May 15, 1945. F. B. FORWARD 2,375,910

PREFABRICATED BUILDING CONSTRUCTION

Filed Jan. 31, 1942 5 Sheets-Sheet 1

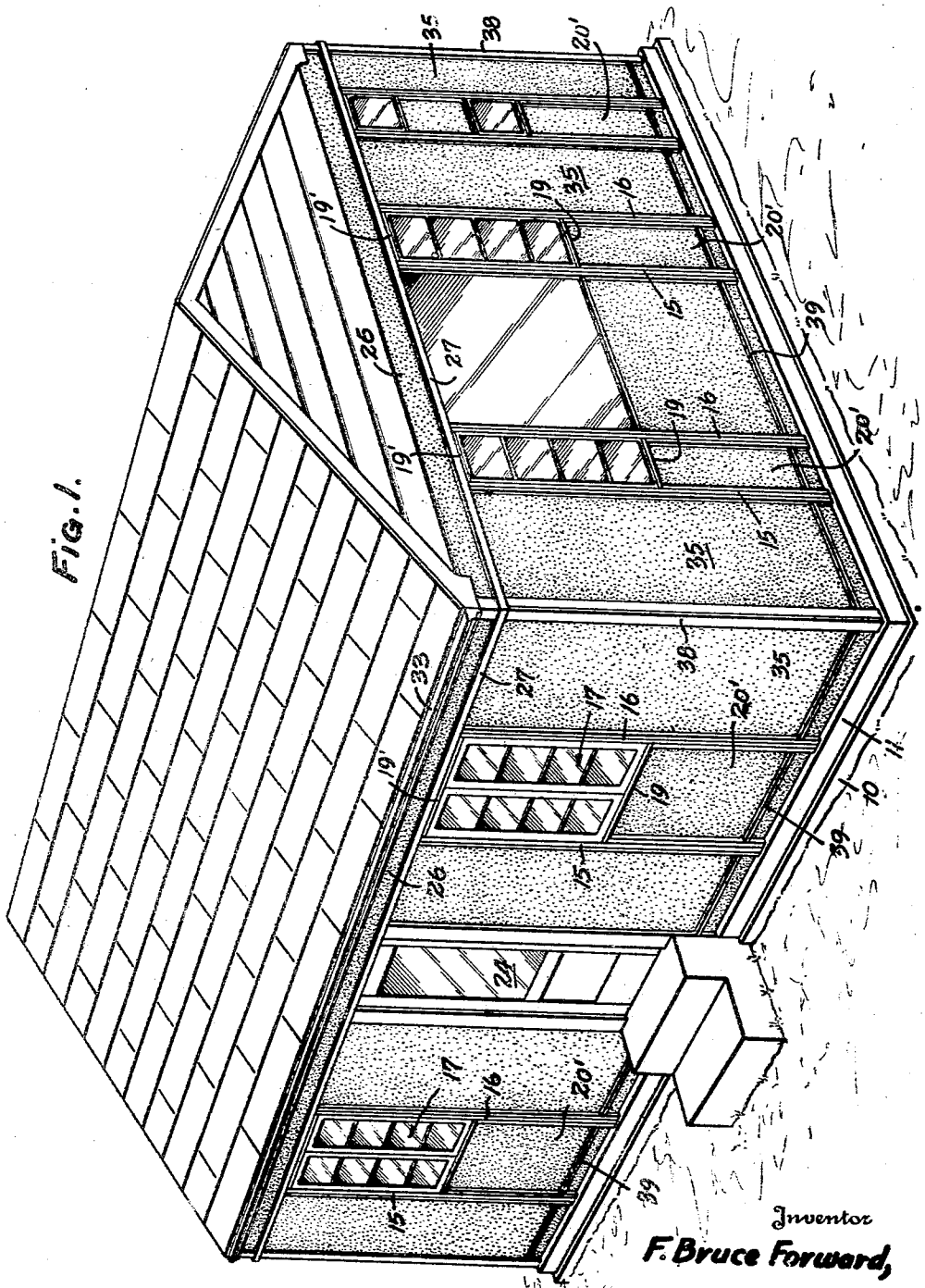


Fig. 1.

