Aug. 31, 1965 B. F. RAYNES 3,203,145

PREFABRICATED MODULAR HOME CONSTRUCTION

Filed July 25, 1962 9 Sheets-Sheet 1

FIG. 1

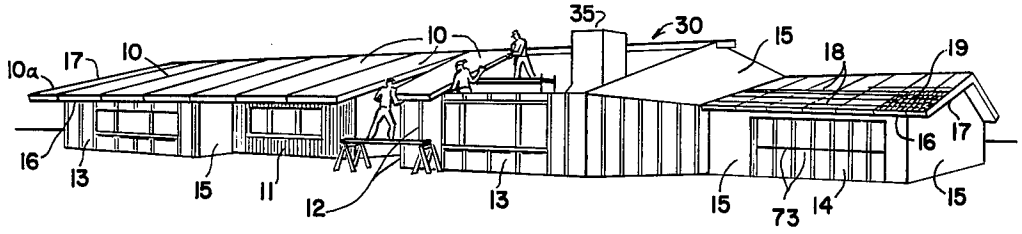


FIG. 2

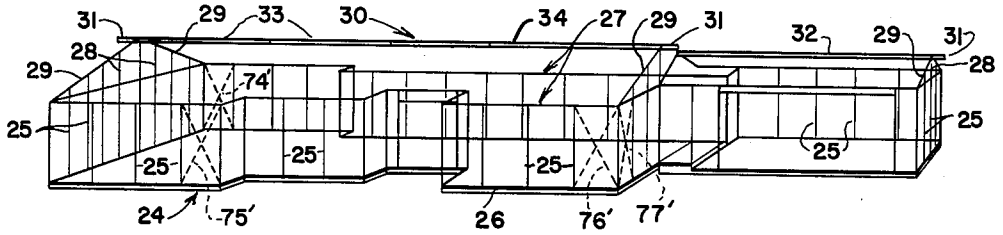


FIG. 3

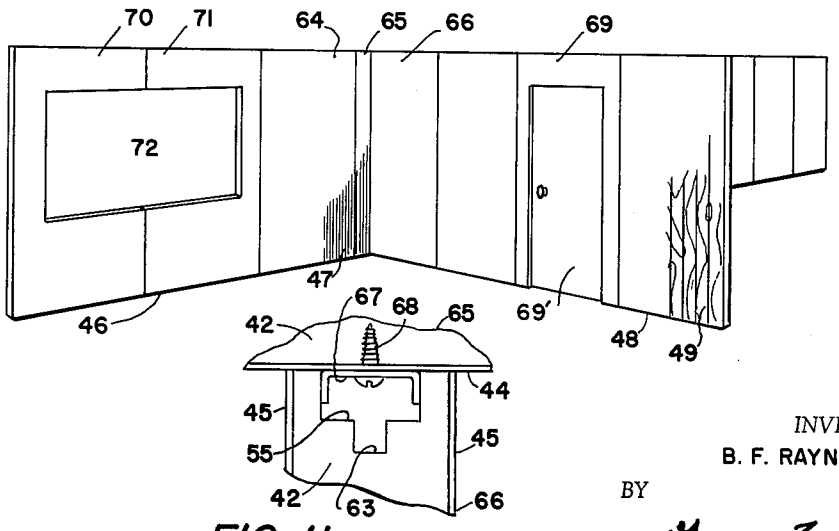


FIG. 11

INVENTOR.
B. F. RAYNES

BY

George E. Pearson
ATTORNEY

Aug. 31, 1965 B. F. RAYNES 3,203,145

PREFABRICATED MODULAR HOME CONSTRUCTION

Filed July 25, 1962 9 Sheets-Sheet 2

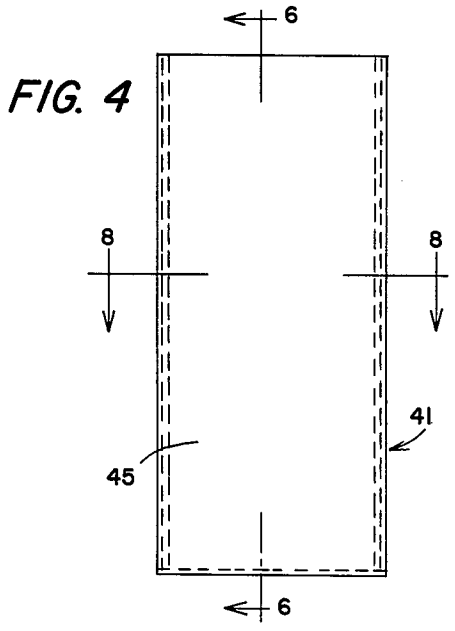


FIG. 4

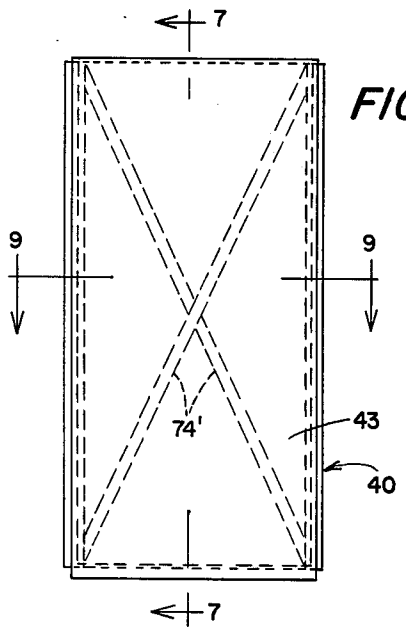


FIG. 5

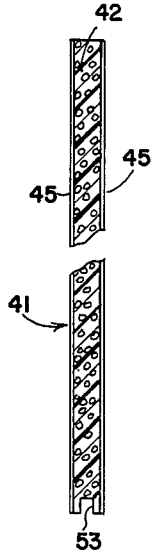


FIG. 6

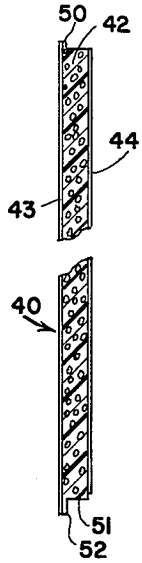


FIG. 7

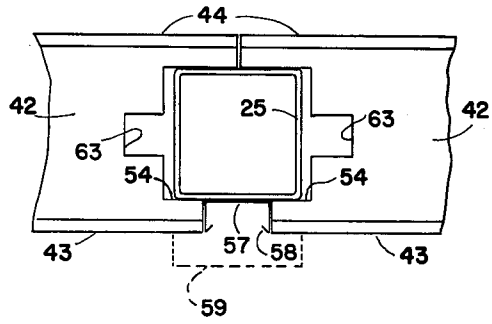


FIG. 10

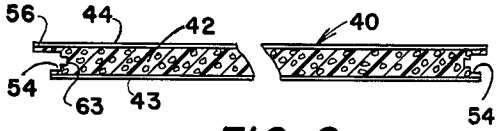


FIG. 9

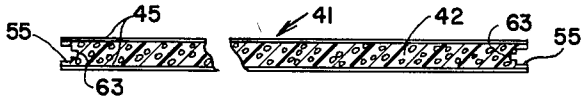


FIG. 8

INVENTOR.
B. F. RAYNES

BY

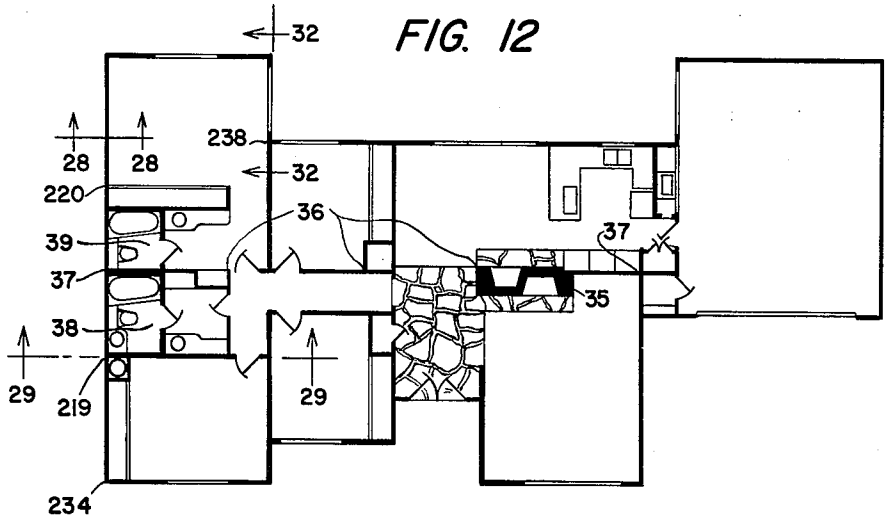
George E. Pearson
ATTORNEY

Aug. 31, 1965 B. F. RAYNES 3,203,145

PREFABRICATED MODULAR HOME CONSTRUCTION

Filed July 25, 1962 9 Sheets-Sheet 3

FIG. 12



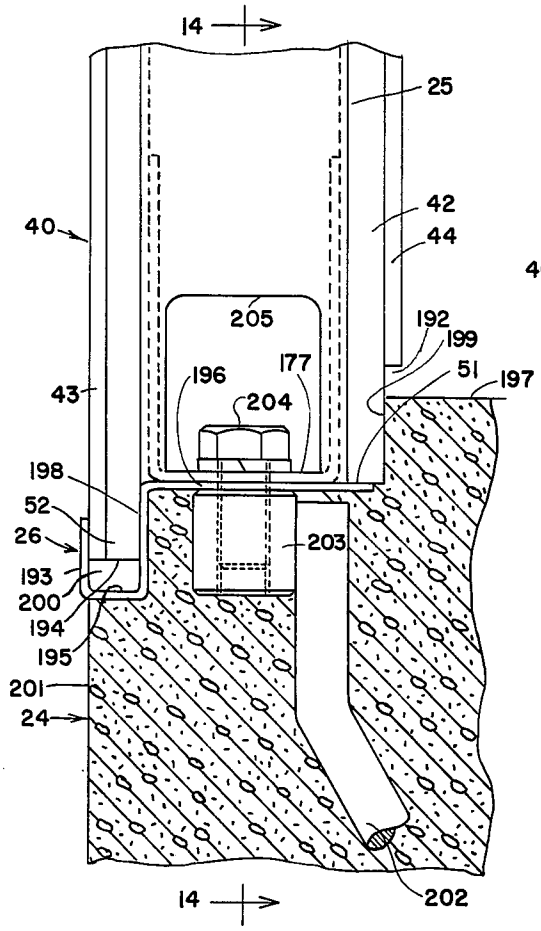
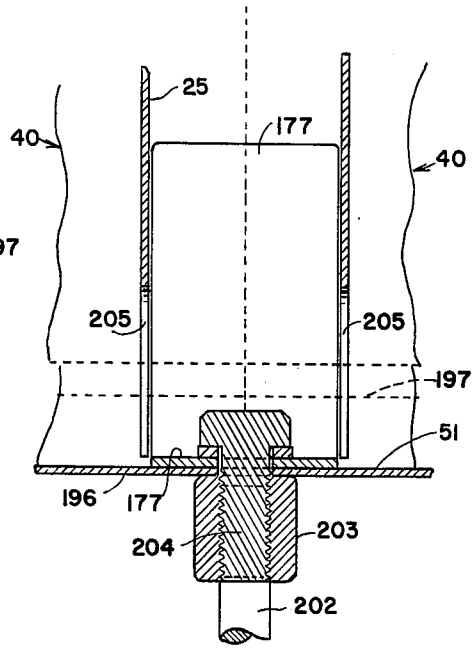


