially coextensive with the structural framework of the roof unit and is covered with a corrosion-resistant metallic sheet 35, e. g. aluminum. Interior panel 33 extends to the outer surface of blocks 32. Insulating material such as a rock wool blanket 36 can be placed between panels 33 and 34, in the same manner as described for wall units. Roof units are also provided with vertical holes 37 which receive bolts (Fig. 10) to secure roof units to wall units.

Roof units and wall units are preferably connected in the manner illustrated in Figure 10. Roof unit G rests upon the upper edge of wall unit C so that the outer surface of block 32 is substantially flush with the exterior surface of wall unit C. An L-shaped member such as angle iron 38 faces on the underside of roof unit G and the exterior surface of wall unit C. The L-shaped member preferably extends for substantially the length of each side wall and the roof units and wall units are fastened to the L-shaped member by suitable means such as bolts 39 or the like which pass through holes 37 in roof units and bolts 40 which pass through holes 16 in wall units. Blocks 32 not only strengthen roof units at the point where they rest upon wall units, but also provide an end sealing member for the insulated portions of roof units. Wall units, regardless of type, i. e. door, window, etc. and whether running longitudinally or transversely of roof units, are preferably connected in the manner illustrated in Figure 10.

Figure 11 illustrates the preferred manner by which wall and floor units are connected. Wall unit C rests upon end plate 21 and block 24 of floor unit E so that the exterior surface of the wall unit is substantially flush with end plate 21 and the interior surface thereof abuts the ends of flooring 26 and 27 whose ends rests on block 24. A bolt such as machine bolt 40, passes through the narrow space between end plate 21 and block 24 and through hole 17 in horizontal stud 11 forming the bottom edge of wall unit C. Bolt 40 is held securely in place by washer 41 and is screwed into a threaded plate 42 which is secured above hole 17 in horizontal stud 11 by nails or similar means. Generally, two bolts per wall unit provide the building with the necessary rigidity. Wall units are attached to the longitudinal edge of end floor units in the same manner as illustrated in Figure 11. The method illustrated for connecting wall and floor units has numerous advantages such as ease of assembly

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and disassembly, and the provision of a structurally strong union of units.

A tight weatherproof seal can be obtained between adjoining units in a variety of ways and with great simplicity. For example T-shaped members 43 (Fig. 12) of suitable material such as 20 gauge galvanized steel which preferably extend for substantially the length of floor units, provide an excellent seal between adjacent floor units. Interior corners and seams between roof and wall units can be sealed by quarter round trim 44 (Figs. 10 and 11) of Ponderosa pine or the like. Exterior roof seams can be sealed with aluminum strips 45 (Fig. 1) which extend along the seams across the roof of the building and exterior wall seams can be sealed with battens 46 (Fig. 1) of Ponderosa pine or the like. Battens of similar material can also be used to seal interior wall and ceiling seams in similar manner.

Door and window units are preferably constructed to accommodate commercially available doors and windows. Insulated metal doors and basement or utility windows are particularly suitable for use with our building.

It is claimed:

1. A building of the knockdown, sectional type comprising a roof, side walls and a floor formed of prefabricated, paneled units of substantially uniform width maintained in edge-abutting relation by means of transverse tie rods, said units comprising the roof and floor of said building having a structural framework comprising a plurality of spaced, substantially parallel, longitudinal members having their ends attached to a transverse end member, the periphery of said roof and floor units being formed of said longitudinal members and end members, rod receiving means passing transversely through said longitudinal members intermediate the ends of said roof and floor units, a block between adjacent longitudinal members and contiguous with said rod receiving means, said units forming the roof of said building having their proximate ends supported by side walls comprising a plurality of edge-abutting wall units, and means for attaching said roof and said side walls, the framework of units forming the floor having a block between adjacent longitudinal members and contiguous with said end members so as to underlie wall units, and the framework of units forming each end of said floor having a longitudinal member contiguous with the longitudinal member forming an edge of said floor so as to underlie wall units, said wall units having their lower edges resting on said end members and longitudinal members forming the peripheral edge of said floor, and means for attaching said wall units to said floor, the framework of one of the two wall units forming each corner of said building including a longitudinal member contiguous with the longitudinal end member forming the vertical edge of said side wall to provide support for the longitudinal end member forming the vertical edge of the adjacent side wall.

2. The building of claim 1 wherein the abutting longitudinal members forming the longitudinal edges of adjacent units of said roof lie intermediate abutting vertical edges of adjacent wall units.

3. The building of claim 2 in which the flooring is attached to said framework and extends between said blocks contiguous with said end members and longitudinal members contiguous with said longitudinal members forming an edge of said floor, whereby the periphery of said floor is provided with a recessed portion for receiving and supporting the lower edges of wall units.

4. The building of claim 1 in which the means for attaching wall units to said floor comprises means extending vertically between said blocks contiguous with said end members and said longitudinal members contiguous with said longitudinal members forming an edge of said floor, said means being secured to the lower ends of said wall units, means for securing wall units abutting at the corners of said building which comprises a transverse tie rod extending horizontally from the end longitudinal

member forming the edge of one side wall, through the space provided between the longitudinal member contiguous with longitudinal end member forming the edge of the adjacent side wall and means for securing said tie rod to the outer faces of said longitudinal end member and contiguous longitudinal member. 5

5. The building of claim 4 wherein units forming the floor of said building have a length which is a multiple of the width plus about twice the thickness of wall units, and units forming the roof of said building have a length at least as great as the length of units forming the floor of said building. 10

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