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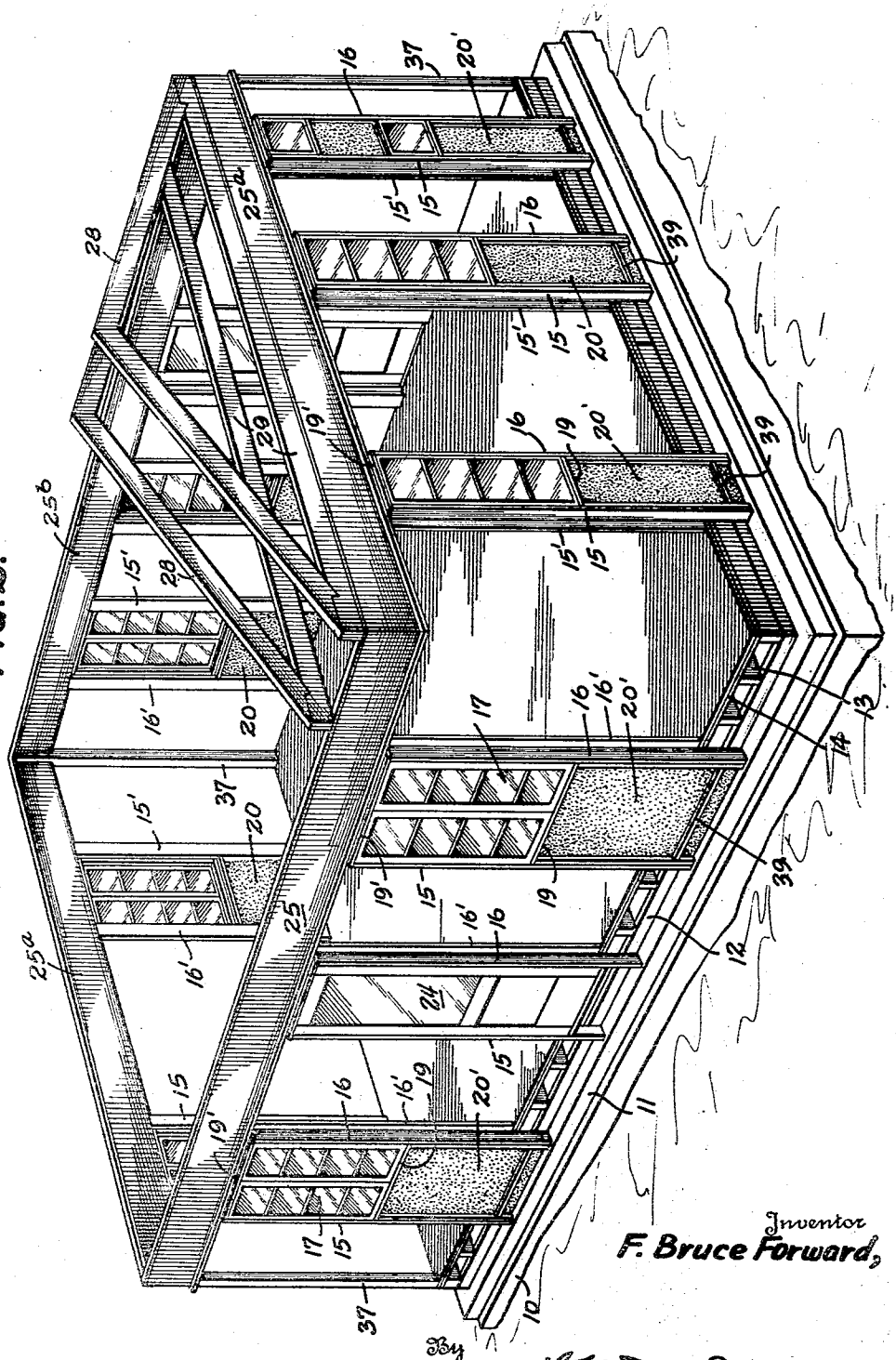

Fig. 2.

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PREFABRICATED BUILDING CONSTRUCTION

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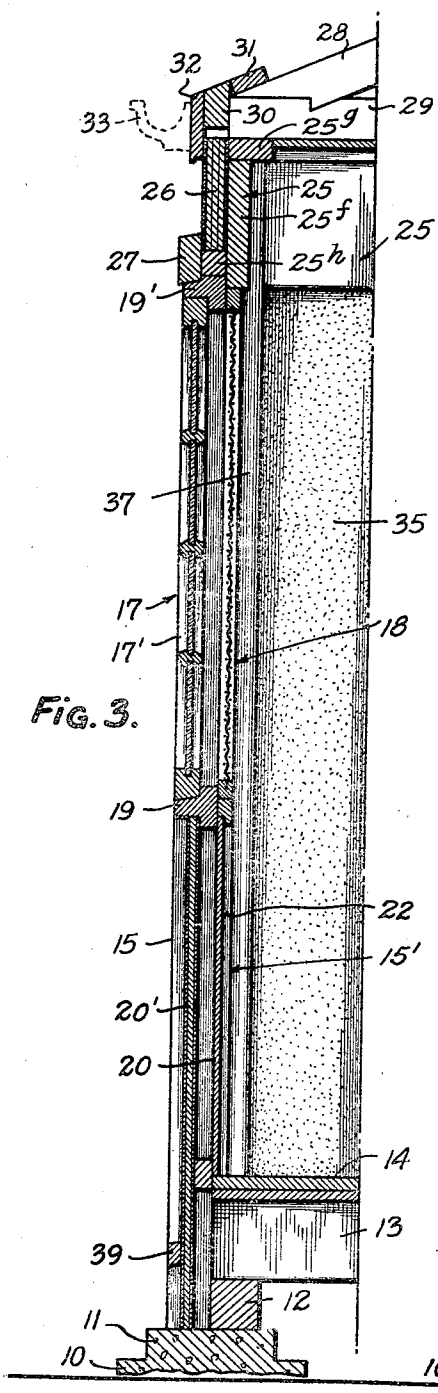


Fig. 3.

