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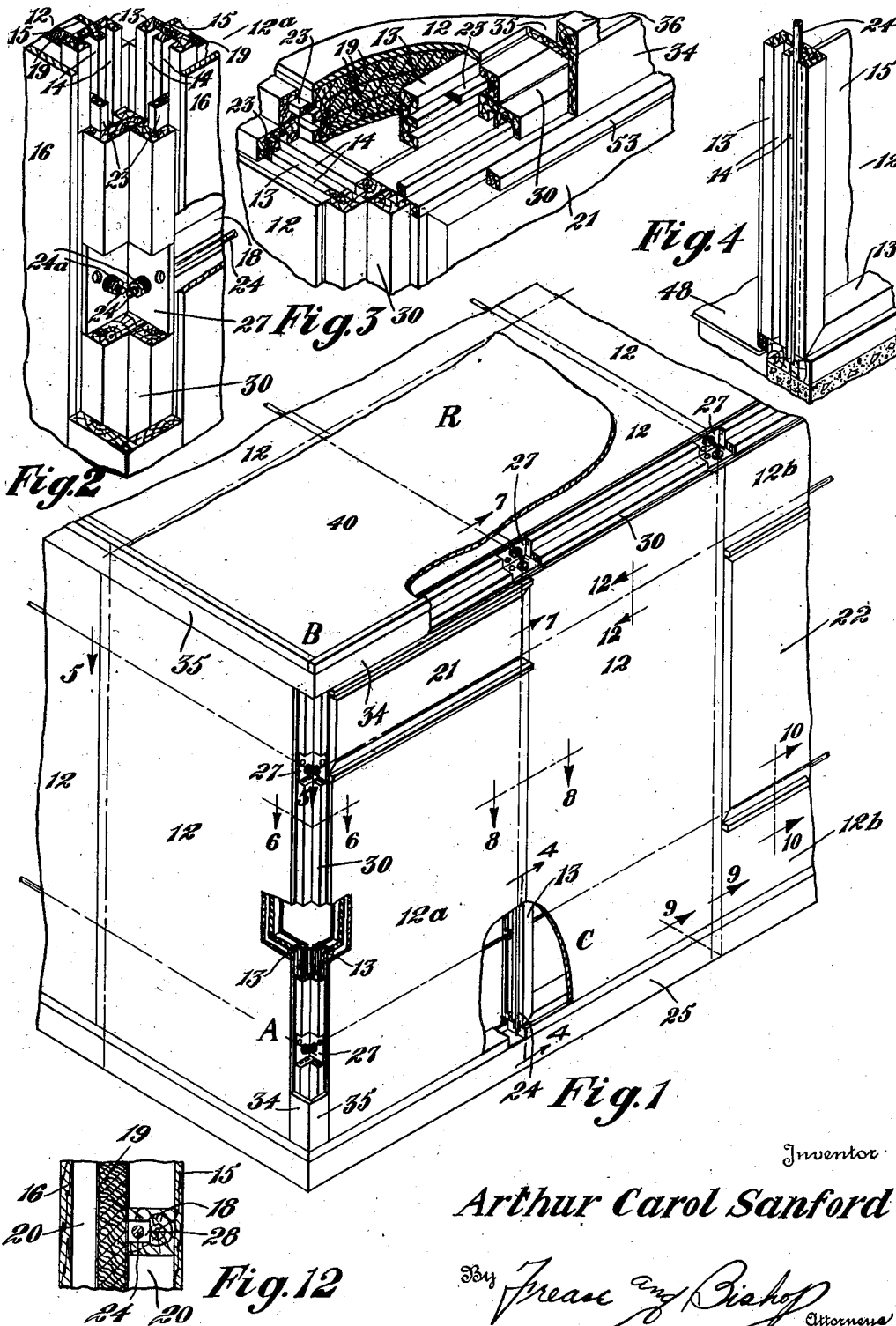
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2,260,058

