United States Patent [19]

Smith et al.

[11] **3,881,286**

[45] **May 6, 1975**

[54] **PREFORMED FLOOR AND ROOF STRUCTURE**

[76] Inventors: **Edward A. Smith,** 6641 W. 6th St., Los Angeles, Calif. 90048; **Robert L. Day,** 1518 Grismer St., Burbank, Calif. 91504

[22] Filed: **July 23, 1973**

[21] Appl. No.: **381,529**

[52] **U.S. Cl.** **52/90;** 52/274; 52/495; 52/664

[51] **Int. Cl.** **E04b 2/56**

[58] **Field of Search** 52/495, 496, 280, 281, 52/488, 664, 665, 656, 274, 90, 263

[56] **References Cited**

UNITED STATES PATENTS

2,970,676	2/1961	Maciunas	52/488 X
3,246,435	4/1966	Russell	52/496 X
3,396,499	8/1968	Biffari	52/488 X
3,462,897	8/1969	Weinrott	52/90 X
3,529,393	9/1970	Wilkins	52/496 X
3,603,628	9/1971	Smith et al.	52/758 H

Primary Examiner—Price C. Faw, Jr.

[57] **ABSTRACT**

The prefabricated building structure comprises a series of metal or structural rails and a set of panels. At the installation site, the rails are progressively built into a rectangular grid as the panels are captured by the progressively closing grid, the panels having peripheral grooves interlocked by the rails.

7 Claims, 9 Drawing Figures

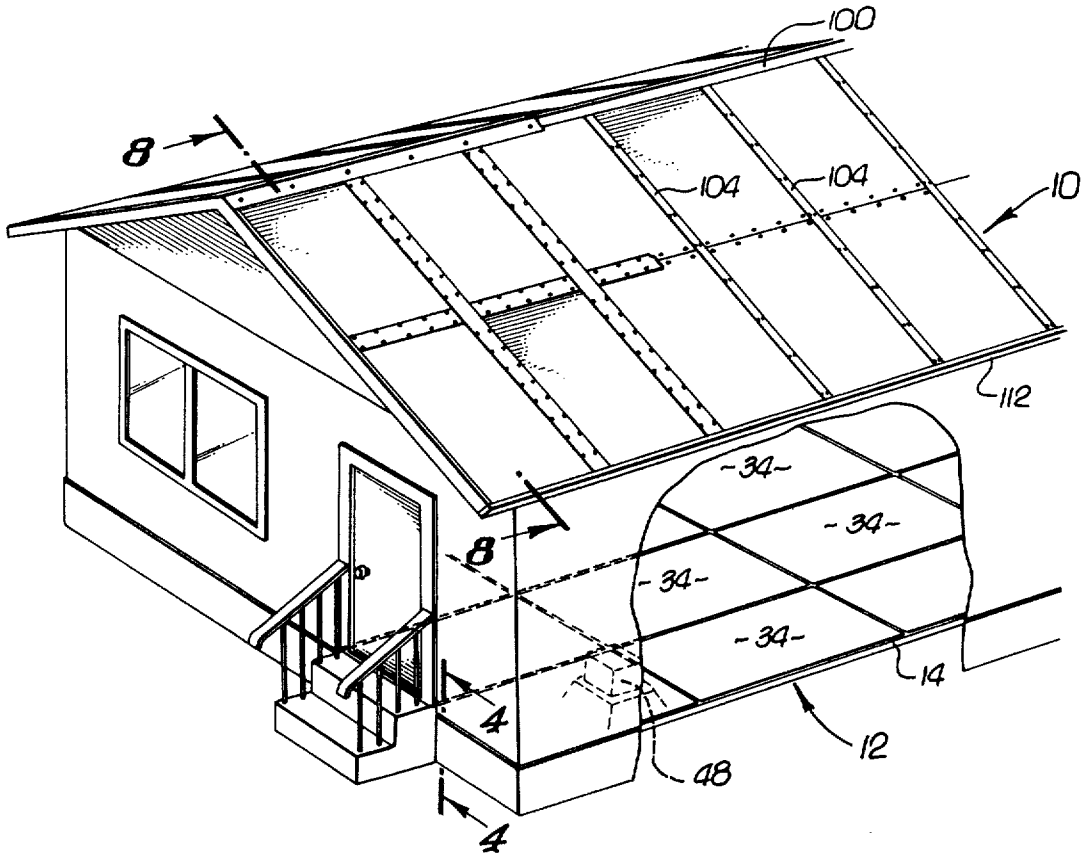


FIG. 1.