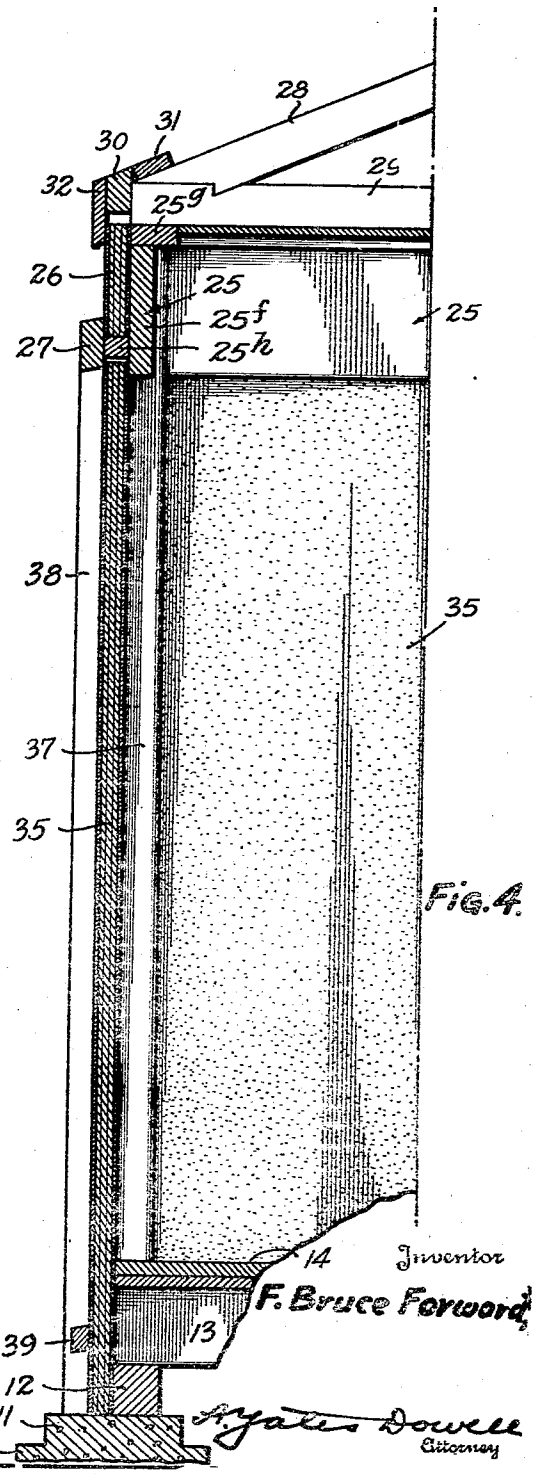


Fig. 4.

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PREFABRICATED BUILDING CONSTRUCTION

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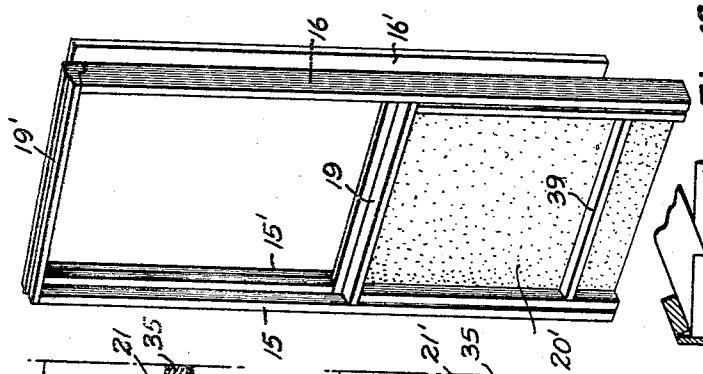


Fig. 6a.

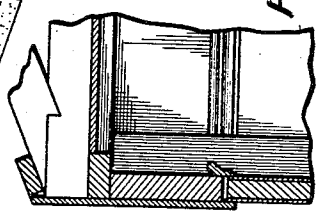

Fig. 9.

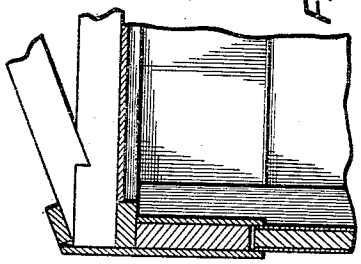

Fig. 8.

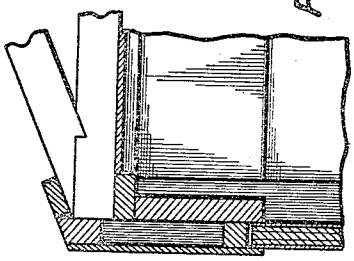

Fig. 7.