FIG. 13

FIG. 14



INVENTOR.
B. F. RAYNES

BY

George E. Pearson
ATTORNEY

Aug. 31, 1965 B. F. RAYNES 3,203,145

PREFABRICATED MODULAR HOME CONSTRUCTION

Filed July 25, 1962 9 Sheets-Sheet 4

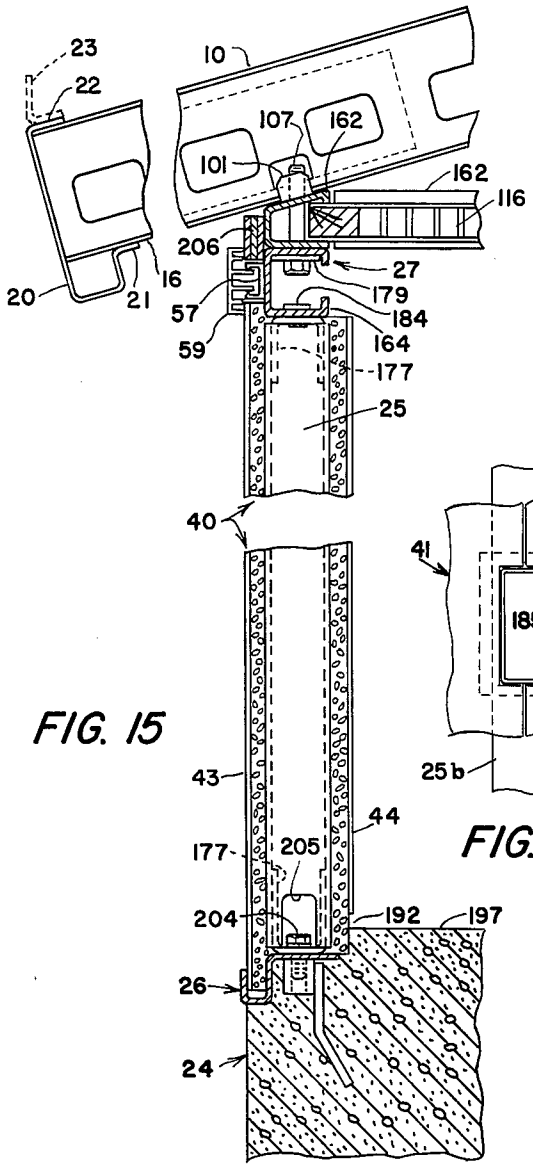


FIG. 15

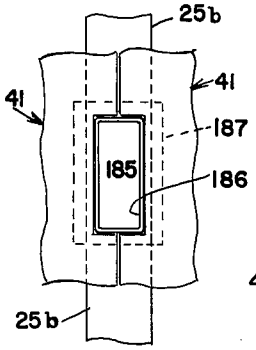


FIG. 16a

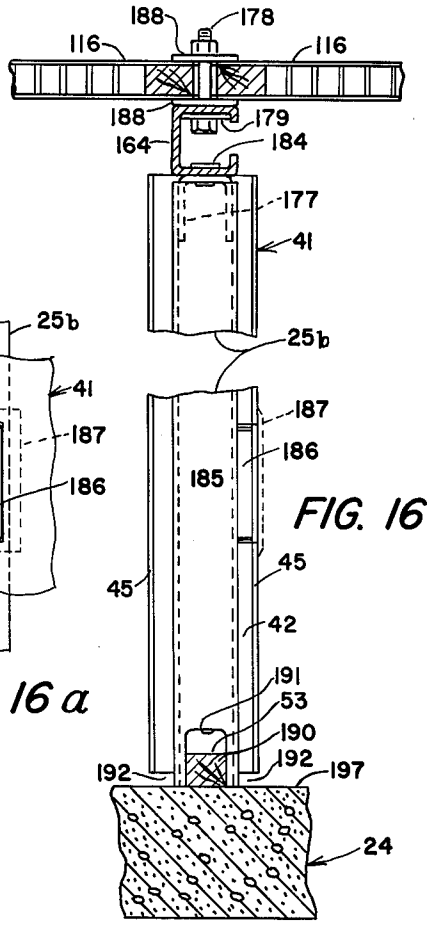


FIG. 16

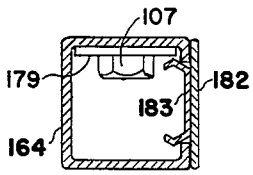


FIG. 17

INVENTOR.
B. F. RAYNES

BY

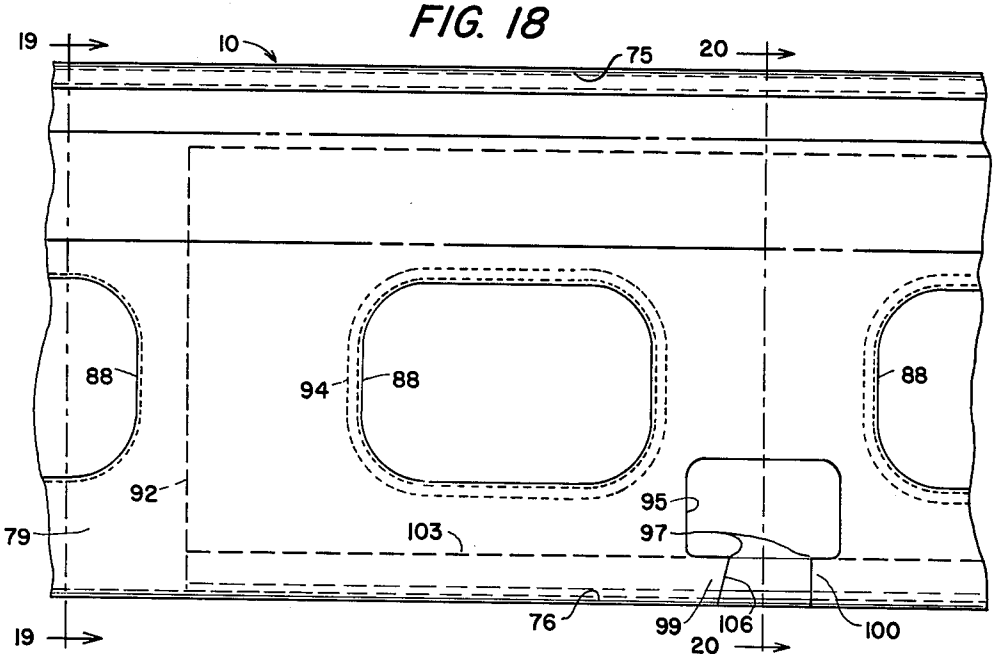
George E. Pearson
ATTORNEY

Aug. 31, 1965 B. F. RAYNES 3,203,145

PREFABRICATED MODULAR HOME CONSTRUCTION

Filed July 25, 1962 9 Sheets-Sheet 5

FIG. 18



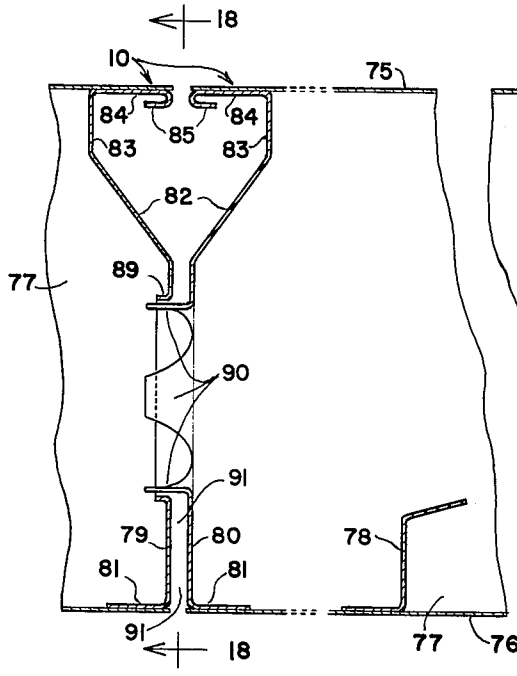


FIG. 19

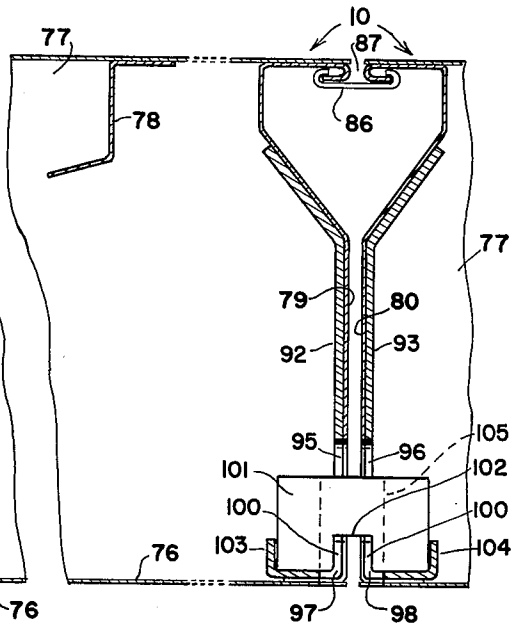


FIG. 20

INVENTOR.
B. F. RAYNES

BY

George E. Pearson
ATTORNEY

PREFABRICATED MODULAR HOME CONSTRUCTION

Filed July 25, 1962 9 Sheets-Sheet 6

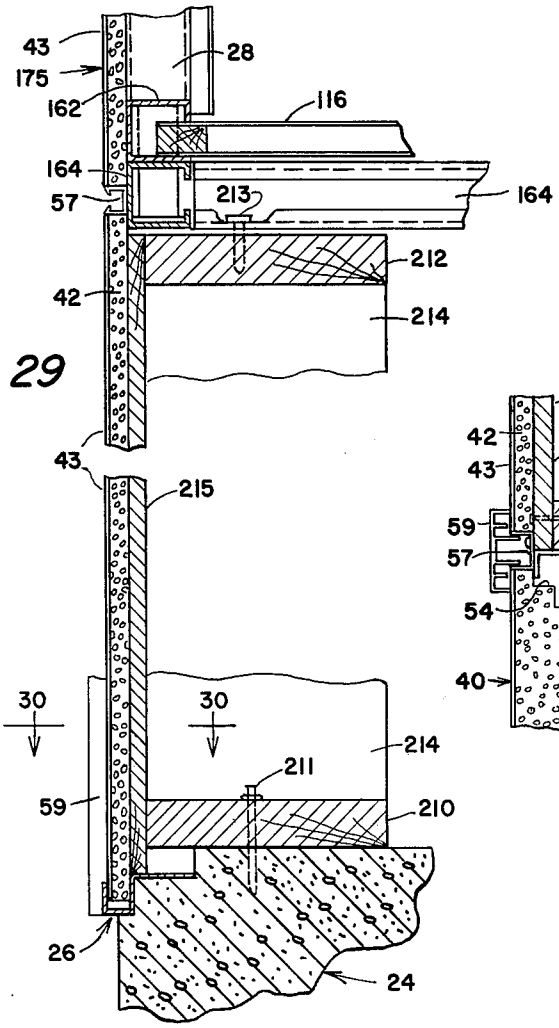


FIG. 29

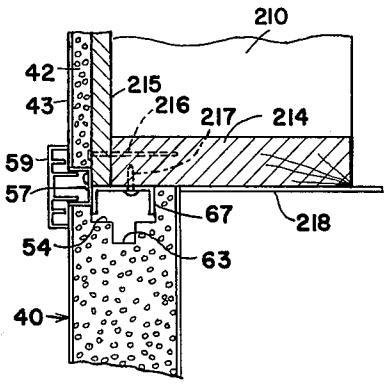