PREFABRICATED BUILDING STRUCTURE

Filed Sept. 5, 1939

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

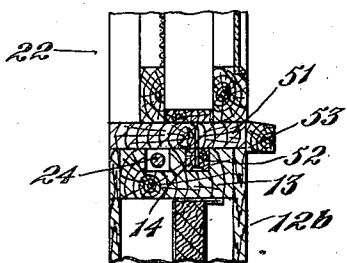
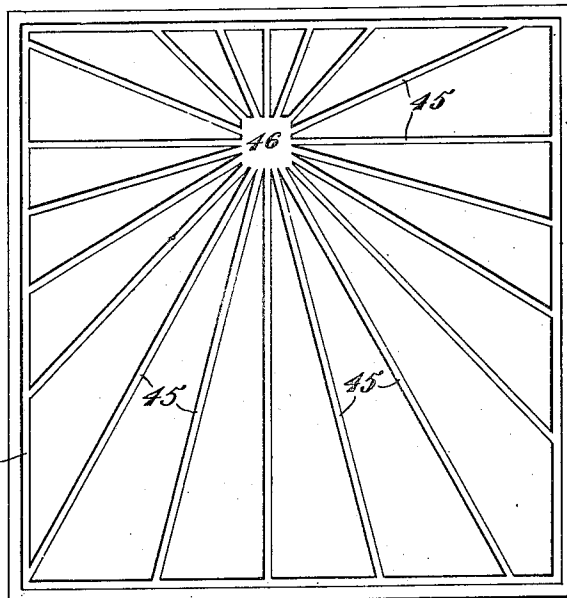
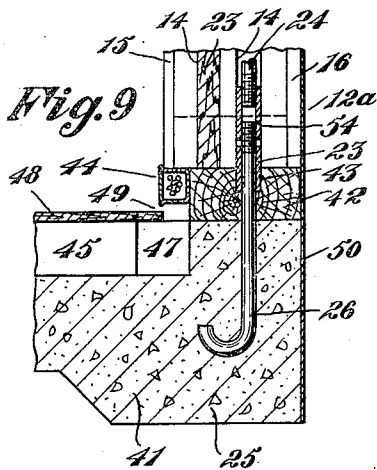
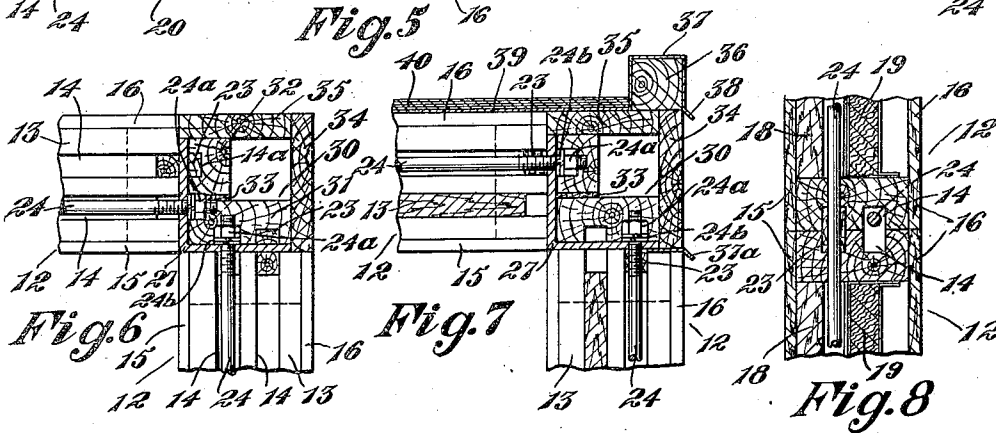
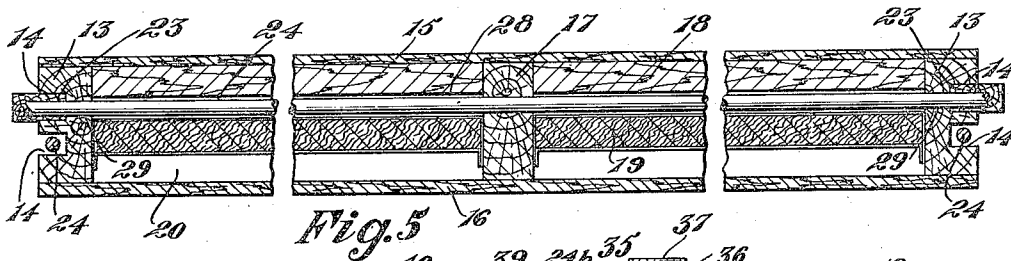