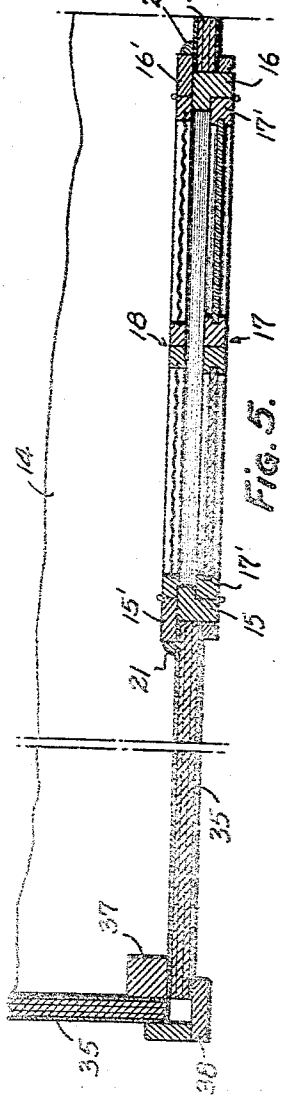


Fig. 5.

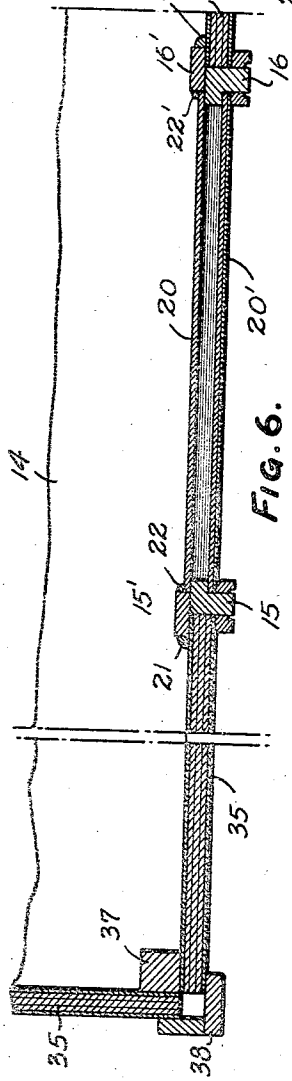


Fig. 6.

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PREFABRICATED BUILDING CONSTRUCTION

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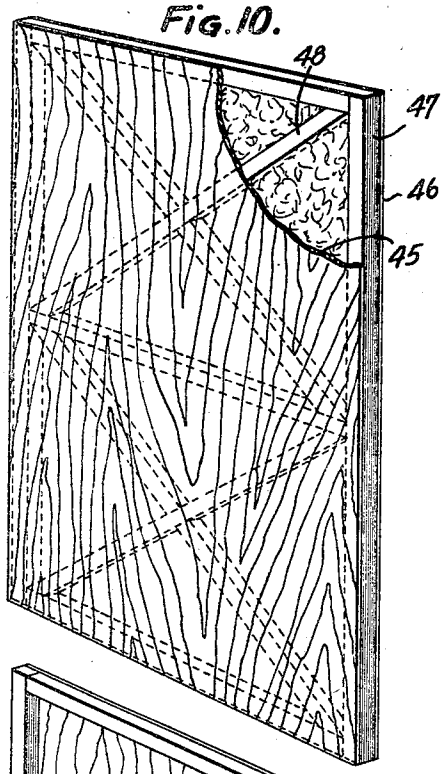
Fig. 10.



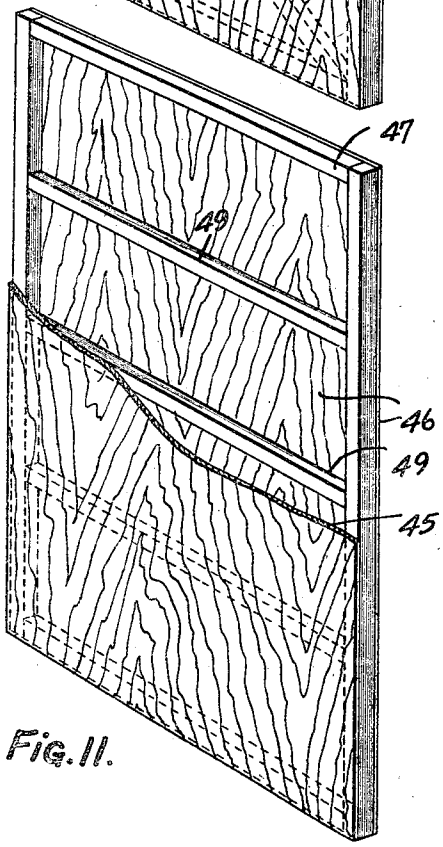
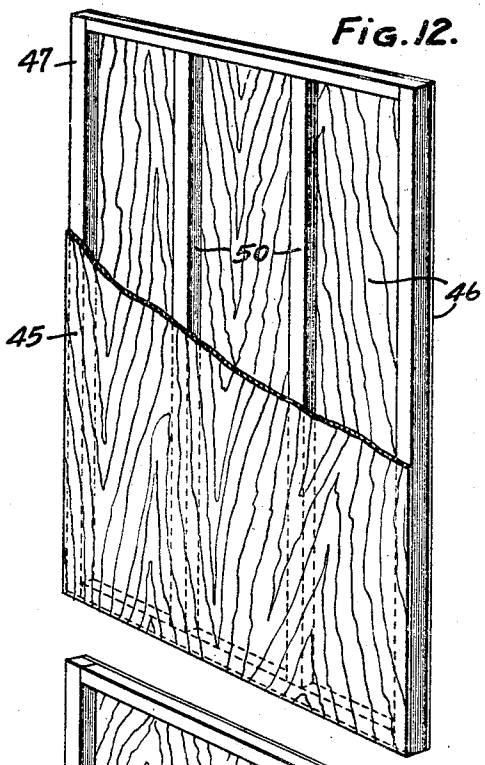




Fig. 11.