FIG. 30

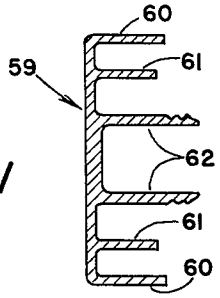


FIG. 21

INVENTOR.
B. F. RAYNES

BY

George E. Pearson

ATTORNEY

PREFABRICATED MODULAR HOME CONSTRUCTION

Filed July 25, 1962 9 Sheets-Sheet 7

FIG. 27

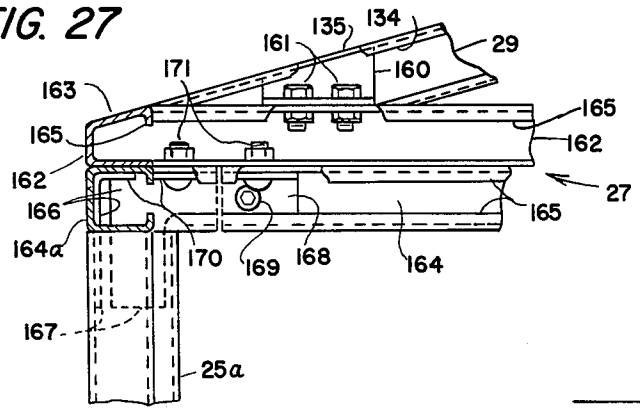


FIG. 28

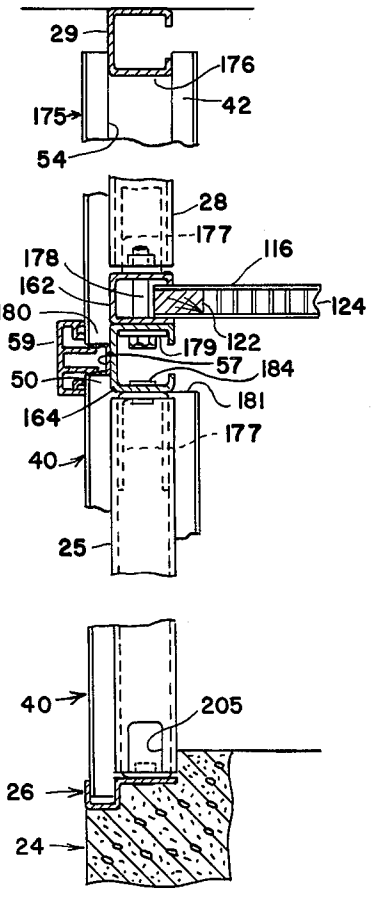
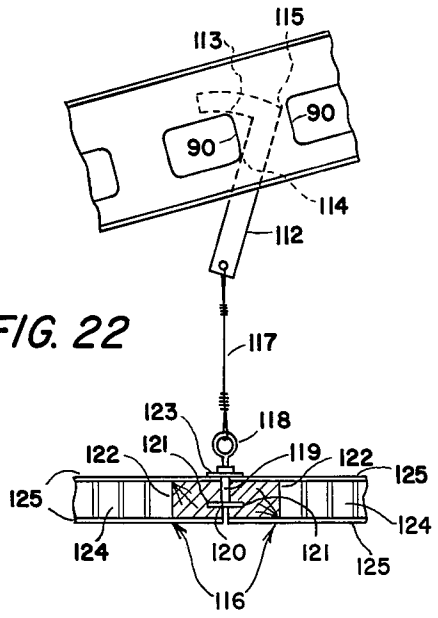


FIG. 22



INVENTOR.
B. F. RAYNES

BY

George E. Pearson
ATTORNEY

Aug. 31, 1965 B. F. RAYNES 3,203,145

PREFABRICATED MODULAR HOME CONSTRUCTION

Filed July 25, 1962 9 Sheets-Sheet 8

FIG. 23

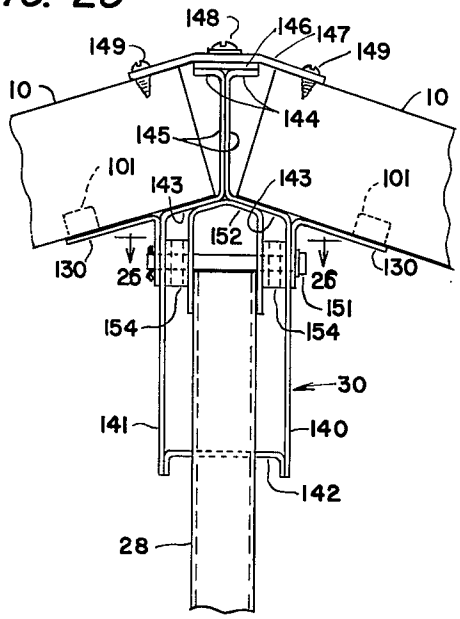
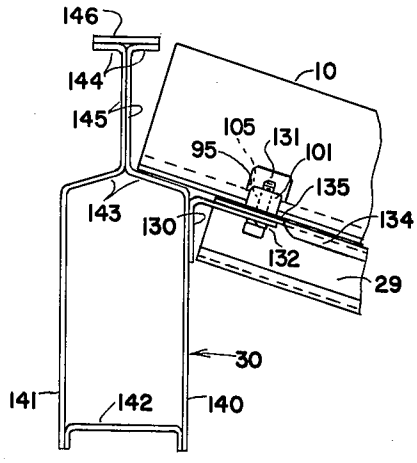


FIG. 24



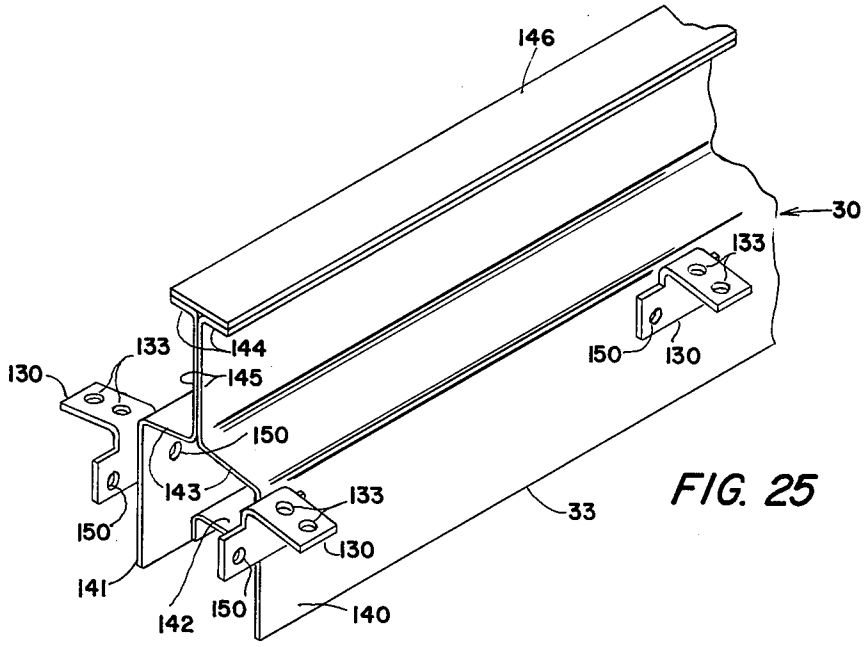


FIG. 25

INVENTOR.
B. F. RAYNES

BY

George E. Pearson
ATTORNEY

PREFABRICATED MODULAR HOME CONSTRUCTION

Filed July 25, 1962 9 Sheets-Sheet 9

FIG. 32

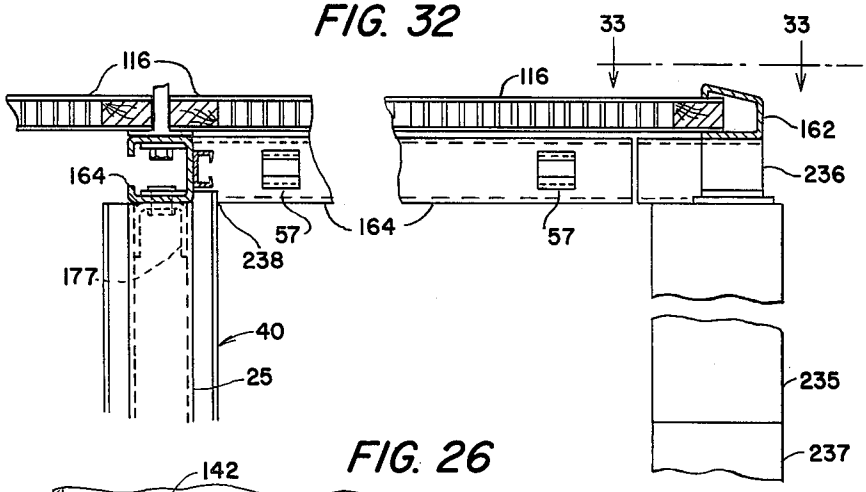


FIG. 26

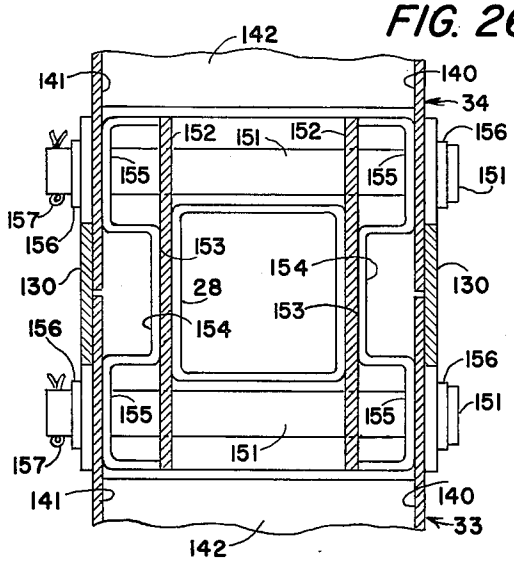
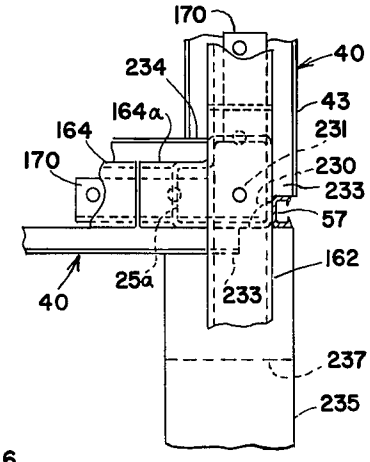


