

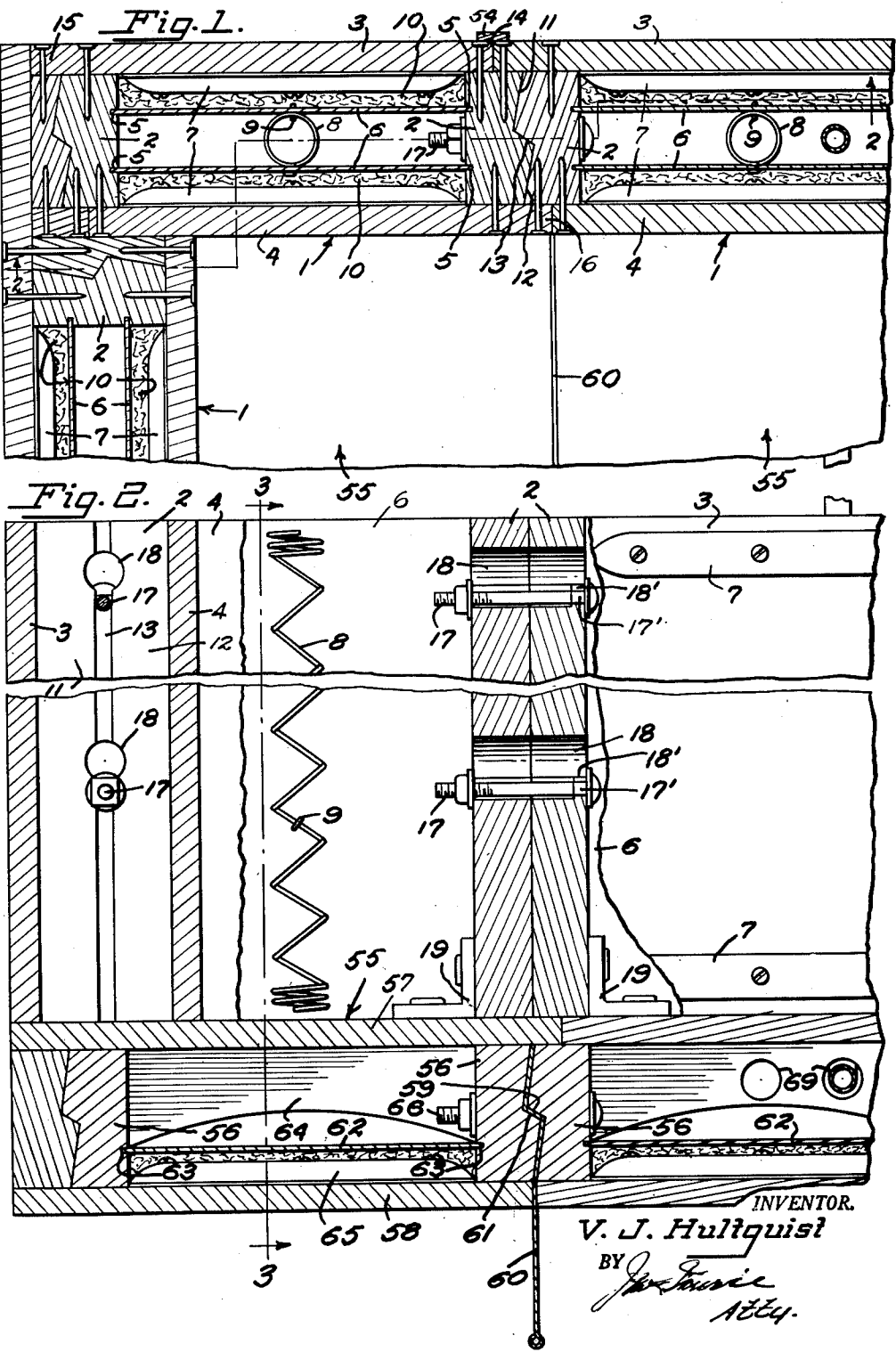
Feb. 24, 1953

V. J. HULTQUIST  
METHOD OF ASSEMBLING PREFABRICATED BUILDING  
UNITS IN A BUILDING CONSTRUCTION

2,629,138

Filed March 8, 1947

3 Sheets-Sheet 1