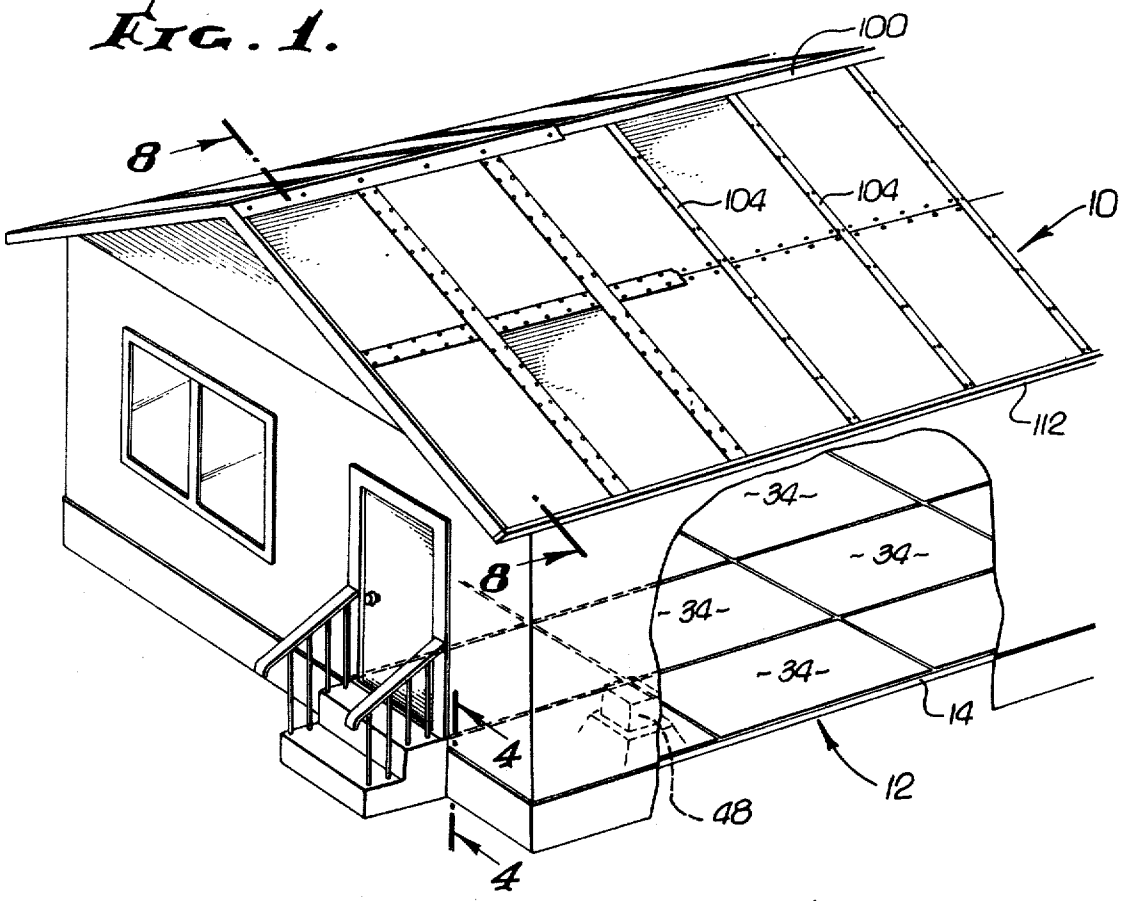

100
8
104
104
10
112
34
34
34
34
8
14
4
12
48
4

FIG. 2.