FIG. 33



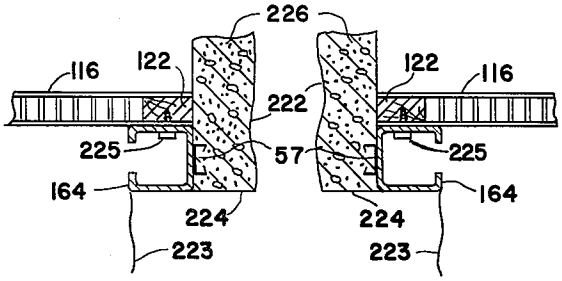


FIG. 31

INVENTOR.
B. F. RAYNES

BY

George E. Pearson
ATTORNEY

United States Patent Office 3,203,145 Patented Aug. 31, 1965

3,203,145

PREFABRICATED MODULAR HOME CONSTRUCTION

Burt F. Raynes, Chula Vista, Calif., assignor to Rohr Corporation, a corporation of California

Filed July 25, 1962, Ser. No. 212,393
29 Claims. (Cl. 52—234)

This invention relates generally to building construction and more particularly to modular home construction wherein modular components such, for example, as wall and roof panels, studs, sill plates, header and ridge beams, door and window frames, fireplace units, unitized bathrooms, and the like, may be fully fabricated at the factory with precision and in volume and assembled and erected at the home-site with minimum time and labor, thereby to effect economies in factory production and on-site construction.

An object and feature of the present invention is to provide such modular construction in homes of distinction having all of the quality features, aesthetic appeal and charm of conventional housing.

Another object and feature resides in the provision of modular homes constructed of factory fabricated modular components in a manner to expedite the production and on-site construction thereof and to effect economies therein which may be passed on to the home purchaser while at the same time providing a home construction which will assure a maximum of long life, structural integrity, and freedom from maintenance problems.

Another object and feature in a modular home construction as thus characterized is to provide a panelled wall and roof construction wherein the advantages of an all steel load-bearing framework are combined with the well-known advantages of sandwich panel construction.

Another object and feature in an all steel framework and sandwich panel construction is to provide an arrangement wherein members of the framework serve as the primary load-bearing elements while also serving to retain the panels in free floating and interlocking relation therewithin.

Still another object and feature is to provide a structural steel framework and free floating foamed plastic core panel construction wherein the foamed plastic provides all the desired qualities of insulation, structural integrity, application to facing skins of diverse construction, and other qualities, while also providing foam-to-metal, and other interfaces which effectively seal the adjoining parts.

Still other objects, features and advantages of the present invention reside in the modular construction, function, and arrangement of component parts wherein, for example, structural members serve also as wireways, panel retainers, and the like, and wherein shear lock foamed plastic roof panels provide all the desired characteristics and qualities of light weight, highly insulative construction while also serving therewith to structurally integrate the panelled walls into a rigid unitized building structure.

These and other objects, features and advantages will become more fully apparent as the description proceeds, reference being had to the accompanying drawings wherein:

FIG. 1 is a view in perspective of a modular home embodying the features of the present invention;

FIG. 2 is a view in perspective of the framework and foundation structures used in the modular home of FIG. 1;

FIG. 3 is a perspective view depicting the inner and outer panelled wall construction employed in the modular home of FIG. 1;

FIGS. 4 and 5 are views in elevation of inner and outer wall panels respectively;

FIGS. 6 and 7 are sectional views taken along the lines 6—6 and 7—7 of FIGS. 4 and 5 respectively;

FIGS. 8 and 9 are sectional views taken along the lines 8—8 and 9—9 of FIGS. 4 and 5 respectively;

FIG. 10 is a fragmentary view of adjoining wall panels and their enclosed stud and trim construction;

FIG. 11 is a fragmentary view depicting the manner of joining the inner and outer panel walls of FIG. 3;

FIG. 12 is a plan view of the modular home of FIG. 1;

FIG. 13 is a fragmentary view depicting the manner of securing the outer panelled walls to the foundation structure;

FIG. 14 is a sectional view taken along the line 14—14 of FIG. 13;

FIG. 15 is a fragmentary sectional view of the outer panelled wall and associated roof and foundation structures taken on module;

FIG. 16 is a fragmentary sectional view of an inner panelled wall and associated ceiling and foundation structures taken on module;

FIG. 16*a* is a fragmentary view in elevation of the outlet box construction depicted in FIG. 16;

FIG. 17 is a sectional view depicting the wireway-header beam construction;

FIG. 18 is a fragmentary view in side elevation of a roof panel;

FIGS. 19 and 20 are sectional views of adjoining roof panels as viewed substantially along the lines 19—19 and 20—20 of FIG. 18;

FIG. 21 is a view in section of a trim strip employed throughout the modular home construction as herein disclosed;

FIG. 22 is a fragmentary view depicting the manner of suspending the ceiling panels from the roof panels;

FIG. 23 is a fragmentary view of a pair of roof panels taken on module and disclosing the ridge beam support therefor;

FIG. 24 is a view similar to FIG. 23 and disclosing the ridge beam and gable beam support for the roof panels in the region of a gabled end wall of the modular home construction of FIG. 1;

FIG. 25 is a fragmentary view in perspective of the composite ridge beam construction;

FIG. 26 is a sectional view taken along the line 26—26 of FIG. 23;

FIG. 27 is a fragmentary view depicting the framework structure in a gabled corner of the modular home of FIG. 1;

FIG. 28 is a sectional view of the gabled end wall as seen along the line 28—28 of FIG. 12;

FIG. 29 is a sectional view of the unitized bathroom wall as seen along the line 29—29 of FIG. 12;

FIG. 30 is a fragmentary sectional view taken along the line 30—30 of FIG. 29;

FIG. 31 is a fragmentary view in section depicting the manner of supporting the ceiling panels on the fireplace structure;

FIG. 32 is a fragmentary sectional view of the patio construction as seen substantially along the line 32—32 of FIG. 12; and

FIG. 33 is a sectional fragmentary view as seen along the lines 33—33 of FIG. 32.

Referring now to the drawings for a more complete understanding of the invention and more particularly to FIG. 1 thereof, there is shown thereon a typical modular home which embodies the structural features of the present invention, the same being constructed and assembled with modular components such, for example, as the roof

panels 10 and exterior wall panels such as used on the exterior walls 11, 13 and 15. These panels, as well as other modular components of the building construction, are wholly fabricated at the factory and assembled on-site as depicted, for example, in FIG. 1 wherein the workmen are engaged in the assembly of a roof panel 10. As will appear more fully as the description proceeds, the adjacent roof panels 10 are secured together and to the structural steel framework of the building in a manner to structurally strengthen the same and generally provide unitary rigidity thereto while also providing an open beam-ceiling type interior, where this is desired, and additionally providing a well balanced roof overhang at the eaves 16 and the gables 17 to thus enhance the aesthetic qualities of the home.

The roof thus assembled from the panels 10 may be finished in any suitable conventional manner as by nailing thereto the spaced strips 18 to which the shake shingles 19, in turn, may be nailed in the usual manner. As another example, the galvanized steel surface of the roof panels may be alternately covered with hot-mopped tar and tar paper, and pea gravel applied to the final layer of the hot-mopped tar, after which the larger rocks or stones may be distributed over the roof surface in a random manner to thus provide a conventional rock roof finish. In any case, a fascia 20, FIG. 15, is employed to cap the exposed ends of the roof panels 10. Fascia 20 preferably is formed into the configuration shown from sheet metal and is fastened to the roof panels as by metal screws, or the like, at 21 and also at 22, a gravel stop 23 also being fastened to the roof panels, as at 22, when a gravel roof is employed, as aforedescribed.

The wall panels and roof panels, as aforementioned, are supported on an all steel framework which is made of structural steel members and constitutes the primary load-bearing elements of the building structure. This framework, in turn, is supported on a conventional concrete foundation slab generally designated 24. As best seen in FIG. 2, the framework comprises tubular metal studs 25 which are arranged on four-foot modules and secured at the bottom to a metal sill plate 26 which follows the perimeter of slab 24 and is secured thereto. A beam structure generally designated 27 is a composite of tubular steel members, hereinafter more fully to be described, which are secured to the upper ends of the studs 25 and extend around the perimeter of the building as defined by the studs. The lower one of the composite members 27 serves to frame the wall panels, and the upper one of the members serves, at the eaves, as the roof beam support for the roof panels. The gabled end walls of the building comprise additional stub studs 28 which are aligned with the lower studs 25 and are suitably secured at the upper ends thereof to gable beams 29.

The ridge beam structure generally designated 30 comprises relatively short 30 inch overhang portions 31, a relatively long beam portion 32 which spans the garage area, and three intermediate 12 ft. portions 33 and a 16 ft. portion 34 which span the main dwelling room area of the building structure. Aligned studs 25 and 28, such as are positioned directly below the junction of ridge beam members 31 and 33 and 31 and 34 in the gabled end walls of the building structure, are repeated at the junctions of beams 33 and adjacent beams 33 and 34, and thus provide support for the ridge beam through the aligned studs and directly to the foundation slab 24.

The ridge beam structure 30 lies directly behind the fireplace structure 35, as best seen in FIG. 1. Thus, these structures may be mutually supporting and, as best seen in FIG. 12, the stud supports for the ridge beam members 33 and 34 may fall along the line of the inner wall provided directly therebeneath. The ridge beams 33 and 34 will thus be supported at the fireplace and elsewhere, as at 36, and at 37 in the gabled ends of the house.

The fireplace structure 35 may be constructed in the form of a modular component, factory built and assembled on-site, as in the case of other modular components comprising the building construction of the present invention. In the instant case, as disclosed, the fireplace structure 35 is constructed on-site, in a conventional manner, and is wholly supported on the concrete foundation slab 24.

As best seen in FIG. 12, the modular home construction of the present invention embodies as modular components thereof, a pair of fully unitized bathrooms 38 and 39 which are generally of the type disclosed and claimed in the copending application of Bernie King, Serial No. 158,414, filed December 11, 1961, for Unitized Bathroom Structure, now Patent No. 3,110,907. It suffices herein to state that such bathroom structure comprises a molded fiberglass and plastic interior and a wood studded exterior framework to which the interior shell is suitably lashed and secured. The fiberglass and plastic shell has molded integrally therewith a bathtub, and other fixtures, and further features a wall-hang toilet and recessed flush tank as well as recessed and unitized plumbing tree lines thereto. As will appear more fully as the description proceeds, the present invention features the manner in which the fully unitized bathrooms are structurally integrated into the modular home construction of the present invention.