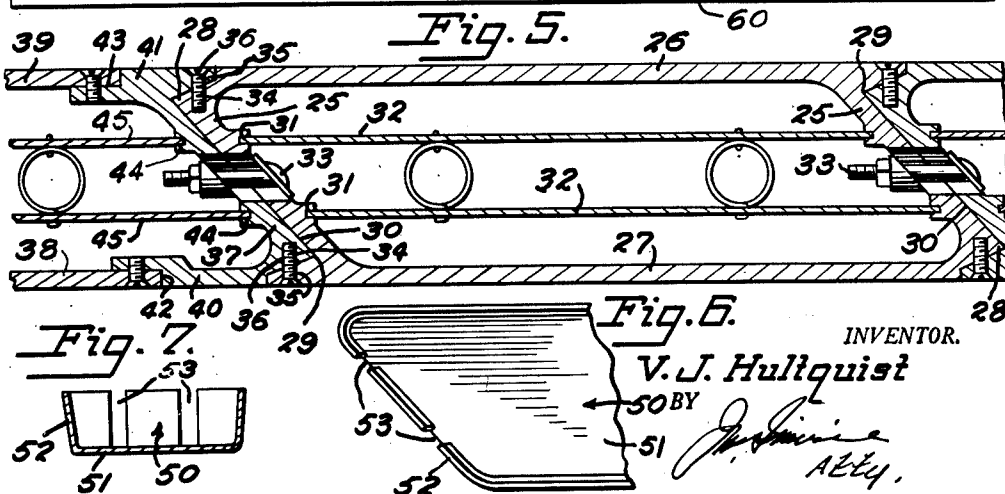
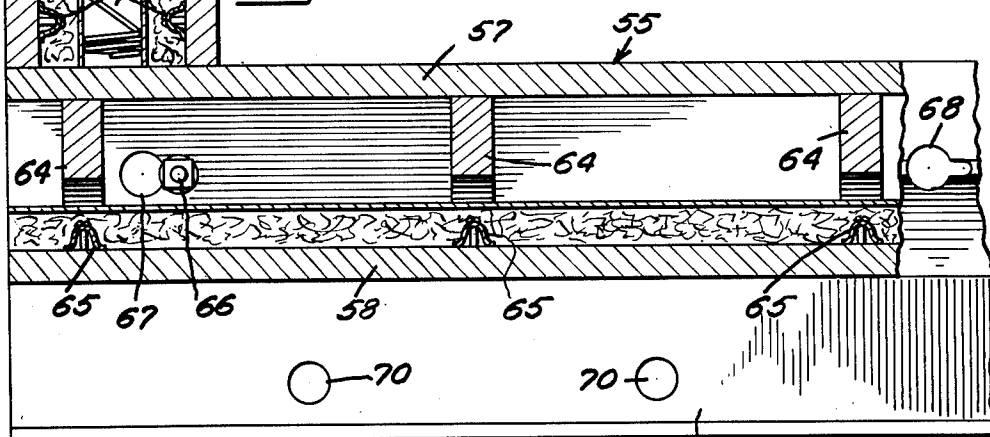
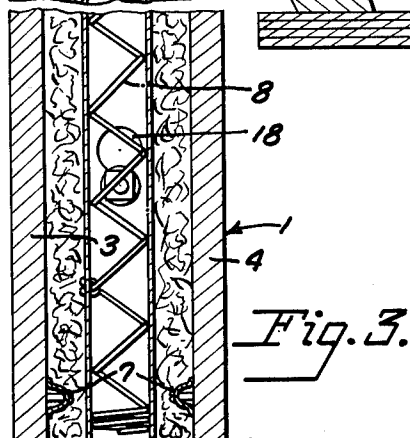
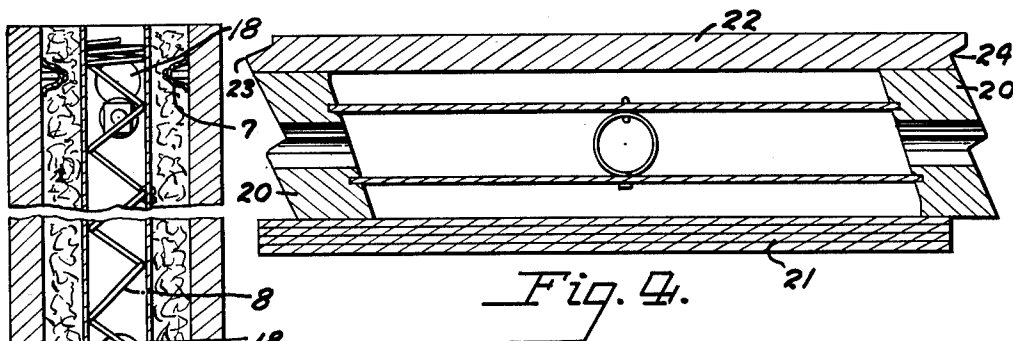
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INVENTOR,