Fig. 12.



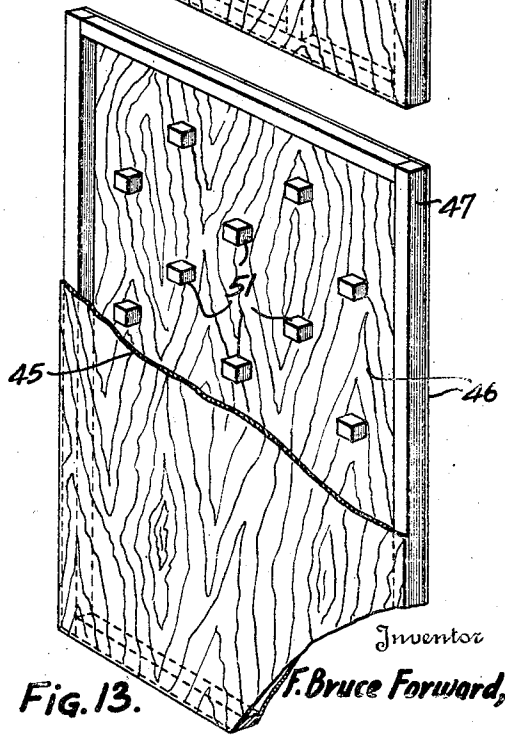




Fig. 13.

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2,375,910

# UNITED STATES PATENT OFFICE

2,375,910

## PREFABRICATED BUILDING CONSTRUCTION

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Application January 31, 1942, Serial No. 429,084

10 Claims. (Cl. 20—2)

This invention relates to building construction broadly, and is particularly concerned with buildings of the type wherein certain or all of the parts are shipped in the form of prefabricated units ready for erection on location.

One of the more desirable modern types of prefabricated building embodies so-called "curtain" walls, or walls made up of framework and filler panels of laminated and bonded ply wood, fibre board or the like presenting a curtain effect when viewed from the exterior. This type of building may be constructed at a relatively low cost and with a fair degree of expediency. However, since one of the principal advantages of homes or buildings of the prefabricated type is economy in construction, it is desirable that the cost be as low as possible consistent with architectural beauty and comfortable living quarters.

Prefabricated buildings of the panel wall type present problems not present in orthodox building construction. This is obvious when it is considered that the units must be capable of relatitvely easy fabrication at the mill, compact, strong and rigid for safe and low cost transportation, and capable of erection on location in an expeditious manner by either skilled or unskilled labor. Care must be taken in distributing the load with respect to the panels, since certain materials may be highly efficient as far as insulation, moisture-proofing, surface wear and other desirable factors are concerned and yet not be capable of withstanding load stresses either temporarily or permanently. Numerous types of buildings have been proposed for many years past, but in the main they have been rejected because they did not meet the foregoing requirements.

It is an object of the present invention, therefore to provide a prefabricated building and method of constructing the same wherein the parts or units may be fabricated at the mill in an expeditious manner, arranged compactly for shipment and will stand relatively rough handling during transportation and erection, enable quick assembly on location according to plan by skilled or unskilled labor, and will distribute the load in a manner such as to ensure long life without distortion and misalignment of walls or wall surfaces.

One of the features of the present invention consists in prefabricating the windows and/or doors in the form of combined trim and load bearing units or panels which take the load of the roof and coacting overhead structure and transfer it directly to the foundation or base support. These combined trim and load bearing window and door units are constructed in a manner such that they may be fabricated complete at the mill and erected on location with a minimum of time, labor and materials. The walls between these units preferably consist of wall panels which interlock with said units to complete the outer wall. Since they take practically no load, they may be made from a wide selection of materials, and irrespective of their weight, they may be put in place easily and quickly. The only horizontal tie necessary for the load-bearing units is a girder of a particular type, one for each side and end wall. On this girder the roof assembly is erected.

Another object of the invention is to provide an improved type of wall panel for prefabricated building construction generally, and particularly for buildings of the type herein disclosed.

The various objects and advantages of the invention will be rendered more apparent in view of the following description taken in conjunction with the drawings, wherein:

Fig. 1 is a view in perspective of a prefabricated building in accordance with the invention;

Fig. 2 is a view similar to Fig. 1 but showing the building in partly erected condition with the combined trim and load bearing window and door units in place ready for application of the wall panels therebetween;

Figs. 3, 4, 5 and 6 are sectional views taken substantially on the lines 3—3, 4—4, 5—5 and 6—6 of Fig. 1;

Fig. 6*a* is a detail perspective of one of the load-bearing window units;

Figs. 7, 8 and 9 are cross sectional views taken through the cornice portion of a building in accordance with the invention particularly illustrating modifications in the tie girder;

Figs. 10 to 13, inclusive, are detail views in perspective and partly broken away of types of wall panels which may be used for the outer walls.