Fig. 10

Fig. 11

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UNITED STATES PATENT OFFICE

2,260,058

PREFABRICATED BUILDING STRUCTURE

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Application September 5, 1939, Serial No. 293,331

8 Claims. (Cl. 20-2)

The invention relates generally to building construction, and more particularly to the economical construction of buildings by erecting and assembling unit parts of panels which have been prefabricated according to modern factory methods.

The present invention is particularly adapted for constructing inexpensive homes or dwellings within the financial range of a large majority of the population made up of those who are entirely unable to afford the building of homes by the present conventional method of using lumber and other materials and fabricating practically everything at the point of erection. This conventional method is expensive not only because of the cost of materials but more especially because of the labor cost involving innumerable hand operations including cutting, trimming, fitting and finishing operations.

Prior prefabricated structures have proposed the use of prefabricated units, but the construction of the units themselves has required special materials and in many cases has required a number of special shapes or sizes, which has unduly increased their fabrication and erection cost.

Moreover, certain of such prior structures require the erection of a self-supporting metal framework for the whole structure, and the metal framework for the whole structure or at least for one or more walls thereof must be completely erected before the prefabricated units can be put in place. This self-supporting metal framework involves a large amount of metal and its erection requires increased time and labor, so that the cost saved by using prefabricated unit panels is largely offset by the material and erection cost of the metal framework.

It is therefore a general object of the present invention to provide a novel and improved prefabricated building structure which can be erected more easily and rapidly, and with materially less erection and manufacturing cost, than has been heretofore possible.

A further and more specific object is to provide a building structure in which the walls and roof are constructed of prefabricated units in a minimum number of standard sizes, resulting in greatly reducing cost of erection and manufacture.

Another object is to provide a novel structure utilizing units prefabricated entirely from ordinary inexpensive materials of standard sizes and shapes, and said units having heat insulating properties.

A further object is to provide an improved building structure constructed of prefabricated units which are adapted after erection to have any desired exterior finish applied thereto, such as brick veneer, shingles, siding and the like.

Another and very important object is to provide a structure utilizing prefabricated units requiring a minimum amount of metal reinforcement and clamping means consisting of ordinary metal rods erected step by step with the prefabricated units and adapted to form a network for completely binding the entire structure together when it is completed.

A further object is to provide a prefabricated structure which lends itself to a multiplicity of changes in design and appearance.

A still further object is to provide a novel structure utilizing the same prefabricated unit construction in all interior walls as well as exterior walls and roof, whereby the entire structure includes a very small variety of materials and parts and eliminates substantially all hand operations at the point of erection.

And finally, it is an object of the present invention to provide a novel prefabricated building structure which incorporates all of the foregoing advantageous features, and constitutes an inexpensive, strong and well insulated dwelling.

Other specific objects include the provision of a novel and efficient heating system which enables the structure to be erected upon a slab in the ground and eliminates the necessity of providing the usual foundation and basement required in conventional dwellings.

The foregoing and other related objects are accomplished by the parts, elements, improvements, and combinations comprising the present invention, which is shown by way of example in the accompanying drawings, and hereinafter described and claimed.

In general terms, the invention comprises a structure made up of prefabricated units which are constructed entirely of ordinary materials in standard sizes and shapes, the units being made in standard widths and lengths which are according to a module system, and the units having double grooves at their marginal edges to accommodate a spline at the joints and a reinforcing rod, the rods in adjoining walls being connected together at the building corners to form a network binding the units together under compression.