*V. J. Hultquist*

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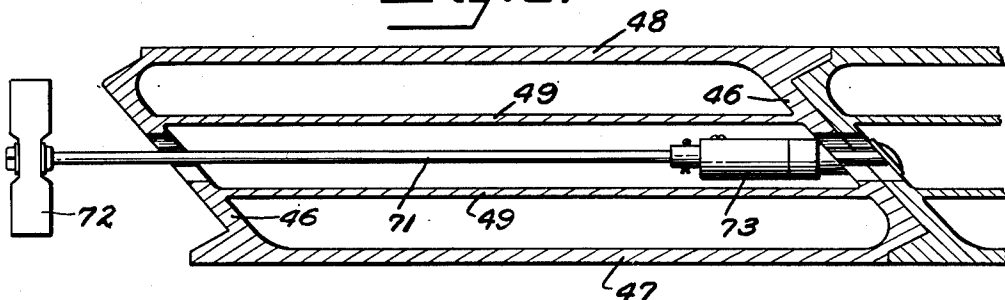
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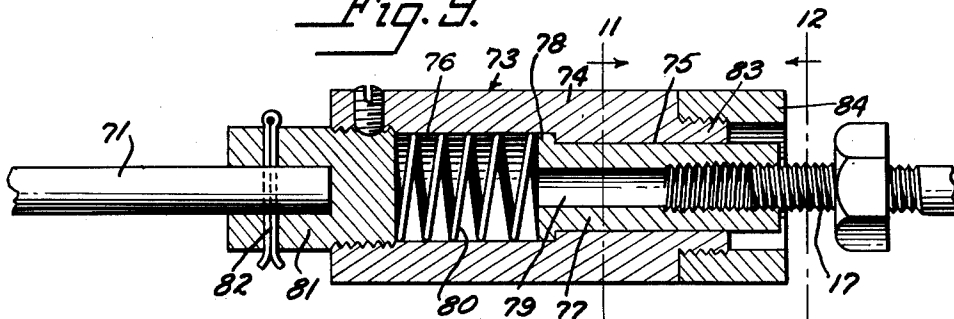
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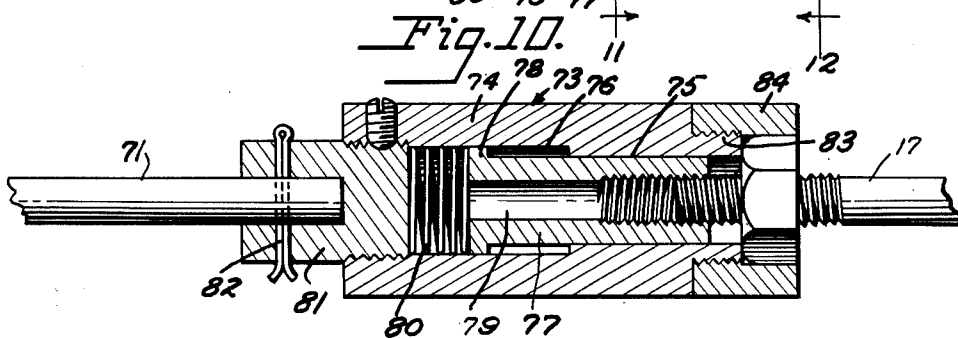
*Fig. 8.*