Referring now to FIGS. 4 to 9, the numerals 40 and 41 generally designate exterior and interior panels each of which is a structural sandwich in the form of a laminate of three material layers bonded together as a unit and of which the central layer or core 42 preferably is formed of expanded polystyrene beads, this being a sandwich construction which is well known in the present state of the art. It will be understood that, in general, any foamed plastic material which is suitable for the purpose, such as polyurethane, and the aforementioned expanded polystyrene, may be used, and is referred to hereinafter as foam-core.

In each case, the outer layers, facing or skins, as they are called, are relatively thin and relatively stronger than the materially weaker foam-core material 42 to which they are bonded. In the case of the exterior panel 40 the exterior skin 43 may be formed of wood grained asbestos cement board with battens 12, as depicted for panelled walls 13 and garage door 14 in FIG. 1. Exterior skins 43 similarly may be formed of striated asbestos cement board, as depicted for the panelled walls 11 in FIG. 1. In still other cases the exterior skins may be formed of smooth surfaced asbestos cement board or exterior grade plywood as depicted for the panelled walls 15 of FIG. 1.

The interior skins 44 of the exterior wall panels 40 will generally be similar to the skins 45 of the interior panels 41. Interior skins 44 and 45, for example, may be formed of tempered hardboard with textured vinyl surface or plain pastel vinyl enemal finish. In other cases the interior skins may be formed of genuine V-grooved plywood, or simulated wood-grained plywood formed of hardboard. In still other cases, the interior skins may be formed of drywall which may be tinted or papered, as is desired. Combed or striated plywood affords still another choice of many possible materials suitable for use on the inner skins. In FIG. 3, by way of example, the inner skins of the exterior panelled wall 46 are depicted as being formed of combed plywood 47 whereas the skins of the interior panelled wall 48 are depicted, as at 49, of being formed of genuine V-grooved plywood.

Referring again to FIG. 7, the exterior skin 43 of exterior panel 40 extends above and below the inner skin 44, and the core 42 likewise is formed such that a portion of the core adjacent exterior skin 43 also extends above the inner skin as indicated at 50. The lower end of the core is formed so as to have a stepped surface, the bottom surface 51 being somewhat below the bottom edge of inner skin 44, and the bottom suface 51 terminating just short of the outer skin 43 to thus leave a portion of the core adjacent the outer skin which depends therewith

to the lower edge extremity thereof as indicated at 52, all for a purpose hereinafter more fully to appear.

Referring now to FIG. 6, it will be seen that the upper surface of core 42 of interior panel 41 is formed level with the skins 45, and the bottom surface of core 42 is notched or routed to form a groove 53 therein, all for a purpose hereinafter more fully to appear.

With reference to FIGS. 8 and 9, it will be seen that grooves 54 and 55, which are generally similar to groove 53 in interior panel 41, are provided, respectively, in the side surfaces of the cores 42 of the exterior and interior panels 40 and 41. As best viewed in FIG. 9, the left side of skin 44, and a portion of the core 42 adjacent thereto, extend beyond the corresponding side of skin 43, this extended portion being designated 56. On the right side of panel 40, the same side portion of skin 44 and core 42 is similarly elongated with respect to the corresponding side of skin 43. By contrast, it will be noted that both edge portions of exterior skin 43 are formed identically with respect to the grooves 54. Thus, when a pair of exterior panels 40 are placed side by side to enclose a stud 25 within the pocket formed by the confronting grooves 54, the sides of exterior skins 43 form a gap therebetween which may be of the order of 1 inch to provide for expansion and contraction thereof with temperature changes and to accommodate within the gap, a clip 57 which is generally C-shaped and secured as by spotwelding to the tubular stud 25, the gap, and hence the clip 57 being disposed centrally of the longitudinal center line of the stud. By contrast, the sides of the interior skins 44 substantially abut with one another substantially at the longitudinal center line of the stud 25. The sides of interior panel 41 are identically formed with respect to the grooves 55 therein and, hence, these panels when placed side by side to enclose a stud therebetween have the confronting sides of the skins abutting on both sides of the stud, as will become at once apparent due to the symmetry of the panel, as best viewed in FIG. 8.

It will be understood that the side configurations of panels 40 and 41 are varied, as required, to fit corner areas, as in FIG. 33, and elsewhere. The exterior panels 40, for the most part, however, will be formed the same on both sides, as shown in FIG. 10. The particular panel disclosed in FIG. 9, for example, would be used in the patio area, FIG. 32, where at the inner wall corner 238, FIGS. 12 and 32, the extended portion 56, FIG. 9, would be required to meet its adjoining panel 41.

The tubular studs 25 are square in cross section, being of the order of two inches on a side. Since the panels 40 and 41 are approximately three inches thick, the same thus virtually isolate and insulate the relatively good heat conductor of the metallic stud from the environmental heat conditions on opposite sides of the adjoined panels by reason of the low heat conductivity of the substantial layer of polystyrene plastic virtually surrounding the stud. To enhance the tightness of the joint between panels afforded by the tubular metal stud 25, the grooves 54 and 55 are formed undersize with respect to the stud so that the panels form a tight fit and seal therewith at the mutually engaging surfaces of the stud and core 42.

The gap occupied by clip 57 between exterior adjacent skins 43 is closed by any suitable masking strip or device such, for example, as the aluminum extrusion disclosed in FIG. 21 and generally designated 59. Masking or trim strip 59 is generally of channeled configuration having outer flanges 60 and inner flanges 61, one or both of which may engage the skins 43 when the centrally disposed and serrated gripping flanges are inserted within the clips 57. There are several clips 57 distributed in spaced relation longitudinally of the studs 25, such that the inwardly turned ends 58 of the spring clips are moved to grip the serrations on the trim flanges 62 to thus effect a substantially snap-on engagement therewith. This snap-on engagement renders the masking strip 59 virtually non-retractable from its mounted position to thus prevent removal by pranksters, and the like, while at the same time providing an effective seal and closure of the gap, this being particularly true if a calking compound is used with the masking strip.

A further groove 63 is provided in grooves 54 and 55, FIGS. 8 and 9, of the core material 42. These grooves conveniently may be used to carry telephone wires, intercom lines, and other low voltage lines and wires, as may be desired or required in the plan of the modular home.

Referring again to FIG. 3, it will be seen that the interior wall 48 is off module with respect to the exterior wall 46, that is to say, wall 48 meets with wall 46 just to the right of the junction of panels 64 and 65. The manner in which panel 65 of wall 46 forms a joint with panel 66 of wall 48 is disclosed in FIG. 11 wherein it will be seen that channel member 67 is secured as by screws 68 to the skin 44 and core 42 of panel 65. Channel 67 is interfittingly received within the groove 55 formed in panel 66, the channel 67 thus serving in the manner of a half-stud to thus form the joint between the panels much in the same manner as the studded joint is formed between the in-line panels, as aforedescribed.

Referring again to FIG. 3, panel 69 is disclosed as mounting a door 69', and panels 70 and 71 are disclosed as defining a window area 72.

The garage door 14 is formed of exterior panels to provide the batten and board exterior wall surface effect as provided in the wall portion 13 of FIG. 1. These panels are hinged along the top and also along the intermediate line 73 to thus provide the normal garage door access function while also providing an exterior surface which blends with and complements other exterior wall panels of the modular home. Of even greater significance is the thus fully paneled interior wall surface of the garage area which, although functionally a garage in view of the door 14, has the same interior wall appearance as any of the other rooms of the modular home and may thus optionally be used as a recreation room, or the like, in view of its expansive floor space and open ceiling area.

Referring now to FIGS. 18 to 20, it will be seen that the roof panels 10 comprise upper and lower metallic facings 75 and 76 which may be formed of thin gaged galvanized steel. Interposed between these facings and bonded thereto is a very thick central layer of foam or core 77 of expanded polystyrene beads to afford a high degree of heat and acoustic insulation in the roof covering. A plurality of steel stiffeners 78 which are secured as by welding to the facings 75 and 76 and distributed in spaced relation along the length thereof, extend into the body of the core 77 and serve to anchor the facings to the central core as well as to provide overall rigidity and strength to the roof panels.

One side of each roof panel is closed by a web 79 and the other side closed by a similar web 80, these being formed of the same material as used in the facings 75 and 76. Each of the webs at the bottom has a turned in flange 81 which is welded to the lower facing 76. The upper end portions of the webs are directed diagonally inwardly as at 82 from whence the webs are directed at right angles to the facings, as indicated at 83, and finally terminated in outwardly extending portions 84 which are secured as by welding to the upper facing 75. Terminal portions 84 are doubled back as at 85 to thus provide hook means for interlocking engagement with elongated C-channel strips 86, FIG. 20, by means of which adjacent panels 10 are locked together. Once interlocked in this manner by the channel member 86, the gap 87 between the adjoined panels may be filled with a suitable calking compound, or the like, to thus provide a continuous smooth and water tight roof surface.

The central portion of web 79 is provided with a plurality of spaced and generally rectangular openings 88, FIG. 18, the peripheral edge 89 of which is turned

inwardly, as best seen in FIG. 19, to thus provide a surface for telescopically receiving a similarly formed series of flanges 90 formed on the facings 80 and directed outwardly therefrom. To provide a more or less resilient engagement between the male and female flanges 90 and 89, the apertures in facings 80 are so formed that the peripheral web material around these openings may be bent outwardly as tabs which may yieldably be forced to enter the coacting continuous peripheral and relatively rigid coacting flange 89.

Upon assembly of adjacent roof panels 10 and effecting the interlocking engagement of the coacting flanges 89 and 90, their associated webs 79 and 80 remain spaced apart to provide an opening 91 therebetween which is bridged by the exposed surfaces of flanges 90. Opening 91 serves to receive FIGURE 7—shaped hooks 112, FIG. 22, and the exposed flanges 90 serve as pins to engage these hooks, as at 113 and 114. Each hook 112 is constrained, more or less, to maintain this engagement with the roof flange 90, as depicted in FIG. 22, by reason of being engaged also as at 115 with the adjacent flange 90. Each hook is thus supported by one flange 90 and entrapped between adjacent flanges 90 to thus prevent release and withdrawal of the hooks from the roof panels.

As disclosed in FIG. 22, each hook 112 serves to support and suspend adjoining ceiling panels 116 from the roof panels. For this purpose, a wire or cable 117 is suitably employed to interconnect the hook with an eye bolt 118 which is secured to the ceiling panels. The eye bolt 118 is threaded to a T-fastener 119 whose flange 120 is seated in a groove provided therefor by the confronting notches or recesses 121 formed longitudinally in the wood edge members 112 of the ceiling panels. By reason of this arrangement, a fastener 119 may be slid along the adjoining ceiling panels until its eye bolt 118 is positioned directly below a ceiling hook 112. On tightening the eye bolt, the adjoining panels then become clamped between the flange 120 and a washer 123, or the like, employed with the eye bolt.