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

Figure 1 is a fragmentary isometric view of a building constructed according to the invention, parts being broken away to indicate the detailed construction at the joints and building corners;

Fig. 2 is an enlarged fragmentary isometric view of the corner construction as at A in Figure 1, parts being broken away and parts in section;

Fig. 3 is an enlarged fragmentary isometric view of the top corner as at B in Figure 1, parts being broken away and parts in section;

Fig. 4 is an enlarged fragmentary isometric view as on line 4-4 in Figure 1, parts being broken away and parts in section;

Fig. 5 is an enlarged transverse sectional view of one of the prefabricated units as at 5-5, Figure 1, showing the position of the spline members and reinforcing rods therein when the units are erected;

Fig. 6 is an enlarged fragmentary sectional view as at 6-6, Figure 1;

Fig. 7 is an enlarged fragmentary sectional view as at 7-7, Figure 1;

Fig. 8 is an enlarged fragmentary sectional view as at 8-8, Figure 1;

Fig. 9 is an enlarged fragmentary sectional view as at 9-9, Figure 1;

Fig. 10 is an enlarged fragmentary sectional view as at 10-10, Figure 1;

Fig. 11 is a plan view of the floor slab supporting the building structure and showing the heating system; and

Fig. 12 is an enlarged fragmentary sectional view as at 12-12, Figure 1.

Similar numerals refer to similar parts throughout the various views of the drawings.

In the drawings the invention is shown as applied to the construction of a one-story dwelling having a flat roof, but it will be understood that the design and the appearance of the structure may be varied as desired, and the roof may be likewise varied in design and appearance by adding gables and the like, without departing from the scope of the invention.

Moreover, while I have illustrated a structure in which the exterior surface of the walls is formed by the exterior surfaces of abutting panel units, the improved construction is adapted for being supplemented by any desired exterior finish such as brick veneer, shingles or siding.

The walls of the improved structure are made up of abutting panel units such as indicated at 12, 12a and 12b, a cross section of a preferred embodiment of one of the units 12 being shown in Fig. 5. The height of the units 12 is the full height of the walls and is preferably eight feet and the width of the units 12 is preferably four feet, because these dimensions are best adapted for factory production of the panel units.

As shown in Fig. 5 each panel unit has an outer frame of standard 2" x 4" wood members 13 extending entirely around its periphery and having two exterior longitudinal grooves 14 therein, and an interior plywood panel covering 15 and an exterior plywood panel covering 16 is secured to the frame members 13 in any suitable manner.

Preferably the interior covering 15 is one-quarter inch waterproof resin glue plywood and the exterior panel covering 16 is three-eighths inch waterproof resin glue plywood, although other covering materials can be used if desired. A vertical frame member may be used midway between the outer members 13 as shown at 17 and is preferably an ordinary 2" x 4" member of standard size.

Suitable cross brace wood members 18 may ex-

tend between the frame members 13 and 17 at intervals throughout the height of the panel units, and these cross brace members 18 preferably are made by slitting a standard 2" x 4" member longitudinally in half. An insulation wall or blanket 19 is provided within the panel units 12 and preferably is encased in waterproof paper and positioned against the cross brace members 18 as best shown in Fig. 5. This insulation blanket 19 is preferably one inch in thickness so as to leave an air space 20 between the blanket and the exterior plywood panel covering 15.

It is understood that the improved panel units may be constructed of other materials, and may be made of suitable plastics or other materials which are formed or cast preferably with the double grooves in all exterior edge faces.

All of the prefabricated panel units for exterior walls are identical in construction to the panel units 12 and vary only in size, that is, width and height. In order to provide for doors, windows, etc. it is of course necessary to provide units of lesser height and width than the panels 12, but according to my invention, such panel units are all made in sizes according to what may be termed a module system. In other words, the panel units 12 are multiples of the other panel units in width or height so that a minimum number of sizes of panel units is required. Thus in Fig. 1 a panel unit 12a is shown fitting under a small window 21, and the panel unit 12a is four-fifths the height of the panel units 12 while being the same width. Similarly, the panel units 12b above and below a large window 22 are one-fifth the height of the panel units 12.