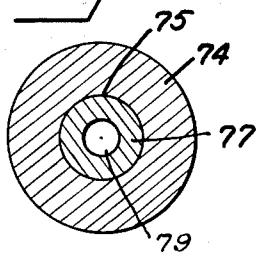
*Fig. 9.*



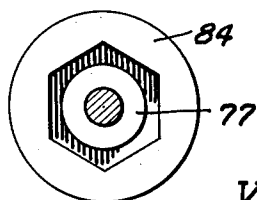
*Fig. 10.*



*Fig. 11.*



*Fig. 12.*



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## UNITED STATES PATENT OFFICE

2,629,138

METHOD OF ASSEMBLING PREFABRICATED  
BUILDING UNITS IN A BUILDING CON-  
STRUCTION

Victor J. Hultquist, Alcoa, Tenn.

Application March 8, 1947, Serial No. 733,267

1 Claim. (Cl. 20—2)

1

This invention relates to prefabricated building construction, and more particularly to a method of assembling prefabricated units in a building construction.

The erection of prefabricated buildings is rapidly assuming a place of importance in present day construction. This type of construction owes its increasing popularity to its inexpensiveness, and the facility with which a building can be erected with a small crew of workmen. The inexpensiveness is due to several factors; mass production of the units used in the final construction, the relatively few different types of units employed to complete the job, and the large areas covered by the erection of a single unit.

The present invention leads toward further facilitating and improving this type of construction by providing a building unit which, due to its particular structural features, is capable of withstanding the different stresses imposed upon walls, roof, and flooring, and may be used for all these purposes, thus reducing to one the types of units needed in the erection of a single building.

It is the principal object of the present invention to provide a method of assembling building units that is easy and simple and provides a finished construction.

It is another object of the invention to provide a method of assembling prefabricated building units that is efficient and economical.

Other objects of the invention will become apparent from the following detailed description of preferred embodiments of the invention when taken in conjunction with the drawings which accompany and form a part of this specification.

In the drawings:

Figure 1 is a horizontal section taken through a corner of a building showing the building units of the present invention in place;

Figure 2 is a staggered vertical section taken on the line 2—2 of Figure 1;

Figure 3 is a transverse vertical section taken on the line 3—3 of Figure 2;

Figure 4 is a horizontal section through a modified form of wall unit;

Figure 5 is a similar view of another modification;

Figure 6 is a partial plan view of a cover plate used in connection with the building units;

Figure 7 is a sectional view through the cover plate;

Figure 8 is a horizontal section through a still further modification of the wall unit, the special wrench used in connecting the units being shown in operative position;

2

Figure 9 is a longitudinal section through the head of the wrench with a bolt in position for insertion in the building unit;

Figure 10 is a similar view with the bolt in position for drawing up the nut;

Figure 11 is a transverse section taken on the line 11—11 of Figure 9; and

Figure 12 is a transverse section taken through the bolt on the line 12—12 of Figure 9 looking at the nut socket end of the wrench.

Referring to the drawings in detail, and first adverting to that form of the invention shown in Figures 1 to 3 inclusive, the invention consists in part of a building unit 1 which is rectangular in shape. The size of the unit may vary to suit particular needs, but preferably, when used in wall construction, the unit will be the height of a single story, and of such width that it will cover an extensive area and yet not be too bulky to be handled by one workman.

Building unit 1 is made up of spaced side rails 2, an outer panel 3, and an inner panel 4, the panels bridging the space between the side rails and being longitudinally coextensive therewith and connected thereto by means of screws or other suitable means. When the unit is in place in a wall, the side rails 2 serve as studs to take the vertical weight thrust, and in certain constructions, when used as roof or flooring, the side rails function as weight supporting joists. Side rails 2 have longitudinally extending grooves 5 cut into their inner faces. The grooves extend the full length of the side rails and form guides to receive the side edges of inner partitions 6 which also are longitudinally coextensive with the side rails. The partitions divide the unit into compartments to provide a cellular structure.

The outer and inner panels 3 and 4 are provided with pressed metal cleats 7, which are positioned transversely of the panels. The cleats are substantially U-shaped in cross section, and are held in place on the panels by screws. The number of cleats used on each panel will depend, to a large extent, upon the size of the panel and the load to be imposed upon the unit. The depth of the cleats is less than the distance from the outer and inner panels to the partitions 6 so that they do not interrupt the continuity of the cells between the panels and the partitions.