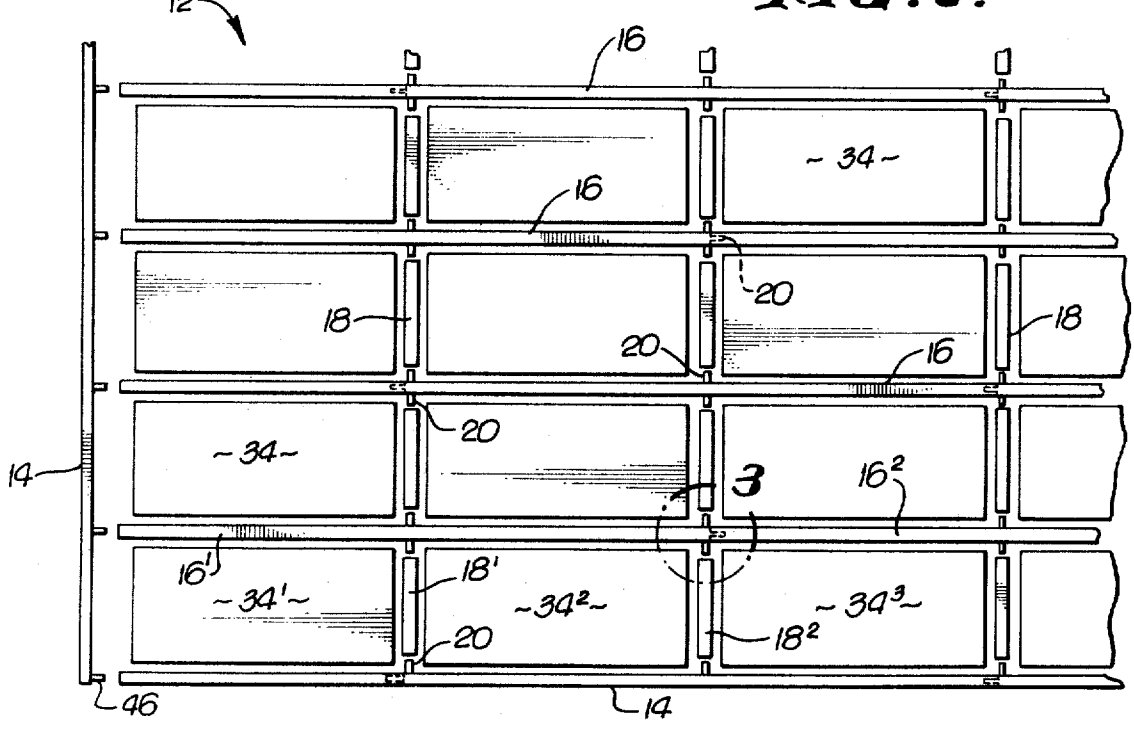

12
16
34
16
20
18
18
20
16
20
14
34
3
16²
16'
34'
18'
34²
34³
20
18²
46