The building in Figs. 1 and 2 is a prefabricated family dwelling and is shown simply for the purpose of illustration, since the herein disclosed structure adapts itself to any desired type of building, such as a bungalow, multiple story house, dormitory and the like.

The principal parts of the building comprise suitable sub-structure including a foundation or footing and a floor, side and end walls including a plurality of load-bearing combined trim and window and door units and interposed wall panels, and super-structure including overhead horizontal tie girders and a roof assembly. Obvious-

ly the interior of the building may be partitioned off in any desired manner and provided with suitable fixtures, such interior structure forming no essential part of the present invention.

Starting with the base or sub-structure, this may comprise a concrete footing 10 having thereon a cap 11 on which rests a sill 12, note Figs. 3 and 4. On the sill 12 a series of floor joists 13 may be disposed to support flooring 14. Between the flooring and joists suitable insulation material is usually installed to prevent dampness from passing upwardly through the floor. Termite shields, not shown, may also be installed between the foundation and wood structure.

After the sub-structure just described has been laid, the building is ready for erection of the prefabricated load-bearing combined trim and window and door units best shown in Figs. 2, 3, 5 and 6. These units each comprise a pair of vertical load-bearing columns 15 and 16 which extend completely from the base cap or analogous support 11 to the overhead or superstructure, to be described, and have connected to the interior sides or edges thereof vertical reinforcing and trim frames 15' and 16'. Between these columns 15 and 16 and frames 15' and 16' a window, combination window and panel, door, screen or the like may be installed. In the sectional views of Figs. 3 and 5 a pair of casement windows 17 with mounting frames 17' are mounted between the vertical load bearing columns 15 and 16, the latter serving as window jambs at this point. The window assembly may also include a pair of casement screens 18, a sill 19 and a head piece 19'. Beneath the sill 19 are a pair of inner and outer wall panels 20 and 20' having a dead-air space therebetween with or without insulation.

It will be noted that the columns 15 and 16 are of angle-shaped contour with the inner leg of the angle projecting inwardly and separating the inner and outer windows 17 and 18 and panels 20, 20'. Suitable trim or molding 21, 21', 22, 22' is secured to the opposite outer edges of the frames 15' and 16' and additional molding 23, 23' is secured to the inner sides of the outer projecting edges of the columns 15 and 16.

All the parts of the load-bearing combined trim and window unit above described may be fabricated and assembled at the mill ready for shipment to the point of location. In making up these units, any type of window or door assembly may be installed therein, various types being shown in Fig. 1 simply for the purpose of illustration. While in certain instances minor modifications in milling, grooving and rabbeting may be required to adapt the vertical load components 15 and 16 to different types of installations, yet the principle involved is the same throughout, and consequently these components have been given similar reference characters wherever they appear.

By referring to Fig. 3, it will be noted that the lower extremities of the vertical load components or columns 15 and 16 are adapted to be secured to the base sill and/or floor joists or may in certain instances be secured to the floor itself, the load being imposed through these columns directly onto the foundation through the cap or analogous member 11. In practice, the vertical columns and their coacting sills are made of wood, and the exterior surface of the column is preferably given the appearance of trim work, and this also holds true with respect to the vertical frames 15' and 16' and the molding 22 and 22' as well as the exterior molding 23 and 23'. Thus, when these various window and door units are erected, they are complete and require no further work thereon. By their very nature, these vertical load components are strong and rugged and may be shipped and handled without danger of sagging and loosening of the joints. Ordinarily the joints are secured by nails and cement. Such joints where the framework is of a light flimsy nature ofttimes break or loosen so that after the units are installed, leaks and looseness develop within a relatively short time. This objectionable feature is entirely eliminated in the present improved type of building unit.

After the different load-bearing door and window units have been erected as shown in Fig. 2, horizontal tie girders 25, 25*a*, 25*b*, and 25*c* are disposed on the top of the load-bearing units. These girders are preferably of identical construction for each building. The girders shown in the building of Fig. 1 each comprises an assembly made up of a beam or girder proper 25*f* capped by a reinforcing strip 25*g* and at its lower edge having secured on the outer side thereof a bearing strip 25*h* which rests directly on the upper ends of the load-bearing units. An outer panel 26 is preferably applied over the outer faces of the beam 25*f* and cap 25*g*. Also molding 27 may be secured to the outer surface of the bearing strip 25*h* to cover the joints at this point.

The girders 25—25*c* may be prefabricated and assembled at the mill with the exception of the molding 27, so that when they arrive on location they are ready to be erected and this can be done quickly and expeditiously. In practice, the girder proper is made of wood while the outer panel 26 may be made of any suitable decorative and serviceable material, including wood.