In the central cell, between the partitions 6, spread coil springs 8 are positioned to bear against the partitions to prevent them from bulging inwardly. The springs are fastened at their ends to the partitions 6 and are held in

3

alignment by means of wire clips 9 passing around the spring wire and through openings in the partitions. The ends of the clips are bent over on the outside of the partition to fasten them in place. As shown on the drawing, the coiled springs 8 preferably have all of their convolutions, except a few at each end, spread so that the points of contact with the partitions are wider spaced than would ordinarily be the case to provide a more yielding support, and for other reasons to be later referred to.

By reason of its cellular construction, the building unit may easily be insulated. Insulating material 10 of any well known type can be inserted into the outer cells between the partitions and the panels. The insulating efficiency of the unit may further be increased by the use of reflecting surfaces applied to the interior walls of the cells by the use of lustrous paints or foils.

In use, whether for wall, roof, or floor, the units are designed to be placed side by side, with the side rail of one unit abutting the side rail of the next. The side rails are so formed that adjacent units will interlock, imparting strength and rigidity to the assembled units and facilitating the formation of a weather-seal. The interlocking structure preferably takes the form of a stepped joint. As shown in Figure 1, each side rail has its outer face cut to form a stepped joint, consisting of three longitudinally extending surfaces 11, 12 and 13, the surfaces 11 and 12 extending at an angle inwardly from the sides toward the center and being on substantially parallel planes, and the surface 13 connecting the surfaces 11 and 12 along the center of the side rail and forming a shoulder. The two side rails of a unit are reversely cut so that they will interlockingly engage the side rails of adjacent units. To further carry out the interlocking of these units, the panels 3 and 4 may be secured to the side rails in staggered relation to one another. The panel 3, for instance, may be positioned with one longitudinal edge substantially midway of one side rail, as at 14, and its other longitudinal edge overlapping and extending beyond the opposite side rail, as at 15. The panel 4 will then be positioned so that its overlapping edge 16 is reversely positioned with respect to the overlapping edge 15 of panel 3. With this construction, the overlapping portions of the respective panels will overlie the side rails of adjacent units, and the panel of one unit may be connected to the side rail of the next by means of nails or screws passing through the panels into the side rails.

When two units have been placed in position with their side rails interlocking, the units are joined by means of bolts 17. Due to the fact that in the erection of a building the units must be sequentially positioned and the bolts passed through the abutting side rails, it will be obvious that special means must be provided for positioning the bolts and for drawing them up into place. To this end, the opposite side rails have formed therein aligned openings 18, so that the bolts 17 may be inserted through an opening 18 in one side rail into openings 18 in the opposite side rail and the abutting side rail of the adjacent unit. The bolts are inserted by a special wrench which will be described later. The openings 18, as shown, take the form of keyhole slots, the enlarged upper portions being of sufficient size to permit the passage of the bolt; its companion nut, the necessary washers, and the head of the above-mentioned wrench. The lower por-

4

tion of the opening is of just sufficient width to receive the shank of the bolt. The bolt, with its nut threaded on the end and washers positioned against the bolt head and nut, is placed in the socket of the wrench and passed through the upper part of one of the openings in the rear side rail. The wrench is pushed through the unit until the bolt passes through the upper parts of the keyhole slots in the opposite side rail and the side rail of the abutting unit. When the bolt is so positioned that the bolt head and its washer is on the inside of one side rail and the nut and its washer is on the inside of the abutting side rail, the wrench is lowered so that the shank of the bolt is dropped into the lower or smaller portions of the keyhole slots which are of sufficient width to receive the bolt shank but of less width than the washers. A portion 18' of one lower slot is of less diameter than the remainder of the slot to snugly fit a square portion 17' on the shank of the bolt adjacent the bolt head to prevent the bolt from turning. The wrench is then rotated to tighten the nut, after which the wrench is withdrawn. Several bolts will be used to secure each two units. The expanded springs 8 have their convolutions spread sufficiently far apart, and the springs have enough resiliency to permit the wrench and bolts to pass freely through the unit.