14

FIG. 3.

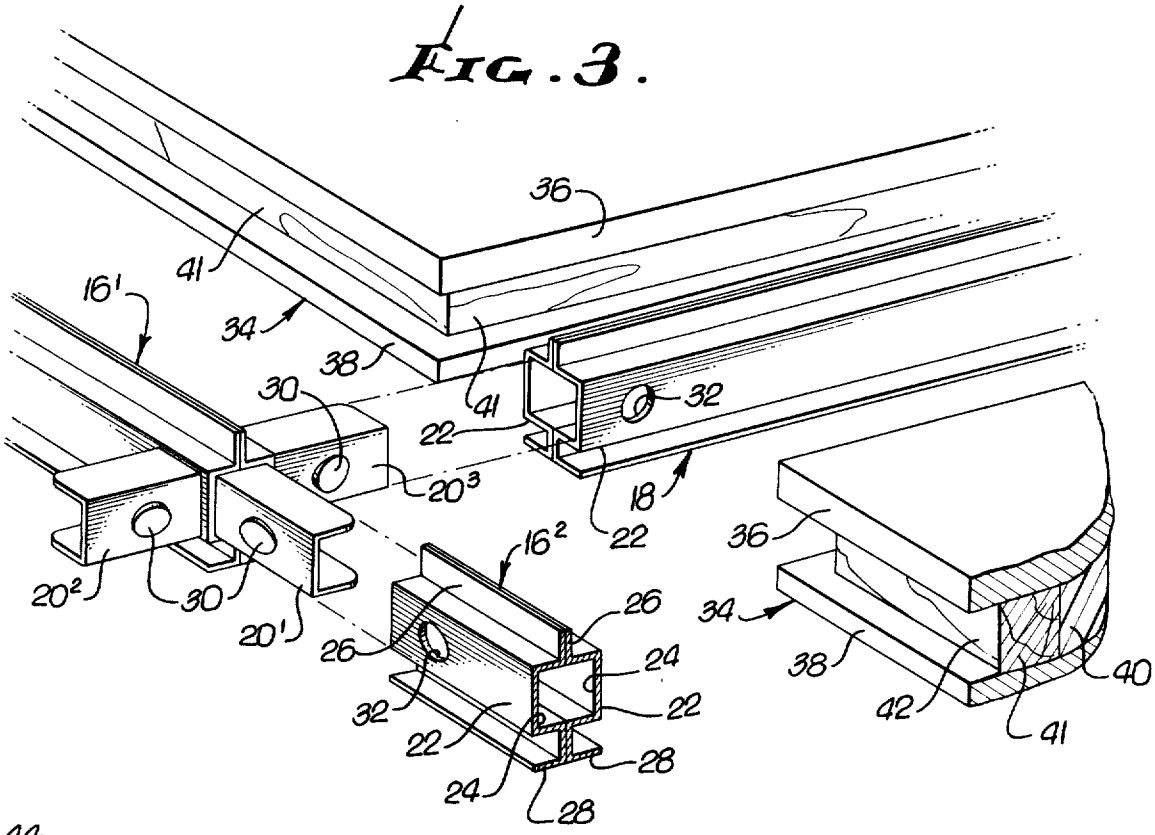


FIG. 6.

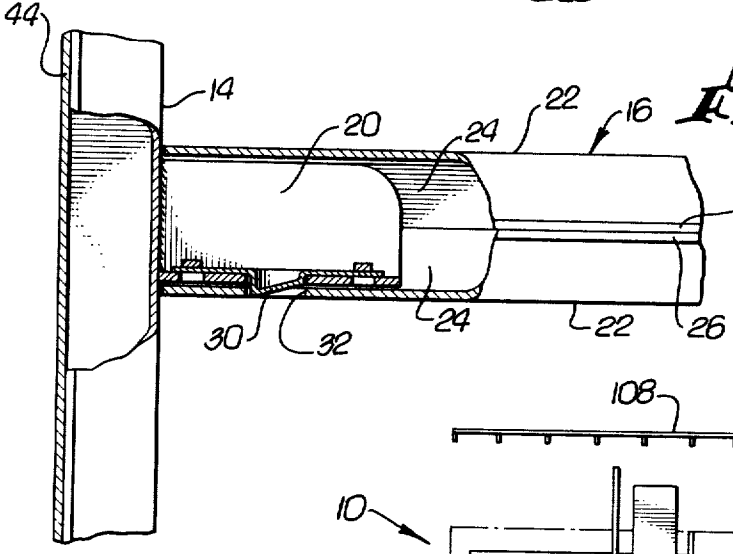


FIG. 7.