The roof structure may be of any suitable type. That here shown is of the comb type and comprises preassembled truss units including rafters 28 and tie beams 29. These units are also preferably assembled and connected at the field mill ready for installation on the site. The outer ends of the beams 29 have connected thereto a cap strip 30 and a nailing strip 31. It will be noted that the rafters 28 and beams 29 are notched and interlocked at their outer ends so that there are no lateral stresses applied to the girders 25—25*c*, the load being applied vertically thereto and transmitted directly to the load bearing units heretofore described.

The outer surface of the beam 30 may have secured thereto a facia strip 32 carrying suitable guttering or spouting 33.

Any desired type of roof may be used, the same forming no part of the present invention.

The spaces between the load bearing window and door units are adapted to receive wall panels 35. These panels may be made of plywood, layers of composition material, and various organic and inorganic materials arranged in different forms and shapes, or they may consist of hollow shells such as those illustrated in Figs. 10 to 14 inclusive, and which will be subsequently described. If reference is had to Figs. 5 and 6, it will be noted that the marginal edges of the wall panels 35 are adapted to engage in grooves provided by the inner frames 15' and 16' and their outer molding strip 36, the latter being applied after the panels have been mounted. While not essential, it may be found of advantage and convenient to utilize corner posts 37 to which the wall panels in the corners of the building may be secured. Exterior trim or molding 38 may be ap-

plied over the outer edges of the corner joint to complete the structure at this point. In Fig. 2 one of the corner posts has been omitted to illustrate how the griders and load-bearing units coact to provide a cantilever construction.

The wall panels do not take any load, note in Fig. 4 where the top of the panel 35 is shown as slightly spaced from the strip 25h, and consequently these panels are not subjected to stresses which would distort or mar their appearance. If properly mounted, large plate glass sections may be used as picture windows from floor to ceiling without danger of fracture. The wall panels may be mounted easily and quickly simply by hinging them upwardly and applying the molding 36 and 27. If desired, suitable trim 39 may be placed around the lower portion of the panels.

Figs. 7, 8 and 9 illustrate different types of girder assemblies. In Fig. 7 the girder, generally indicated at 40, is of substantially the same shape as the girder 25 heretofore described and is provided with a bearing strip 40', which rests directly on the load bearing columns. In this instance, however an outer facia plate 41 of shell-like form is utilized and at its lower edge projects over the joint at the base of the strip 40' and at its upper edge is attached to the cap strip 30. This eliminates the need for molding since the strip 41 serves this function.

In Fig. 8 a girder 42 is shown which is placed substantially flush with the outer wall and has its lower edge resting directly on the load bearing columns. The outer facia plate is indicated at 41' and is substantially similar to the plate 41 shown in Fig. 7. In addition, an inner plate 43 is secured against the inner side of the girder 42 and provides a trim or decorative effect while at the same time the lower edge thereof projects downwardly and covers the joint at the lower edge of the girder.

Fig. 9 illustrates a further type of girder 42' which is similar in shape to girder 42 of Fig. 8, the difference in this instance being that the inner plate 43 is dispensed with and replaced with molding strip 44. The outer facia plate in this instance is indicated at 41''.

Figs. 10, 11, 12 and 13 illustrate a type of prefabricated wall panel which has features rendering it highly desirable for buildings such as those contemplated herein. These panels all have certain features in common, viz: they each provide an easily and quickly fabricated outer shell having a space therein which may constitute a dead-air space or may receive insulation.

In each instance, the outer shell is comprised of oppositely-disposed slabs 45 and 46 which at their marginal edges are secured to edge frames 47, the latter being made up of strips joined in rectangular relation.

The slabs and associated framework are reinforced and maintained in definite spaced relation in Fig. 10 by X-braces 48, in Fig. 11 by simple transverse members 49 and in Fig. 12 by longitudinal members 50. In Fig. 13 the slabs are held spaced by a series of blocks or analogous members.

The slabs are shown as comprised of wood veneer but may be made of various other materials, and such material may be treated to render it fire and moisture-proof or it may originally have such inherent qualities. The slabs and associated framing may be easily treated prior to assembly. In certain localities, material which would otherwise be wasted may be utilized in making these panels. Another feature is that they may be easily fabricated to suit varying specifications.

No attempt has been made herein to set forth all of the advantages of my improved prefabricated building construction, nor is it necessary that any set method be followed in erecting the units which go to make up a building. One of the most expeditious method is to first lay the foundation, and flooring, then erect the load-bearing window and door units, then install the superstructure and finally insert the curtain wall panels; but this procedure may be varied to suit conditions, as may also the construction of the respective units without departing from the spirit or scope of the invention as defined by the appended claims.

What is claimed is:

1. A prefabricated building including a suitable supporting base, a series of windows, load-bearing columns mounting said windows in pre-assembled condition ready for erection, said columns at their lower ends resting on said base and being of a length such as will span the height of one story of the building, a prefabricated tie girder cross-connecting the upper ends of said columns, the latter taking substantially the full load of the girder and super-structure carried thereby, the oppositely facing edges of said columns being formed with angular recesses, and wall panels disposed in the spaces between said windows with their marginal edges engaged in said recesses, said windows and columns being mountable and demountable as integral building components.