The units are provided with brackets 19 fastened to the side rails near the bottom to secure the units to their support.

The basic unit is capable of many modifications, while still maintaining the same basic structure. For example, in Figure 4, a unit is shown which employs side rails 20 which are essentially similar to the side rails 2 of the form previously described, except that they are inclined to the side panels. An inner panel 21 may be composed of plywood and may be given any desired finish. The outer panel 22 has its side edges shaped to form a continuation of the cross-sectional configuration of the side rails. Panel 22 has one edge provided with a vertical tongue 23 and its opposite edge with a groove 24. When two of these units are assembled, the tongue of one unit fits into the groove of the next. This added to the step-joint 24 in the side rails, and the overlapping of the side rail by the panel 21, forms an extremely rigid as well as weather-tight joint when the units are bolted together.

Figure 5 shows another form the unit may take. In this form, the side rails 25 and inner and outer panels 26 and 27 may be integral and formed by extrusion of metal, plastic or the like. In horizontal cross-section, the side rails are angularly disposed with respect to the panels, and the stepped joint is moved from the center of the side rails to the edges. To accomplish this, the abutting face of each side rail is provided with a tongue 28 near one edge, and a groove 29 near the other edge, the apex of the tongue and the vertex of the valley being joined by a smooth surface 30. Opposite side rails are companion members, so that two units may be brought together in interlocking relation. Side rails 25 are provided with vertical grooves 31 to serve as guides for partitions 32. These units are to be secured together by bolts 33, as the units previously described, and in addition, holes 34 and 35 may be formed in the tongues 28 and grooves 29 respectively, so that bolts 36 may be inserted to further aid in holding the units together.

A fill-in unit, for small spaces, may be made by providing extruded side rails 37 as companion.

## 5

members for side rails 25, and separate inner and outer panels 38 and 39 of requisite width. Side rails 37 have vertical side flanges 40 and 41, rabbeted as at 42 and 43 to receive the side panels 38 and 39. The rabbets are of sufficient depth to permit the outer surfaces of the side panels to be flush with the side flanges 40 and 41 of the side rails. The panels are held in position by means of screws or other suitable fastening means. Side rails 37 are also provided with grooves 44 to receive partitions 45.

A further adaptation of the extruded unit is shown in Figure 8. In this type, the side rails 46, inner and outer panels 47 and 48, and the partitions 49 are all unitary, being extruded in a single operation. This type will have all of the desirable features of the other forms, together with ease of manufacture.

With the extruded types especially, cover plates 50 may be used to close the ends of the units. These covers are of pressed metal and are substantially pan-shaped, having a bottom 51 and a surrounding side flange 52. The cover is shaped to fit the inside of the unit, the flange being slightly flared to yieldingly bear against the inner surfaces of the side rails and panels. Recesses 53 are formed in the flange to receive the partitions.

With any of the units described, the inner and outer panels may have any finish desired, so that with the addition of sealing strips 54 over the division lines between units, a finished wall structure is obtained. On the other hand, a brick or other veneer may be placed upon the outside panel, and the inside panel may be plastered or finished with a wood paneling.

Although any of the units described may be used as floor units, in Figures 2 and 3 a floor unit 55 of special construction is shown in detail. The floor unit is quite similar to the wall unit insofar as the side rails 56 and the upper and lower panels 57 and 58 are concerned. The side rails are provided with a stepped joint 59, as described, and the upper panel is positioned so as to overlap one side rail. The lower panel, however, is placed so that its side edges are flush with the sides of the side rails. This is to permit the use of stiffener plates 60 between units. Plates 60 are wider than the thickness of a unit and extend below the unit a substantial distance. The upper portion of the plate is bent, as at 61, to conform to the stepped joint between units. These plates increase the load bearing capacity of the assembled units by imparting a truss action between spans.

Departing somewhat from the structure of the wall unit, the floor unit uses but a single partition 62 fitted into grooves 63 in the side rails. The partition is located near the bottom of the unit, and the compartment or cell formed between the partition and the lower panel 58 may be filled with insulation.