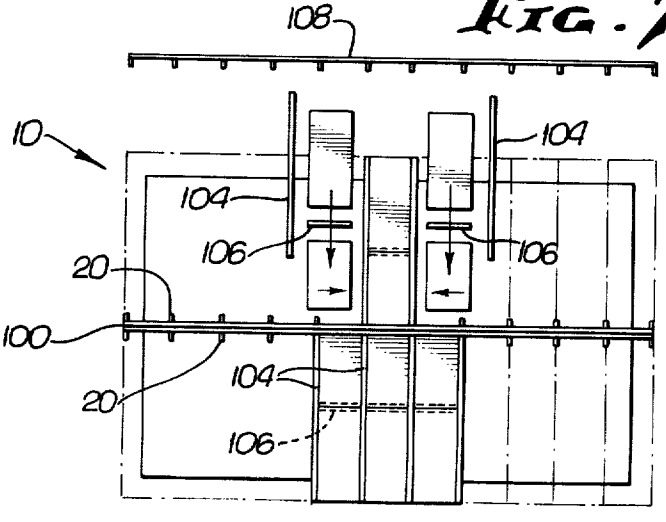


FIG. 4.

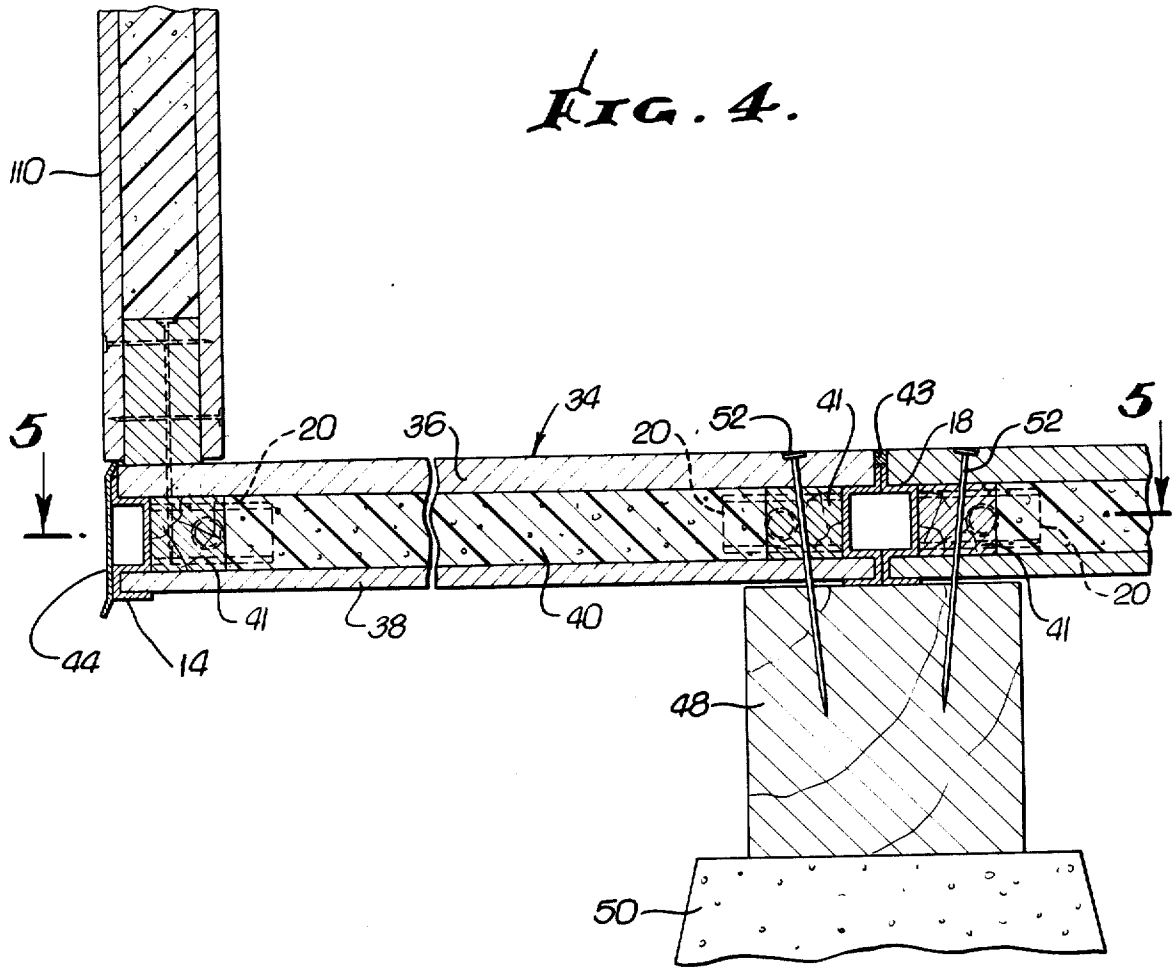
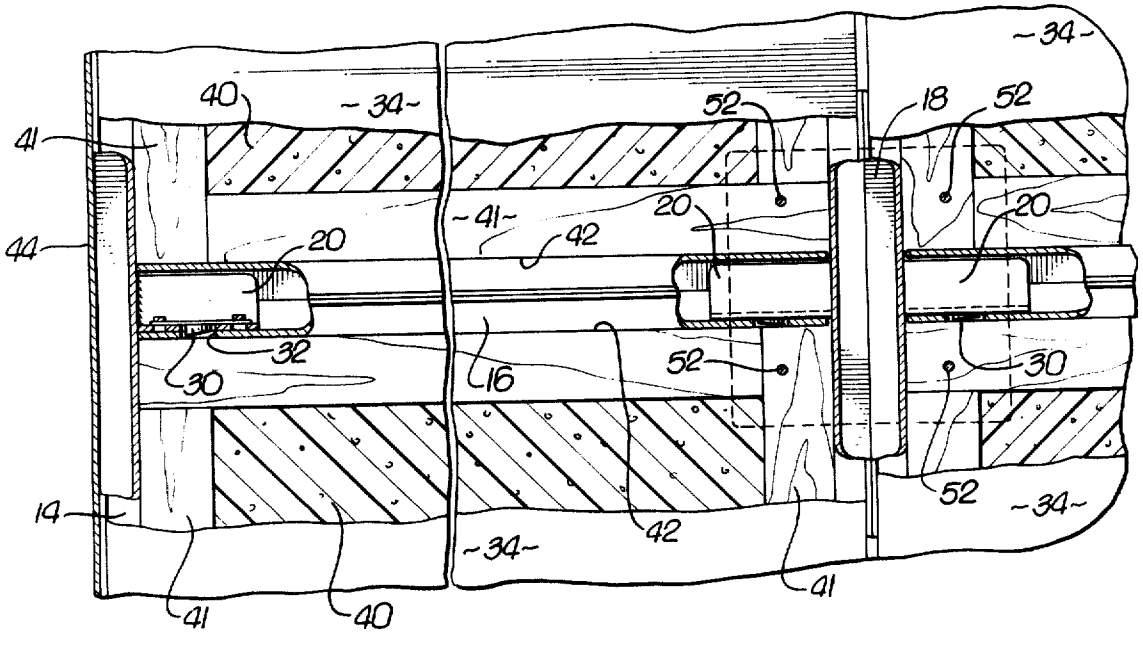