Other sizes of panel units according to the module system may be the same height as unit 12 and a fractional part of the width, as for instance, one-fourth, one-half or three-fourths of the width; or they may be made in fractional heights and widths with respect to the unit 12. For example, to accommodate a door three feet wide by six feet six inches plus high, one of the panels 12 would be replaced by a panel four feet wide and nineteen and one-fifth inches high located over the door, and a panel one foot wide and six feet and several inches high alongside the door.

The panel units for interior partition walls of the improved structure are constructed in sizes according to the same module system, but the interior wall panel units are preferably made thinner than the outer wall panel units, by merely using half 2" x 4" frame members formed by slitting standard 2" x 4" members in half longitudinally. These half frame members are used in place of the 2" x 4" frame members 13 in the panel units 12 and provided with one exterior slot for receiving the spline; otherwise the construction of the interior wall panels is identical with that of the exterior wall panels 12.

As shown in the drawings, the 2" x 4" frame members 13 extend around all four sides of each panel unit, and the exterior grooves 14 in the frame members 13 provide double grooves in all the edge faces of said panel units. One of these grooves is adapted to receive a spline member 23 for interlocking and aligning the abutting or adjoining panel units at the joints thereof. The other groove 14 is adapted to receive a reinforcing rod 24 extending longitudinally of the groove for reinforcing the walls and tying the units thereof together under compression.

In Figure 1 the locations of the various reinforcing rods 24 are indicated by dot-dash center

lines, showing that a reinforcing rod 24 extends vertically in each joint between all the abutting panels, and that horizontal rods 24 extend through the panel units at intervals throughout their height. The vertical rods are anchored in the floor slab 25, as shown at 26 in Fig. 9 and their upper ends project slightly above the upper ends of the panel units. The horizontal rods 24 in the roof wall R extend through the joints between abutting panels and project slightly beyond the ends of the roof wall into the corner between the adjoining panels of the roof wall and side wall, and are in alignment with the vertical rods of the side wall.

Individual means for placing the wall units under compression and for connecting the adjacent ends of the rods of adjoining walls, preferably includes angle clips or plates indicated at 27 and adapted to fit in the building corners between adjoining walls. These angle plates 27 also are used to connect the adjacent projecting ends of the horizontal rods of adjoining vertical walls, and these horizontal rods extend entirely through all of the panel units throughout one wall, that is, from one building corner to another.

As shown in Fig. 5 the horizontal rods 24 extend through a slot 28 in the brace member 18 and through holes 29 in the side frame members 13 which holes communicate with the slots 14 receiving the splines 23, so that the horizontal and vertical rods cross each other in different vertical planes. The spline members 23 are made in sections extending between the horizontal rods or between the horizontal rods and the top and bottom ends of the panel units, so as not to interfere with the passage of the horizontal rods through the walls.

Preferably the angle plates 27 are provided with staggered holes for selectively receiving the rods in each leg of the angle plate so that the angle plates can be used interchangeably at any building corner regardless of which of the two grooves 14 receive the rod 24. Nuts 24a may be screwed on the projecting ends of the rods 24 to clamp the rods to the angle plates 27, and resilient means such as split washers 24b may be interposed between the nuts and the plates, for compensating for expansion and contraction due to weather conditions, although there will be very little change in the length of the rods since they are incased in insulated walls.

At the building corners between adjoining vertical walls and between the vertical walls and the adjoining roof wall R, angular corner spline members 30 are provided for interlocking the panel units of the adjoining walls. These corner splines 30 are made up of a standard 2" x 4" 31 with the double grooves 14 identical with the grooves 14 in frame members 13, and a half 2" x 4" 32 having a single groove 14a, and the members 31 and 32 are secured together in angular or L-shaped form with a piece of plywood 33 therebetween; so that the groove 14a registers one of the grooves 14 in the panel units of one wall and the grooves 14 of the 2" x 4" member 31 register with the grooves 14 of the panel units in an adjoining wall.