Ceiling panels 116 may be formed of any light weight material suitable for the purpose, and to this end, comprise a paper honeycomb core 124 having one-half inch cells, for example, and being approximately one inch thick. This paper core is suitably faced with fiberboard or hardboard skins 125.

Referring again to FIGS. 18 and 20, it will be seen that the webs 79 and 80 are reinformed by doublers 92 and 93 respectively which are shaped to conform with the configuration thereof and likewise suitably formed of steel, although being relatively thicker than the thin webs. Generally rectangularly shaped and aligned openings 95 and 96 are provided in the adjacent doublers and webs, and these openings are narrowed, as at 97 and 98, and extended through the bottom facings 76. As a result of the shape of the openings 95 and 97, web 79 and doubler 92 provide flange portions 99 and 100 and, as a result of openings 96 and 98 in web 80 and doubler 93, similar flange portions 99 and 100 are provided therein, only flange 100 for this web-doubler combination appearing in FIG. 20.

Flanges 99 and 100 are straddled by the legs of a bifurcated nut 101 whose bight portion or surface 102 just clears the edges of the flanges. The lower edge portions of doublers 92 and 93 are turned up as at 103 and 104, respectively, to provide additional flanges for seating and retaining the nut 101 whereby the threaded opening 105 thereof is caused to align with the combined openings afforded by the confronting openings 97 and 98 of the adjacent roof panels. These combined openings and the clearance openings 95 and 96 may thus serve to accommodate a bolt received by a nut 101 to secure the adjacent roof panels to a supporting structure, as presently to be described, the pressure which is thus brought to bear upon the nut 101, upon the tightening of the same, being directed against the support through the lower portions of the doublers and the adjoining portions of the facings 76. Openings 97 and 98 are slanted as indicated at 106, FIG. 18, and the opening 105 through nut 101 is similarly slanted, as depicted in FIG. 15, where bolt 107 serves to clamp adjacent roof panels 10 to the composite wall beam structure 27.

Referring now to FIGS. 23 to 26, it will be seen that adjacent roof panels 10 are also secured as by the nuts 101 to angular brackets 130 which, in turn, are secured to the ridge beam structure 30. As best seen in FIG. 24, the threaded opening 105 for the nut 101 as used for this purpose, extends at right angles to the bearing surface of the nut and the sloping roof surface of the panels 10, a simple bolt 131 and lock washer 132 combination serving, in this case, to tighten the nut 101. Brackets 130 are provided with two openings 133 to selectively receive the bolt 131 to thus allow for adjustment of the roof panels to take care of stretch out thereof. This, moreover, prevents any difficulty which may be encountered in locating a nut 101 in the opening 95 therefor.

Gable beam 29 is also shown to be fastened to bracket 130 in FIG. 24. For this purpose gable beam 29, which has a C-shaped cross section, has the short flange 134 thereof cut away in the region of the bracket so that its upper flange 135 rests on the bracket and beneath the adjacent panels 10 being secured to the bracket at this point. Referring momentarily to FIG. 27, it will be seen that the gable 29 similarly has its short flange 134 cut away to expose the upper flange 135 to thus accommodate a nut 101 (not shown) for securing adjacent roof panels 10 at this point, in the manner as aforedescribed. In like manner, the ridge beam along the length thereof at spaced intervals is similarly altered to accommodate the fastening means for the roof panels. It will be understood, of course, that the adjacent roof panels at a gabled end of the modular home as herein disclosed, comprise a narrow panel 10*a*, FIG. 1, which provides the roof overhang and a normal width roof panel 10 which, like the other panels 10, falls on module in line with the studs 25, FIG. 2, and in line with the exterior wall panels such as 70 and 71, FIG. 3, which are framed by the studs.

Referring again to FIGS. 23 to 26, it will be seen that the ridge beam structure 30, which is the same for all of the ridge beams 31 to 34, is fabricated to relatively thin elongated sheets of metal, preferably steel. Oppositely formed webs 140 and 141 comprise the principal members of the beam, these being bridged at their bottom edges by elongated channel members 142 and directed toward each other as at 143 to thus form a box section or portion of the beam. These inwardly directed beam portions 143 and the outwardly directed upper edge portions 144, together with their intermediate adjoining portions 145 comprise an I-beam section or portion of the beam structure. Thus, the rigid beam structure 30 is essentially a composite beam comprising a box beam lower portion and an I-beam upper portion.

The upper portions 144 of the I-beam section are bridged by a plate 146 to which they are secured, as by welding, and this plate, in turn, and the ends of the roof panels 10 which approach this plate on either side thereof, are capped by a plate 147, FIG. 23, which is angularly formed so as to conform to the panel and beam surfaces and suitably secured thereto as by the fasteners 148 and 149.

Each bracket 130 also has apertures 150 by means of which the brackets are secured to the webs 140 and 141, as the case may be, these brackets being spaced on module along the length of the ridge beam. Suitable fasteners, not shown, may be employed to secure the intermediate brackets 130 to the webs. At the ends of the beams, however, pins 151 are employed for this purpose, since these pins also serve to connect adjacent ridge beams together, such as beams 33 and 34 disclosed in FIG. 2. It will be recalled, furthermore, that aligned studs 25

and 28 providing direct support from the concrete foundation slab 24 also intercept the ridge beams at their junctions, and hence, pins 151 also serve to secure these studs, namely studs 28, to the ridge beam structure 30. How this is accomplished is best disclosed in FIGS. 23 and 26.

Referring now more particularly to FIGS. 23 and 26, it will be seen that the stud 28 is capped by a stirrup 152 of generally inverted U-shaped configuration which is also shaped generally to conform with the merging web portions 143. The depending portions of stirrup 152 are secured as by welding to the stud 28 and are provided with openings to accommodate the pins 151, as best seen in FIG. 26. It will be noted that the channel members 142 of the adjacent ridge beams are amply spaced apart to accommodate and provide ample clearance for the stud 28 which passes upwardly therebetween.

The depending portions of stirrup 152 also have suitably secured thereto, as by welding, in the region 153 thereof, a pair of spacer plates 154. These spacer plates have laterally extending portions 155 which engage the inner surfaces of beam webs 140 and 141. These extensions are also apertured to receive the pins 151 whereby the same, when mounted as disclosed in FIG. 26, serve to fasten the associated beam and stud structure together, the pins carrying suitable washers 156 and being secured in place, as by the cotter pins 157.

Attention is again directed to FIG. 27 wherein it will be seen that gable beam 29 is cut away so as to merge with the upper surface of the composite beam 27 and, additionally, has an angle bracket 160 which is welded thereto and fastened as by the bolts 161 to the ceiling panel retainer and beam portion 162 of the composite beam structure 27. Ceiling retainer 162 in the gabled end of the modular home herein disclosed is generally of C-shaped and rectangular configuration, whereas, where it serves as the roof beam, its upper flange is sloped as at 163 so as to conform to and merge with the slope of the gabled beam 29 and the roof panels 10, as may best be seen in FIG. 15.

Returning again to FIG. 27, it will be seen that composite beam 27 comprises a lower tubular metallic member 164 of generally C-shaped cross section which has both upper and lower short flanges 165 whereas the upper composite beam member 162 has only the upper short flange 165, the upper member 162 being formed in this manner so as readily to receive the aforementioned ceiling panels 116, such as may be seen in FIG. 28, and in other figures of the drawings.

FIG. 27 discloses a typical corner structure wherein a corner stud 25*a* has a special manner of fastening of the same to the composite beam structure 27. For this purpose, L-shaped brackets 166 have depending portions 167 which extend downwardly into the angle stud 25*a*, and have horizontal portions 168 which extend along the beam members 164, and are secured thereto, as by the fasteners 169. A corner beam member 164*a* is mounted directly above the corner stud 25*a*, and the L-shaped brackets 166 also have their depending portions 167 and horizontal portions 168 extend through this corner member 164*a*. The L-shaped bracket members also have at the upper portions thereof, a right angularly extending flange 170 which serves to accommodate fasteners 171 by means of which the beam members 164 and 164*a* are secured to the beam members 162, the depending portions 167 of these brackets being suitably secured as by welding to the corner stud 25*a*.

FIG. 28 generally discloses the wall construction at the gabled end of the modular home herein disclosed, this being the construction as may be seen along the lines 28—28 of FIG. 12. In this case, the gabled panel 175 has its core 42 routed as at 176, and appropriately sloped to conform to the incline of the gable beam 29. Panel 175, of course, is also routed as at 54 to accommodate the relatively short gable stud 28. As is typical of the stud construction throughout, stud 28 has a stirrup 177 by means of which it is secured as by the bolt 178 to composite beam members 162 and 164, a square washer 179 being employed under the head of the bolt 178 to increase the rigidity of the frame structure thusly secured. The tightening of bolt 178 has another function, namely, that of squeezing the upper and lower flanges of channel member 162 somewhat so as to grip the ceiling panel 116 between the short flange 165 of member 162 and its bottom flange upon which the ceiling panels 116 rest, substantially as best seen in FIG. 28. As seen in FIG. 15, the bolt 107 performs a similar function in clamping the ceiling panel 116.

Gabled panel 175, FIG. 28, has a depending portion 180 which encloses the external surface of beam 162 and, in part, that of beam 164 where it meets in spaced relation with the upperly projecting portion 50 of exterior wall panel 40. In the intervening space is located one of the aforementioned clips 57, in this case secured to beam 164. This clip, in turn, secures the horizontally extending matching of trim strip 59. It will be noted that panel 40 on its inner wall rises as at 181 just below the opening in beam channel 164. This beam channel also serves as a wire race way to accommodate the wiring for the modular home, and access to this wiring is available through the opening in the channel member. This opening is normally closed, as may be seen in FIG. 17, by means of a closure plate 182 which extends the full length of each channel member 164. Plate 182 has secured thereto a snap-on clip 183 which snaps into the opening of race way 164 and, like the plate, itself may extend the full length of the race way.

Referring now to FIGS. 16 and 16*a* which disclose an inner wall structure, it will be seen that interior panel 41, together with its adjacent panel, encloses an interior wall stud 25*b* whose stirrup 177, like that of the stud 25, is secured to the race way by a tubular fastener nut 184 which may be of the type known in the art as a Nelson stud. Thus, wiring in the wire way 164 may be brought downwardly through the studs to a switch, for example, located within the outlet box area 185 of the stud as depicted in stud 25*b*. A rectangular opening is provided in the stud at this point, and this opening is enclosed by a rectangular ring 186 which projects from the stud substantially to the surface of the panel, suitable openings also being provided in the adjoining panels 41 to accommodate the ring 186. The opening is then closed by a conventional switch or wall socket outlet plate 187.

It will be understood that provision for similar electrical outlets are provided, as required in other studs, both inner and outer wall. In any case, wiring from the race way is brought down through the studs 181 to the electrical outlet, the arrangement thus being such that the studs serve both to provide a metallic covering for the wiring but also serving as a conventional outlet box as well.