110
5
5
20
36
34
20
52
41
43
18
52
20
41
38
40
41
44
14
48
50

FIG. 5.


34
40
34
52
18
52
41
41
20
20
44
20
42
32
30
16
52
30
14
52
34
42
34
41
41
40

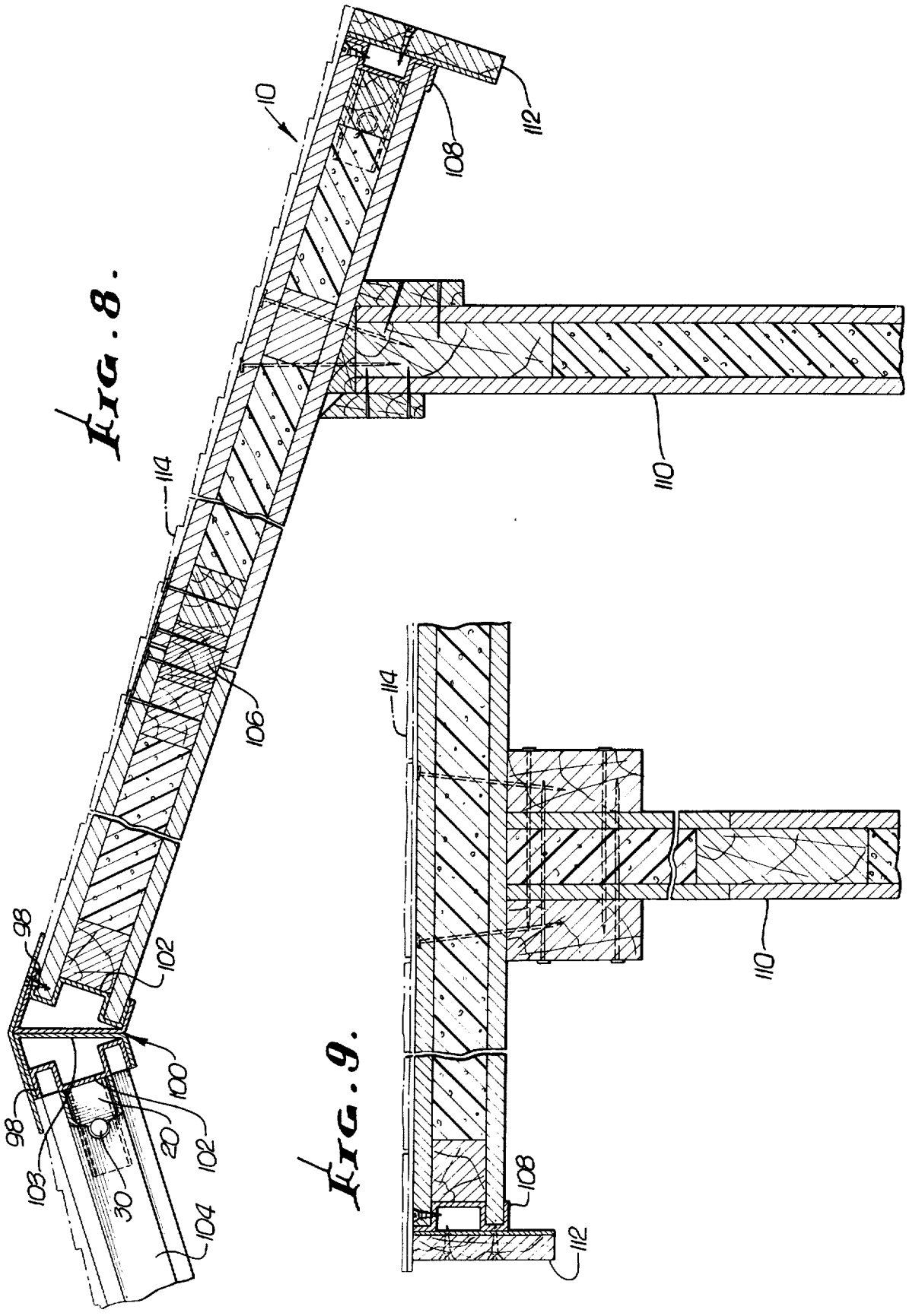

10
112
108
110
114
106
98
102
100
98
20
102
103
30
104

FIG. 8.

114
110
108
112

FIG. 9.

PREFORMED FLOOR AND ROOF STRUCTURE

FIELD OF INVENTION

This invention falls in the field of building construction, and more particularly to structural frames for buildings.

BACKGROUND OF THE INVENTION

It is now well recognized that economical housing depends upon how much of the structure can be built in the factory and how little of the structure need be completed at the building site. Various modular grid systems have been proposed in the past. In general, these systems are cumbersome and complicated and hence leave much to be desired in terms of economy. For example, the junctions are complicated by mitred joints or the like; the panels require a good deal of labor to attach to the rail framework. The primary object of this invention is to provide an extremely simple prefabricated modular frame construction that uniquely utilizes simple connector mechanisms and a novel interfit of the panels with a rectangular grid such that no fasteners are required between the panels and the rails.

SUMMARY OF THE INVENTION

In order to accomplish the foregoing object, we provide a unique rail and panel combination whereby these components interfit each other in a simple and effective manner to form a strong rigid building. Specifically, the panels comprise "skins" of plywood or the like sandwiching between them a foamed core. A peripheral channel about each panel interfits an intermediate key formed on the companion rail. The rails snap together by the aid of connector structures of the type shown and described in U.S. Pat. No. 3,603,628 to Edward A. Smith, et al. of Sept. 7, 1971 entitled FRAME CONNECTOR STRUCTURE. The interior rails comprise companion roll formed halves welded together. The outside or boundary rails comprise a single element corresponding to one of the halves of the interior rails. By judiciously staggering the location of connectors, and by utilizing a system of cross reinforcement a very rigid structure results.

BRIEF DESCRIPTION OF THE DRAWINGS

A detailed description of the invention will be made with reference to the accompanying drawings wherein like numerals designate corresponding parts in the several figures. These drawings, unless described as diagrammatic, or unless otherwise indicated, are to scale.

FIG. 1 is a perspective view diagrammatically illustrating a building structure made in accordance with the present invention.

FIG. 2 is a plan view of the floor structure, the parts being shown in exploded relationship to each other.

FIG. 3 is an exploded view showing a typical junction at the corners of a panel, and corresponding to the encircled area 3 of FIG. 2.

FIG. 4 is an elarged vertical sectional view of the floor structure, and showing a pier as well as an outside wall, the sectional plane being indicated by the line 4—4 of FIG. 1.

FIG. 5 is a horizontal sectional view taken along a plane corresponding to line 5—5 of FIG. 4.

FIG. 6 is an enlarged fragmentary view of a connector structure, part of the apparatus being broken away and shown in section.

FIG. 7 is a diagrammatic view illustrating the manner in which rails and panels are assembled to form a roof structure.

FIG. 8 is a vertical sectional view illustrating a pitched roof structure made in accordance with the present invention.