Spline members 23 interfit the groove 14a and the mating groove 14 of the adjoining panel units, and the spline members 23 interfit one of the grooves 14 in the member 31 and the mating groove 14 of the adjoining panel units. These corner spline members 30 extend along the building corners between the angle plates 27 therein

and provide means for interlocking the panel units of adjoining walls.

Wood corner plates 34 and 35 are provided at the building corners for covering the corner spline 30 and the angle plates 27, the sides of the angle plates 27 and corner splines 30 being such as to form an offset at the outer faces of the adjoining panel units for receiving these corner plates, as clearly shown in Figs. 6 and 7.

At the building corners between the vertical walls and the roof, a 2" x 2" cap piece 36 may be provided on top of the outer edge of the corner plates 34 and 35 as shown in Fig. 7, and a metal flashing 37 is applied over the corner piece and has an outturned drip flange 38 at the exterior side thereof and an inwardly extending flange 39 overlying the plate 35 and a portion of the adjoining panel units 12 in the roof. A waterproof roofing of layers of tar, felt and gravel may be built up on top of the flashing 37 and the roof panels as indicated at 40 in Figs. 1 and 7. Preferably, a metal flashing 37a is inserted in all horizontal joints between units, or between units and corner plates, as shown in Fig. 7.

The floor slab supporting the structure is preferably a concrete slab 41 which may be approximately six inches in thickness and is indicated in Fig. 9, and the exterior walls of the structure preferably rest on a 2" x 4" plate 42 having a single longitudinal groove 43 in its upper side, the plate 42 resting directly on the outer marginal surface of the slab 41. A metal channel 44 of well known construction for housing electric wiring and serving as a baseboard and receptacle outlet is located in the corner formed at the inner surface of the outer walls between the bottom ends of the panel units and the plate 42, as shown in Fig. 9.

Preferably the floor slab is provided with a series of radiating ducts 45 which extend outwardly in the upper surface of the slab from a central duct 46 to a continuous duct 47 extending entirely around the floor slab adjacent to the floor plate 42 and immediately below the baseboard channel 44. The heating plant for the building structure is located directly over and communicating with the central duct 46 when the structure is erected, and a layer of flooring 48 which may be plywood is applied over the floor slab covering all of the radiating ducts 45 and terminating under the baseboard channel 44 as shown in Fig. 9. The flooring 48 is preferably applied with mastic cement after all other work on the structure has been completed.

Accordingly heated air may be circulated from the central heating duct 46 outwardly through the radiating ducts 45 and into continuous duct 47, from which it circulates into the rooms of the structure through the slot 49 between the channel 44 and floor covering 48. In this way the entire floor of the structure is uniformly heated and insulated from the cold permeating from the outside through the floor slab. Suitable air outlets may be provided in the upper portions of the rooms for returning the air to the heating plant.

As shown in Fig. 9 the lower part of the exterior walls and the exterior of the floor slab may be waterproofed by applying thereto a waterproof membrane 50 such as sheet copper and the like.

The door and window jamb construction of the improved building structure is made to conform to and interlock with the frame members 13 of the panel units. As shown in Fig. 10 the joint between the window 22 and the abutting panel

unit 12b is shown by way of example. The window jamb includes a wood strip 51 having a spline portion 52 which fits into one of the grooves 14 of the frame member 13 of an abutting unit for interlocking the window and adjoining panel units together, and a sill cap piece 53 is provided on the exterior of the jamb member 51. A similar cap piece 53 may be applied on the exterior of the window jamb at the head and sides thereof.

In erecting a building structure according to the present invention, the concrete floor slab 41 is first poured, suitable forms being used to provide for the radiating ducts 45 and the continuous duct 47 in the upper surfaces of the slab. Preferably, standard 2" x 4"'s are used as forms for the radiating ducts 45 and a half 2" x 4" is used for the continuous duct 47, and these forms are removed after the concrete is set.