Referring again to FIG. 16, it will be seen that the race way 164, which is the same for the inner walls as for the outer walls, serves at the inner walls to support the ceiling panels 116, the bolt 178 and square washer 179 combination being employed to secure the same together, as in other cases heretofore described. In this particular instance, upper and lower square washers 188 are employed to clamp the panels 116 therebetween as the bolt 178 is tightened. In order to further grip and secure the ceiling panels, the corners of washers 188 may be bent inwardly toward the panels to thus clinch the same on tightening of the bolt 178. In any case, the washers 188 will tend to become embedded in the panels such that the same virtually lie flat in supported relation on the wire way 164. When the thickness of the lower washer 188 tends to defeat this desired supported relation between the panels and the wire way, the lower washer optionally may be omitted.

The inner walls are anchored to the foundations slab

24 by means of wood runner strips 190 which may be suitably nailed or ramset to the concrete base. The inner wall studs 25b are bifurcated as indicated at 191 so that the studs are adapted to straddle the runner strips 190, substantially as shown in FIG. 16. The routed groove 53 in the core 42 of the interior panel 40 rests in supported relation on the runner strip 190 such that the bottom surfaces of the panel clear the concrete base as indicated by the spaces 192. The interior panels 41 thus literally float within the framework defined by adjacent studs 85b, at the sides, the runner 190 at the bottom, and the race way 164 at the top. The weight of the panels however, by reason of the spacing 192, is supported on the runner strips 190, and the dimensions of the core 42 are such as to yieldingly compress the panel below the race way 164 to thus provide a closely sealed and tight inner wall construction.

The positioning of the inner wall panel facings 44 and 45 above the concrete base is a feature of the present invention in providing an efficient seal between the panels and the ground structure, particularly the concrete-to-foamed plastic interlace afforded by the stepped bottom surface of the exterior panels 40 and their interfitting relationship with the perimetrically extending sill plate 26.

As best seen in FIG. 13 sill plate 26 comprises a generally J-shaped channel section 193 within which the depending portion 52 of exterior panel 40 is received interfittingly therewith. It is to be noted that the bottom surface 194 of this depending portion of the panel does not bottom on the bottom surface 195 of J-shaped member 193. This assures that the large area bottom surface 51 of the yieldable core material 42 engages yieldably with the flat surface portion 196 of the sill plate, this naturally occurring in view of the spaced relation of the skins 44 and 43 above the floor surface 197 of the concrete slab 24 and the bottom surface 195 of J member 193. As a result, the foamed core material 42 forms a highly water resistant seal with the engaging surface of flat portion 196 of the sill plate. This water resistant seal is augmented, moreover, by reason of the additional foam-to-sill interface afforded by the core material in the region 198 of the J member 193. Additional sealing surface is afforded by the foam-to-concrete interface provided in the vertical region 199 of the core material 42, this resulting from the fact that the floor level surface 197 of the concrete slab is lowered and stepped down, or peripherally recessed in the region of the flat portion 196 of the sill plate.

Thus, by reason of the stepped configuration of the bottom surface of exterior panels 40 and the corresponding interfitting surfaces of the foundation structure, a series of natural seals 198, 51 and 199 are formed by the core material in engagement therewith. These sealing surfaces, moreover, follow a tortuous path from the first access of moisture to the core material, namely, at the bottom surface 194 thereof and terminating at the intersection of the floor surface 197 with vertical foam surface 199. It is further significant that the floor level surface 197 lies considerably above the sill surface 195 which, in turn, lies considerably above the grade line by some 8 inches. In addition, suitable caulking compound may be used to fill the space 200 below the panel in the J-portion 193 of the sill plate. The outer leg of this channel portion of the sill plate lies just outwardly of the foundation base 201 and thus serves to protect the lower portion of the asbestos board skin 43 against impact from lawn mower wheels and the like.

Sill plate 26 is preferably formed of thin gaged stainless steel to assure resistance to corrosion and atmospheric conditions. The sill plates may readily be broken at the factory, supplied like lengths of lumber, and cut to length and mitered at the corners on-site, using, for this purpose, a band saw. The sill plates, moreover, are preferably embedded within the concrete foundation slab, being set in place preparatory to pouring the concrete and, as such, serving, in part, as a portion of the forms for laying the concrete slab. In one arrangement, the anchor bolts 202 which have secured thereto, as by welding, a tubular nut 203, are secured as by the bolt 204 to the sill plate 26 and also to a portion of the form employed to develop the slob surfaces 201 and 199. When the concrete has been poured and set, bolts 204 are removed to free the forms and, in place thereof, a stud 25 is mounted on the sill plate, bolt 204 now passing through an opening therefor in the bottom of the stirrup 177 for the stud whereby the stud is securely anchored to the sill plate and to the anchor bolts 202. The exterior wall studs 25 preferably are bifurcated as by the slot 205, on both sides of the stud to thereby make the bolts accessible for the foregoing purpose.

Referring to FIG. 15, it will be seen that the exterior wall just below the eaves, is completed as by three strips of plywood 206, or the like, which may be suitably fastened to the ceiling retainer and seated above a clip 57 for retaining a trim strip 59 in the manner aforedescribed.

Attention is now directed to FIGS. 29 and 30 which disclose the manner in which the unitized bathrooms 38 and 39, FIG. 12, are integrated into the modular construction of the rest of the modular home herein disclosed, the structure as disclosed in FIG. 29 being that which would appear when viewed along the lines 29—29 of FIG. 12. The unitized bathrooms are one story structures and adapted to be inserted between the floor or base level and the ceiling level of the structure in which the bathrooms are to be integrated. Accordingly, the composite beam structure 27 and the ceiling panels 116, as well as the gable panels 175 are substantially identical with those disclosed in FIG. 28, as aforedescribed. The foundation structure 24 and sill plate 26, moreover, are the same as heretofore described.

The bathroom structure comprises a wood floor plate 210 which is secured to the foundation slab 24 as by ram set indicated at 211 and a wood header plate 212 which is secured to the wire way 164 as by a lag screw 213. Wood studs 214 extend between the plate and the header members 210 and 212 at either end thereof. This framework of studs and sill and header plates serves to secure a large plywood panel 215 thereto, as by nailing the parts together as indicated at 216, FIG. 30. The plywood panel 215 and its supporting framework is mounted such that the outer surface of the plywood merger with the outer surfaces of wire way 164 and ceiling retainer 162 at the top of panel 215 and with the channeled surface of sill plate 26 at the bottom of the plywood panel. Thus, a thin layer of foam-core 42 faced with an outer skin 43, as in the case of the other exterior panels 40, in the same manner is seated in the channel portion of sill plate 26 and, at the upper surface thereof, lies adjacent clips 57 for receiving the trim 59, all in a manner as hereinbefore described for the normal panel construction on the exterior walls of the modular home.

Referring now more particularly to FIG. 30, it will be seen that the adjacent exterior wall panel 40 is joined to the bathroom stud structure as by a channel member 67 which is secured to the stud 214 as by a plurality of lag screws 217. A facing 218 which may be hardboard, or the like, provides the wall surface of the adjoining room to the bathroom, and this facing is secured to various members of the bathroom structure such as to the studs 214.

The large expanse of plywood panel 215 which extends from point 219 to 220 as along the gabled wall as viewed in FIG. 12, affords ample shear strength for this wall of the modular home construction. In other walls, as illustrated by way of example in FIG. 2, the structural steel cross bracing 74', 75', 76' and 77' is employed, and these brace members are embedded, as depicted by the dashed lines 74' in FIG. 5, within the core-foam of the exterior wall panel in the process of fabrication thereof. Once these panels are placed in position within their

enclosing framework, the brace members are secured by suitable means (not shown) to the studs 25 and 25*a* comprising the sides of the enclosing framework. As described heretofore, the panels are not required to be load bearing. It will be understood, however, that a wind load on the panels of one of the walls of the building structure will be sustained, at least in part, by the inherent shear resistance afforded by the panels extending at right angles to the wind bearing wall this being due also by reason of the interlock of the panels within their enclosing frames, there thus being provided an anti-wrack structural arrangement.

Referring now to FIG. 31, the wavy lines 222 and 223 depict the stone-faced outline of the fireplace 35. These lines are interconnected by shelf surfaces 224 which support the wireways 164 employed to the front and to the back of the fireplace in the living room and the family room areas of the modular home. Ceiling panels 116 rest directly on the wireways 164 and are secured thereto as by lag screws 225 which engage the ceiling panel edge members 122. Clips 57 provided on the wireways 164 serve to anchor the studs into the grout 226 interposed between the ceiling panel structure just described and the fireplace per se defined by the lines 222, substantially as shown in FIG. 31.

The building construction disclosed in the patio area and as viewed along the lines 32—32 of FIG. 12, is disclosed in FIG. 32 wherein it may be seen that the panel, stud, wireway, and ceiling panel construction, as respectively depicted by the reference characters 40, 25, 164, and 116, are arranged in similar manner to the interior panel 41, stud 25*b*, wireway 164, and ceiling panel 116 supported thereof, as disclosed in FIG. 16. In the patio area, however, the wireways 164 carry the clips 57 for fastening of the trim 59, and the wall panels 40, of course, are exterior panels. The corner construction at the other end of the patio end wall likewise is similar to the corner construction disclosed in FIG. 27 and, accordingly, like character references are employed to designate like parts in FIG. 33.

Angle stud 25*a* has a corner portion cut out near the foundation as indicated by the line 230, FIG. 33. By means of this access opening, it is possible to get at the fastener as at 231 for securing the angle stud to the sill plate 26. It is to be noted at outside corners of the building, that the exterior panels 40 are elongated as at 56, FIG. 9, and as at 233, FIG. 33, to thus approach the corner of the stud within the approximately one inch space occupied by the trim clip 57. In the case of an outside corner such as indicated at 234, in FIG. 12, which point is representative of the corner stud 25*a* disclosed in FIG. 27, clips 57 would be employed on both outside surfaces of the stud and an L-shaped angle trim piece, otherwise having the same general configuration as trim strip 59 is employed to cap the exposed panels at the corner, the pair of clips 57 at the corner being thus used to engage the serrations of the trim strip, much in the same manner as heretofore described in connection with trim strip 59.

Referring again to FIGS. 32 and 33, it will be understood that the ceiling panels 116 cover the entire patio area, and for this purpose, as well as to support the roof panels over the patio, the ceiling panel retainer and roof support 162 spans the gap between the back bedroom and the garage, being supported over this distance by a substantial header beam 235 and a filler beam 236 interposed therebetween. The header 235, in turn, is supported at intervals over the length threof by posts 237, the posts adjacent the ends of the patio being cut away to accommodate the panels, the arrangement being such that the outer surface of each such post extends to the clip 57 so that the trim strip bridges this surface and the skin surface 43 on the opposite side of the clip.