FIG. 9 is a vertical sectional view illustrating a flat roof structure made in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The following detailed description is of the best presently contemplated mode of carrying out the invention. This description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating the general principles of the invention since the scope of the invention is best defined by the appended claims.

FIG. 1 illustrates a dwelling having both a roof **10** and a floor **12** utilizing interfitting rail and panel structures made in accordance with the present invention. The floor structure as shown in FIG. 2 comprises a plurality of peripheral rails **14**, a series of spaced parallel intermediate rails or girders **16** and a plurality of intermediate rails that function as splines or cross braces **18**. The rails **14, 16** and **18** are linked into a generally rectangular gridwork by a series of connectors **20** located at the corners of the array. Connectors may be used to connect sections of long end rails or girders in end to end relationship. The rails are preferably made of rolled steel.

A cluster of connectors is shown in FIG. 3. One of the connectors 20^1 is attached to the end of the girder section 16^1 in order to link up continuing girder section 16^2. The connector **20** is in the form of a rigid hollow support joined at one end, as by welding, to its supporting rail. The connector telescopes into the end of the companion rail. The connector support in the present instance is in the form of a channel designed closely to fit the tubular part of the rail.

The rail **16** or **18** comprises halves **22** joined, as by welding, along a medial plane, the halves having outwardly offset channel shaped portions **24** together forming a rectangular tube. The upper ends **26** of the halves form a narrow upstanding rib. The lower angled ends **28** form with the offset portions **24**, longitudinally extending bottom channels on both sides of the rail.

The connectors 20^2 and 20^3 extend laterally of the rail or girder 16^1 to connect with cross braces or rails **18**. The connectors have spring detents **30** that engage holes **32** formed in the companion rails whereby a rigid mechanical lock is obtained, and as more particularly described in said U.S. Pat. No. 3,603,628.

The panels interfit the rails to be supported thereby with toleration for dimensional variance, whereas the rails are dimensionally controlled to determine the exact configuration of the floor independently of the panels.

Each panel (See FIGS. 3 and 4) comprises two skin layers of plies **36** and **38** that sandwich between them a plastic foam core **40**. Internal wooden panel rails **41** form the boundaries of the foam core. The foam core imparts exceptional strength to the composite structure. The edges of the skin or plies **36** and **38** overlie the core **40** and core rails **41** so as to form a peripheral groove **42**; that receives the outwardly offset portion **24** of the rail with the top ply abutting the rib **26** and the

bottom ply fitting the channel at the bottom of the rail. The groove left above the rib **26** is filled with some suitable caulking **43** (See FIG. **4**). The top ply **36** is thicker than the lower ply **38**. The upper ply is thicker than the rib **26**.

The outside rails **14** (FIG. **4**) are made of individual rail halves. Drip screeds **44** may be provided to cover the recesses formed by the offset portions **24**. The end connectors **46** (FIG. **2**) for the rails have half the depth of the connectors **20** in order to provide a flush joint.

At some or all of the floor corners, piers **48** are provided for transferring the load of the building to footings **50** or to a substructure. In the present instance, piers **48** are provided at each interior corner. In order to secure the floor to the corresponding pier, four long spike nails **52** are located at the four exterior corners just outside the intersection of the rail **16** and braces **18**.

The floor is assembled by progressively connecting the rails and panels. This can be done in a number of ways. For example, as shown in FIG. **2**, the first interior rail 16^1 may be placed along a line of its piers, using whatever connectors may be necessary to form the entire rail length. The panels 34^1 may then be inserted and held in position upon placement of the first cross brace 18^1. The second panel 34^2 and the second brace 18^2 may then be positioned. The parallel outside rail **14** is then positioned. The panels and cross braces on the other side of the rail 16^1 may be positioned in a similar manner. Finally, the perpendicular end rails are placed into position, the transverse rails being flexible laterally to ensure their simultaneous alignment with the corresponding connectors **20** or **46**.

FIGS. **7**, **8** and **9** illustrate rails and panels used to form a roof structure. The rails are the same as the floor rails except that the rails have top flanges **98** (FIG. **8**) to interfit the top panel plies, which, in this instance, have the same thickness as the panel plies. Parts of the top flanges may be cut away or omitted in order to facilitate placement of screws for rigidly receiving the top panel.

FIG. **7** diagrammatically illustrates a ridge pole **100** made of two generally back to back end rails **102** (FIG. **8**) and a clip or bracket **103**. These parts are welded together so that the back to back end rails **102** are inclined to each other in an amount corresponding to the desired pitch of the roof. The ridge pole **100** (FIG. **7**) carries connectors designed to fit transverse rails or rafters **104**. Intermediate brace rails **106** are provided along with end rails **108**. Each roof half is progressively formed by placement of rails, panels, braces and end rails in substantially the same manner as the floor, except that two inclined sections are provided.

The roof sections are nailed to the supporting walls **110** (FIG. **8**). Facia boards **112** are provided as required or desired, as well as suitable roofing material **114**.