The vertical reinforcing rods 24 are anchored in the concrete slab 41 when it is poured and a preferred way of accomplishing this is to anchor the hooked stub rods indicated at 26 at intervals corresponding to the width of the panel units so that their upper ends project some four inches above the slab, as indicated in Fig. 9. The upper ends of these stub rods are threaded and the lower ends of the vertical reinforcing rods 24 are also threaded so that the rods 24 may be easily connected to the stub rods as by a coupling sleeve indicated at 54.

Next the wood plate 42 is laid at the outer marginal surface of the floor slab, being provided with suitable holes permitting the stub rods 26 to pass therethrough.

The panel units and the reinforcing rods therefor forming the outer vertical walls of the structure are then erected by positioning spline members 23 between the stub rods and in the groove 43 of the plate 42 after which a panel unit 12 may be positioned on the plate with one of the grooves 14 in its bottom edge face fitting over the spline 23. One of the vertical reinforcing rods 24 is then connected to the stub rod at the side edge face of the panel unit and located in one of the side grooves 14 of said unit, and the vertical spline members are then positioned in the other side groove with spaces between their ends to accommodate the horizontal reinforcing rods to be inserted later. The abutting panel unit is then positioned with one of its bottom grooves engaging another spline member in the plate groove 43 and one of its side grooves receiving the spline members already positioned in one of the side grooves of the first panel unit.

In the joint formed by the abutting panel units the mating grooves 14 in which the vertical reinforcing rod 24 is located provide a passageway which is much larger than is necessary to accommodate the rod, and this extra space is very useful for inclosing utility wires and piping which may be necessary for the interior of the structure.

After a row of laterally abutting panel units 12, or panel units 12, 12a, 12b, etc., has been thus erected to form a complete vertical wall of the building, and the angle plates 27 are connected to the top ends of the vertical rods, the horizontal reinforcing rods 24 are inserted from one end of the wall through all the panels thereof to the other end of the wall, as indicated in Figs. 1 and 5, and the angle plates 27 may then be positioned and the rods 24a and washers 24b attached to the ends of the horizontal rods to securely clamp the laterally abutting panel units together under compression.

An adjoining vertical wall may then be erected in the same manner and the adjoining panel units at the corner of the two walls are interlocked by means of the corner spline members 30.

In the same way the roof panel units 12 are erected being interlocked with the top ends of the vertical walls by means of the corner spline members 30, and the reinforcing rods 24 in the roof being connected to the angle plates 27 which are also connected to the vertical reinforcing rods.

At any convenient time in the course of erection, the interior partition walls may be erected in the same manner as the exterior walls are erected. These interior walls may be erected according to any desired floor plan, and the same prefabricated unit construction can be applied to the construction of a mantle or fireplace and various other inside details.

It is obvious that in the course of erecting the vertical walls of the structure, doors and windows of various sizes in the module system used can be incorporated by using panel units of fractional widths or heights in connection with the doors or windows, such as the panel units 12a and 12b shown in Fig. 1.

After the walls and roof are all thus erected, the corner cover strips or plates 34 and 35 may be attached, and the cover cap 36 also attached at the upper corners. The flashing 37 may then be applied with the roofing 40 and the complete structure provides a strong rigid building, the wood panel units thereof being held together under compression by the network of reinforcing rods which take the tension, so that the building may be considered as a monolithic structure which not only has exceptional strength and rigidity but has high heat insulating qualities.

It is to be emphasized that the network of reinforcing rods is erected step by step along with the panel units, so that the erection of a self-supporting metal framework prior to the erection of the panel units is not required, and the network of reinforcing rods provides sufficient means for tying the panel units together with a minimum amount and weight of metal involved.