Extending between the side rails at spaced intervals are cross bridges 64 which extend from the partition 62 to the underside of the upper panel 57. These serve to strengthen the floor and supply added rigidity to the units. The lower panels are supplied with pressed metal cleats 65, similar to those used in the wall units. As was the case with the wall units, the floor units are designed to fit together in interlocking relation and be held together by bolts 66 passing through keyhole slots 67. It will be obvious that the stiffener plates 60 will need similar keyhole slots 68 as the bolts must pass through them.

Openings 69 may be provided in the cross

## 6

bridges 64 to permit the passage of water or electrical conduits. These same conduits may be brought up through the side wall through one of the compartments, as shown in Figure 1. The stiffener plates may also be provided with openings 70, so that these plates may serve as hangers for conduits or the like.

The floor unit just described is also suitable for use as a roof unit, and it will be noted that as either flooring or roof, the side rails serve as joists to support the weight. The truss-like stiffener plates substantially increase the strength of the assembled floor or roof.

The wrench previously mentioned is specially designed to hold and insert the unit-connecting bolts. The wrench comprises an elongated body 71 having a handle 72 at one end and a head 73 at the other end. The body portion of the wrench must be of a diameter no greater than that of the bolts used, so that when the wrench lowers the bolt into the smaller part of the keyhole slot, the body of the wrench will still be free to rotate.

The head 73 comprises a cylindrical barrel 74, which is bored axially, providing a cylindrical bore 75 through the forward portion of the barrel, and a cylindrical bore 76 forming a chamber of larger cross-section through the rear portion. A sleeve 77 of corresponding cross-section to the bore 75 fits slidably within the bore 75 and is provided with a flange 78 slidably within the bore 76. Sleeve 77 is also bored axially, as at 79, and the forward end of the bore is threaded to receive the threaded end of the unit-connecting bolt, as will be described. Sleeve 77 is normally urged forward by a coiled spring 80 which fits within the chamber 76 and abuts the end of the sleeve. The forward movement of sleeve 77 is limited by the shoulder between chamber 76 and bore 75. The opposite end of spring 80 bears against a plug 81 threaded into the rear end of chamber 76. Plug 81 may be fixedly held in position by means of a set screw 82. Plug 81 has a recess in its outer end into which the body of the wrench is seated, a cotter pin 82 holding the head to the body portion. The forward end of the barrel 74 has a threaded reduced portion 83, upon which is removably positioned a nut socket 84, of such inner size and shape as to fit the nut used in conjunction with the unit-connecting bolts. A plurality of these fittings may be provided for nuts of different sizes and for nuts which are square, hexagonal, et cetera.

When it is desired to couple two of the building units, a pair of washers is placed upon a bolt 17, and a nut threaded on the end of the bolt. The threaded end of the bolt is then threaded into the sleeve 77 far enough to support the bolt in alignment with the body of the wrench. The bolt and wrench are then passed through one of the keyhole slots 18, as previously described. When the bolt is properly positioned in the lower portions of the slots, the wrench is pushed forward, moving the sleeve 77 rearward against the spring 80, and permitting the nut to enter the socket 84. The wrench is then rotated to tighten the nut. When the nut is turned home, the wrench is drawn outward, permitting the sleeve to move forward and the nut to leave the socket. The wrench can then be rotated in the opposite direction to remove the sleeve from the threads of the bolt. The wrench is then free and can be removed from the unit.

While there has been described preferred and

practical embodiments of the invention, it is to be understood that many changes may be made from the precise embodiments shown without departing from the scope of the appended claim.

What I claim is:

In prefabricated building construction, the method of joining prefabricated units having spaced side rails and closed sides with aligned keyhole slots in the side rails and bolts having means engageable with said side rails to prevent relative turning of said bolts when seated in said keyhole slots, comprising placing the units in position with their side rails abutting, passing a long-handled wrench holding a bolt and nut through the wide portion of the keyhole slot in one side rail and through the opening in the opposite side rail and the side rail of the abutting unit, lowering the wrench until the bolt is seated in the smaller part of the keyhole slots with the bolt head on one side of one side rail and the nut on the opposite side of the abutting side rail and with said bolt means engaging the side rail to prevent turning of the bolt, rotating the wrench to tighten the nut, and then removing the wrench.

VICTOR J. HULTQUIST.

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