The roof shown in FIG. **9** is similarly formed, but in this instance comprises one composite flat section. Both the floor and the roof have been successfully tested under load.

Intending to claim all novel, useful and unobvious features shown or described, we make the following claims:

1. In a building structure:

a. a series of spaced parallel rails, said series including inside rails as well as two outside rails;

b. each inside rail having at least one pair of connector structures affixed thereto and extending laterally outwardly on opposite sides of the corresponding inside rail at a place located intermediate the length of the said inside rail;

c. each outside rail having at least one connector structure affixed thereto extending laterally inwardly on one side at an intermediate place corresponding to the location of said pair of connectors;

d. a series of tubular braces extending perpendicular to the said series of rails and connected at opposite ends to adjacent rails by telescopically receiving and fitting said connector structures to form a rigid substantially rectangular grid;

e. mechanical means operative between each connector and the corresponding brace ends to lock the braces to the connectors at a predetermined relative telescoped position therebetween;

f. said rails and braces being dimensionally controlled to determine the configuration of the grid;

g. a plurality of rectangular panels interfitting the grid, each panel comprising a pair of outer plies and a substantially rigid core, the outer plies overlying the rigid core to form a peripheral groove;

h. said braces and said series of rails each laterally projecting into said peripheral panel grooves to lock the panels to said grid;

i. said panels being dimensionally controlled to prevent interference in the fit of said rails and braces.

2. The building structure as set forth in claim **1** in which said inside rails as well as said braces have a longitudinally uniform tubular configuration; each of said series of rails and each of said braces having angled flanges overlying the edges of at least one of the corresponding panel plies.

3. The building structure as set forth in claim **1** together with a pair of end rails parallel to said braces, said braces being located inwardly of the ends of the corresponding series of rails; said end rails having connectors telescopically received in the corresponding ends of the said series of rails.

4. The building structure as set forth in claim **1** together with piers for supporting said structure, and located at the intersections of the braces and inside rails with the corners of said panels resting at least indirectly upon said piers, said piers having a cross sectional area sufficient to extend beyond the horizontal projection of said intersecting rails whereby said corners of said panels may be nailed to said piers.

5. In a building structure:

a. a series of spaced parallel tubular rails, said series including inside rails as well as two outside rails;

b. each inside rail having at least one pair of connector structures affixed thereto and extending laterally outwardly on opposite sides of the corresponding inside rails at a place located intermediate the length of the said inside rail;

c. each outside rail having at least one connector structure affixed thereto extending laterally inwardly on one side at intermediate place or places corresponding to the location of said pair of connectors;

d. a series of tubular braces extending perpendicular to the series of spaced rails and connected at opposite ends to adjacent rails by telescopically receiving and fitting said connector structures to form a rigid substantially rectangular grid;

e. a pair of end rails parallel to said braces and closing the grid;

f. a plurality of connector structures for each end rail and fixedly mounted on said end rail and telescopically received in the corresponding ends of the said series of rails;

g. mechanical means operative between each connector and the corresponding brace ends to lock the braces to the connectors at a predetermined relative telescoped position therebetween;

h. said rails and braces being dimensionally controlled to determine the configuration of the grid;

i. a plurality of rectangular panels interfitting the gridwork, each panel comprising a pair of outer plies and a substantially rigid core, the outer plies overlying the rigid core to form a peripheral groove;

j. the tubular portions of said inside rails and said braces having a configuration such as to project into said peripheral grooves of said panels to lock the panels to the grid;

k. said panels being dimensionally controlled to prevent interference in the fit of the rails and braces.

6. In a pitched roof structure:

i. a pair of roof sides, each including

a. a series of spaced parallel rails forming rafters, including inside rails, and two outside rails;

b. each inside rail having at least one pair of connector structures affixed thereto and extending laterally outwardly on opposite sides of the corresponding inside rail at a place located intermediate the length of said inside rail;

c. each outside rail having at least one connector structure affixed thereto extending laterally inwardly on one side at an intermediate place corresponding to the location of said pair of connectors;

d. a series of tubular braces extending perpendicular to said series of rails and connected at opposite ends to adjacent rails by telescopically receiving and fitting said connector structures to form a rigid substantially rectangular grid;

e. mechanical means operative between each connector and the corresponding brace ends to the braces to the connectors at a predetermined relative telescoped position therebetween;

f. said rails and braces being dimensionally controlled to determine the configuration of said grid;

g. a plurality of rectangular panels interfitting the grid, each panel comprising a pair of outer plies and a substantially rigid core, the outer plies overlying the rigid core to form a peripheral groove;

h. said braces and said series of rails each laterally projecting into said peripheral panel grooves to lock the panels to said grid;

ii. a ridge pole having rail parts angled with respect to each other, each of the rail parts having a series of intermediate connectors affixed along one side telescopically received in the corresponding ends of the ridge poles.

7. The combination as set forth in claim **1** in which said mechanical lock means comprises components that snap into registering engagement upon sufficient telescopic movement of the said braces and said connector structures.

* * * * *