After the walls and roof of the structure are completed as described the waterproof sheeting 50 is applied, and any exterior finish can be applied to the walls as desired, as for example brick veneering, shingles or siding. The appearance of the structure is easily altered to produce a variety of designs by changing the relative lengths of the outer walls and by using different combinations of the windows with different fractional size panel units. Also, another vertical wall of panel units may be added on top of the lower wall to provide a two story building and the shape of the roof may be altered to provide a gabled roof or the like.

Where the flat roof is used with a single story building or where the roof wall becomes a second story floor, the reinforcing rods therein are preferably uniformly spaced in each direction, as for example the rods running one way are spaced four feet apart, and the rods running at right angles are also spaced four feet apart. Increased roof and floor spans are taken care of by increasing the size of the metal reinforcing rods and by spacing the rods at smaller intervals in each direction in the roof or floor.

I claim:

1. A building structure comprising a roof and walls formed of edge-abutting prefabricated units having double grooves in their marginal edges,

spline members interfitting one set of said grooves at the joints between abutting units, reinforcing rods located in the other set of said grooves at the joints between abutting units and projecting therefrom at the building corners, and means connecting the projecting ends of said rods for holding the units together.

2. A building structure including side and roof walls formed of abutting prefabricated units each having two grooves in its marginal edges mating with the grooves in abutting units, spline members interfitting one set of mating grooves for interlocking abutting units, reinforcing rods located in the other set of grooves of each wall, reinforcing rods extending through each wall at right angles to the first said rods, and means at all the building corners individually connecting the reinforcing rods in adjoining walls.

3. In a building structure, a wall formed of abutting prefabricated units each having two grooves in its abutting edges, a reinforcing rod extending through one of said grooves at each joint between units, reinforcing rods extending through said wall at right angles to the first said rods, spline members interfitting the other of said grooves at each joint and extending along the joints between said units, and means on said rods at the ends of the wall for holding all the units thereof together under compression.

4. In a building structure, a wall formed of abutting prefabricated units each having two grooves in its abutting edges, a reinforcing rod extending through one of said grooves at each joint between units and projecting from the ends of said wall, spline members interfitting the other of said grooves at each joint for interlocking the units, and means on the projecting ends of said rods for clamping the units under compression.

5. A building structure including adjoining walls and a roof formed of interlocked prefabricated panel units having grooved abutting edges, reinforcing rods located in said grooved edges and reinforcing rods extending through said panel units at right angles to said first rods to form a reinforcing network in the planes of the walls and roof, and means for individually connecting the rods extending through the panel units of adjoining walls together and the rods

in the grooved edges of the walls with the rods in the roof for clamping the wall and roof units together under compression after the units are erected.

6. A building structure including side walls and a roof wall formed of abutting prefabricated panel units, all of said panel units having standard 2" x 4" wood outer frame members provided with two parallel exterior grooves, spline members interfitting one set of mating grooves for interlocking abutting units, reinforcing rods located in the other set of mating grooves of said units, reinforcing rods extending through all the units of the walls at right angles to the rods in said grooves, means at all the building corners individually connecting adjoining rods of adjoining walls, and corner members formed from standard 2" x 4" wood members located in the corners between the adjoining walls and between the walls and the roof, said corner members having grooves mating with the grooves in the panel units of said adjoining walls and roof, and splines interfitting the mating grooves of said corner members and said adjoining wall and roof panel units.

7. A building structure comprising a roof and adjoining walls formed of edge-abutting prefabricated units having double grooves in their marginal edges, spline members interfitting one set of said grooves at the joints between abutting units, reinforcing rods extending through the other set of said grooves, and individual means connecting the rods in the walls with adjoining rods in the roof for tying the walls and roof together.

8. A building structure including side and roof walls formed of abutting prefabricated units having grooved joints, spline members interfitting said grooved joints intermediate the building corners, longitudinally extending corner spline members interconnecting adjoining walls at the building corners, reinforcing rods extending through the walls and projecting therefrom at all the building corners, and means located within the building corners between adjoining walls individually connecting each pair of reinforcing rods in adjoining walls for tying the units together.

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