2. A prefabricated building including a suitable supporting base, a series of windows, load-bearing columns mounting said windows in pre-assembled condition ready for erection, a top prefabricated girder assembly and superstructure mounted thereon, said columns at their lower ends resting on said base and at their upper ends engaging and supporting said girder and superstructure, said columns and girder assembly being prefabricated to provide panel recesses and the columns being of such cross-sectional dimensions as to be exposed both interiorly and exteriorly of the building and having their exposed surfaces trim-finished, and a plurality of wall panels disposed in the spaces between the windows and their associated columns and having their marginal edges engaging in said recesses, said columns also functioning as side frame members for the windows and together with the latter being mountable and demountable as unitary building components.

3. A prefabricated building including a suitable supporting base, a floor structure disposed on said base, a series of windows and doors, vertical load-bearing columns mounting said windows and doors, said columns being constructed as framing to receive said windows and doors, said columns, windows and doors being preassembled ready for erection on the building site and being mountable and demountable as unitary building components, a prefabricated top girder assembly and superstructure mounted thereon, said columns at their lower ends resting on said base and being secured to the floor structure and at their upper ends engaging said girder and supporting the latter and associated superstructure, said columns and girder being prefabricated to receive wall panels, and a plurality of wall panels disposed in the spaces between the windows and doors and their mounting columns and having their marginal edges received in re-

cesses provided by the columns and girder, the construction and arrangement being such that said columns receive the vertical load without transmitting substantially any of the load to said wall panels.

4. In a prefabricated building having suitable foundation and floor structure, a series of prefabricated load bearing units, each of said units including at least a pair of spaced columns and associated framing having therein windows and/or doors and associated paneling, superstructure including prefabricated girders extending horizontally across the tops of said units and resting on said columns, said units in conjunction with said girders providing a cantilever construction whereby substantially all the weight is taken by said columns, said columns and associated framing having exterior and interior exposed surfaces trim-finished, and a plurality of substantially flat plane-surfaced wall panels having their marginal edges engaged in the framing provided by said columns and girders.

5. For use in prefabricated building construction, a prefabricated load-bearing unit including a pair of columns adapted to extend the full height of at least one story of a building and transmit the load of the super-structure to the foundation or sub-structure of the building, said columns being of a cross-sectional dimension greater than the thickness of the outer walls of the building, and a window mounted between and supported by said columns.

6. For use in prefabricated building construction, a load-bearing unit including at least a pair of columns of a length sufficient to span the height of at least one story of a building and transmit the load of the super-structure to the foundation of the building, said columns having at least a portion of the length thereof constructed as framework to receive a window or windows and/or associated paneling, the opposite surfaces of said columns and associated framing being trim-finished.

7. In prefabricated building construction, the method which consists in providing suitable substructure including a foundation and flooring, prefabricating the windows and/or doors of the building with vertical load bearing columns and associated framing, said columns being of a length sufficient to reach from the substructure to the super-structure of the building, then erecting said units with the lower ends of the columns resting on the sub-structure and their upper ends projecting free, mounting super-structure thereon with substantially the entire load of the super-structure imposed on said columns, and thereafter mounting wall paneling in the spaces between said columns.

8. A prefabricated building comprising a supporting base including footings, sills disposed on said footings, floor structure mounted on said sills, doors and windows for the building, a plurality of load bearing units adapted to support superstructure, each of said units consisting of a pair of vertically extending posts with a window or door mounted therebetween and the posts functioning as side frames therefor, said units being prefabricated at the mill ready for erection and being mountable and demountable as a unitary building component, the posts being of a cross sectional dimension greater than the outer wall of the building so as to be exposed both interiorly and exteriorly of the building and having their exposed surfaces trim finished, prefabricated girders supporting superstructure including a roof, said units being erected with the lower ends of the post resting on said sills and the upper ends thereof directly receiving and supporting said girders so that the posts bear the full load of the superstructure and transmit the load directly to the sills and footings, the lower edges of the girder and the outer sides of said posts being constructed and arranged to provide wall panel framing, and wall panels disposed in the spaces between the windows and doors and engage in recesses provided by the columns and girders.

9. In prefabricated building construction, a supporting base, a series of windows, load-bearing columns carrying said windows preassembled ready for erection, said columns being of a length corresponding to the height of one story of the building with their lower ends resting on said base, a prefabricated tie girder connecting the upper ends of said load-bearing columns, the latter bearing substantially the full load of the girder and superstructure carried thereby, the oppositely facing edges of said columns being provided with angular recesses, and curtain wall panels located in the spaces between said panels with their marginal edges in said recesses, said windows and columns being mountable and demountable as integral building components.

10. In prefabricated building construction, a supporting base, spaced load-bearing wall columns on said base having oppositely disposed edges provided with angular recesses, a prefabricated tie girder connecting said load-bearing columns at the upper portion of each wall, said columns bearing substantially the full load of the girder and supported structure, and wall panels disposed between said load-bearing columns with their marginal edges in said recesses, said columns and wall panels being mountable and demountable as integral building components.

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