From the foregoing, it should now be apparent that a modular home construction has been provided which is well adapted to fulfill the aforestated objects of the invention. It will be apparent, moreover, that the various modular components comprising this building construction readily lend themselves to production fabrication at the factory, thereby to effect economies in such production, and such modular components also lend themselves to ready assembly on-site, thereby to effect further economies in the erection of such modular structures. It will be apparent, furthermore, that such building construction, while having all of the advantages and aesthetic qualities and charm of conventional dwellings, will additionally have greater lasting qualities and effect increased economies and greater comforts in use due to the greater durability of the materials employed such as the all steel load bearing structure, and due to the high degree of temperature control afforded by reason of the highly insulative qualities of the foam-core panels.

While the invention hereinbefore disclosed has been best described with reference to exemplary constructions thereof which give satisfactory results, it will be apparent to those skilled in the art, to which the invention most closely relates or appertains, that the same may be embodied in other forms or carried out in other ways without departing from the spirit or essential characteristics of the invention. The present embodiments of the invention are therefore to be considered as in all respects illustrative and nonrestrictive, the scope of the invention being indicated by the appended claims and all changes that come within the meaning and range of equivalency of the claims are intended to be embraced therein.

Having thus described the invention, what is claimed as new and useful and desired to be secured by Letters Patent is:

1. In a modular building construction, the combination of a panelled wall comprising an all steel load-bearing framework and non-load-bearing, foam-cored sandwiched panels, each of said panels comprising a fully factory fabricated and integrated floor-to-ceiling unit having an edge grooved foamed core and spaced facing skins secured to the core, said frame work comprising a plurality of studs set on module and enclosed with the confronting edge grooves of adjacently disposed panels, and each pair of adjacently disposed studs comprising a frame individual to one of said panels and extended perimetrically thereof for engaging the core of the panel yieldably in free floating, weather sealing, and interlocking relation therewith.

2. In a modular building construction as in claim 1, each of said panels comprising inner and outer skins formed of materials compatible respectively with inner and outer environmental conditions, and a foamed plastic core having vertically extending side channels for receiving said studs interfittingly therewith.

3. In a modular building construction as in claim 2, said inner and outer skins being bonded to said core, said core being formed of expanded polystyrene beads, said outer skin being formed of cement asbestos board.

4. In a modular building construction as in claim 2, at least one of said panels having cross-bracing framework members embedded in said foamed plastic core and attachable with the pair of adjacently disposed studs individual thereto.

5. In a modular building construction, the combination of an all steel load-bearing framework, a plurality of non-load-bearing, foam-cored wall panels having the cores thereof engaged by said framework in free floating, weather sealing, and interlocking relation with respect to said framework, each of said panels comprising a fully factory fabricated and integrated floor-to-ceiling unit having an edge grooved foamed core and spaced facing skins secured to the core and a foundation structure, said framework comprising a sheet metal sill plate secured to said foundation structure and extended peripherally thereof, a header beam extended peripherally above said sill plate, and a plurality of hollow metal studs set on module and enclosed within the confronting edge grooves of adja-

cently disposed panels and secured each at the bottom thereof to said sill plate and each at the top thereof to said header beam, each said pair of adjacently disposed studs and said sill plate and header beam connected thereto comprising a frame individual to one of said panels for receiving the same and extended perimetrically thereof and yieldably in interfitting relation with the core of the panel.

6. In a modular building construction as in claim 5, each of said studs having a pair of stirrups secured thereto at the top and bottom thereof and a pair of fasteners individual to the stirrups for securing the stud to said sill plate and to said header beam, each stirrup being a U-shaped strap secured in the region of its leg portions to the inner wall of the stud and apertured in the bight portion thereof to receive the fastener individual thereto.

7. In a modular building construction as in claim 5, said header beam being of tubular metal construction having a generally C-shaped configuration in cross section and serving additionally as a wireway and providing an elongated slot for access to wiring disposed within and threaded through the wireway, certain of said studs having electrical outlet means, and said studs and header beam having hollow fastening means for securing the same together and for passing said wiring therethrough and extending the same to said electrical outlet means.

8. In a modular building construction as in claim 5, said foundation structure comprising a concrete slab, said sill plate terminating in a vertically directed J-shaped channel portion disposed below the floor level of said foundation slab, each said panel comprising a central foamed plastic core and inner and outer facing skins bonded thereto, each panel having the upper and lower edge portions of the outer skin thereof respectively extended in overlapping relation to said header beam and depended within said J-channel of the sill plate in interlocking relation therewith, each panel having the sides of its core grooved to receive interfittingly and interlockingly therewith a pair of said studs disposed respectively adjacent thereto, each panel having the lower edge portion of its inner skin disposed slightly above said floor level, the core of each said panel forming foam-to-metal interfaces with said studs and header beam, and the core of each said panel forming foam-to-metal and foam-to-concrete interfaces with said sill plate and foundation slab respectively.

9. In a modular building construction, the combination of a foundation structure and inner and outer panelled walls comprising framework members and foamed core sandwiched panels interlocked and held thereby yieldably in weather sealed relation therewith and in position on said foundation structure, each said panel comprising a fully factory fabricated and integrated floor-to-ceiling unit having a foamed plastic core and facing skins bonded thereto, said framework members comprising for each panel a pair of hollow metal studs set on module and enclosed by the foamed cores of adjacent panels and a hollow metal header beam member generally C-shaped in cross section and secured to said studs at the upper ends thereof, each said panel having the sides of its core grooved to receive said studs, said header beam members comprising a header beam which encircles the rooms of the building construction and serves as a continuous wireway, certain of said studs having electrical outlet means for receiving wiring extended thereto from said wireway and through the hollow studs.

10. In a modular building construction as in claim 9, said framework members for the outer panelled walls comprising a sheet metal sill plate secured to said foundation structure and extended perimetrically thereabout, said sill plate terminating in a vertically directed J-channel portion disposed below the floor level of said foundation structure and disposed to receive the lower edge portions of the outer skins of the outer wall panels, each stud in said outer panelled walls having upper and lower stirrups secured thereto and said stirrups having fasteners secured respectively to said perimetrically extending header beam and to said sill plate, each said header beam fastener being hollow to pass said wiring into the stud from the wireway, each stud in said outer panelled walls having an opening for access to said sill plate fastener individual thereto.

11. In a modular building construction as in claim 9, said framework members for said inner panelled walls comprising wooden runners secured to said foundation structure, and a header beam disposed above said runners and extended therealong, each said stud for the inner panelled walls being bifurcated to straddle its runner interfittingly therewith and each said stud having a stirrup secured to the upper end thereof, each said stirrup having a hollow fastener for securing the same to said header beam and for passing said wiring into the stud from the wireway.

12. In a modular building construction as in claim 11, each panel for the inner panelled walls having its core grooved to receive said runner individual thereto and having its facing skins at the lower edges thereof disposed slightly above the floor level of said foundation structure.

13. In a modular building construction, the combination of a foundation structure, a ceiling structure, and inner and outer panelled walls each comprising framework structure and foam-cored sandwiched panels interlocked and held thereby yieldably in weather sealing relation therewith and in position on said foundation structure, each of said panels comprising a fully factory fabricated and integrated floor-to-ceiling unit having a foamed core engaged perimetrically by the framework structure individual thereto, said framework structure for the outer panelled walls comprising hollow metal studs set on module and enclosed by the foam-cores of adjacent panels and a composite header beam, said header beam comprising upper and lower hollow metal square tubes each being generally C-shaped in cross section, said framework structure for the inner panelled walls comprising hollow metal studs set on module and enclosed by the foam-cores of adjacently disposed panels and a header beam conforming to and coextensive with said lower metal tube of the composite beam and providing therewith a continuous wireway, certain of said studs having electrical outlet means, each of said studs having means including a hollow fastener for securing the same to the header beam individual thereto and for passing wiring from said wireway therethrough into the studs to said outlets therein, said ceiling structure comprising a plurality of sandwich panels, said upper hollow metal tubes having longitudinally extending slots for receiving therewithin the edge portions of certain ones of said ceiling panels, said composite beam having means for securing said upper and lower tubes together and simultaneously locking the upper tubes to said certain ones of the ceiling panels.

14. In a modular building construction, the combination of a foundation structure, an all steel load-bearing framework supported on and secured to said foundation structure and comprising wall and ridge beams, a plurality of non-load-bearing, foam-cored wall panels having the cores thereof engaged by said framework yieldably in free floating weather sealing and interlocking relation with respect to said framework, each of said panels comprising a fully factory fabricated and integrated floor-to-ceiling unit having a foamed core engaged perimetrically by the framework structure individual thereto and a composite roof structure comprising a plurality of shear lock roof panels interlocked together and secured to said framework on module with respect to said wall panels and in beam-to-beam spanning relation with respect to said wall and ridge beams.

15. In a modular building construction as in claim 14, said roof panels each comprising a foamed plastic core and sheet metal facing skins bonded thereto.

16. In a modular building construction as in claim 15, each said roof panel at each side thereof having a sheet metal web interconnecting said sheet metal facing skins, adjacently disposed webs of adjacent panels having mutually telescoping portions for interlocking the panels.

17. In a modular building construction as in claim 15, each said roof panel at each side thereof having a sheet metal web interconnecting said sheet metal facing skins, adjacently disposed webs of adjacent panels having edge portions terminating in oppositely directed channel sections, and a locking channel member generally C-shaped in cross section and having its channel edge portions disposed respectively within said oppositely directed channel sections for interconnecting the panels to tie the same toegther.

18. In a modular building construction, as a modular component, a shear lock roof panel comprising a foamed plastic core, sheet metal facing skins bonded to said core, and a pair of sheet metal webs disposed at the sides of said panel and secured in the region of the end portions thereof to said skins, each of said webs terminating in an inwardly directed edge portion spaced in substantially parallel relation to the same facing skin, said webs having laterally aligned peripheral flanges respectively directed inwardly and outwardly of the panel, said outwardly directed flanges being undersized interfittingly relative to said inwardly directed flanges.

19. In a modular building construction, the combination of a foundation structure, an all steel load-bearing framework structure comprising a sheet metal sill plate structure secured to said foundation structure and extended perimetrically thereof, a plurality of square tubular studs set on module and secured respectively to said sill plate structure, a tubular header beam structure extended perimetrically above said sill plate and secured to said studs, a ridge beam structure secured to and supported by certain of said studs, and a gable beam structure secured to said ridge beam structure and secured to and supported on certain other ones of said studs, a composite roof structure supported on and secured to said header, gable, and ridge beam structures, said roof structure comprising fully factory fabricated and unitary interlocking panels set on module in spanning relation to said header and ridge beam structures and each comprising sheet metal facing skins, interconnecting sheet metal webs, and a foamed plastic core bonded to said skins and webs, and a plurality of non-load-bearing, foam-cored wall panels each having the core thereof mounted yieldably in free floating, weather sealing, interlocking and framed relation with respect to an adjacently disposed pair of said studs and their interconnecting header beam and sill plate structures, each said wall panel comprising a fully factory fabricated unitary floor-to-ceiling unit having a foamed plastic core and facing skins bonded thereto.

20. In a modular building construction as in claim 19, said composite roof structure comprising means for securing said roof panels to said header, gable, and ridge beam structures, said panel securing means comprising J-shaped channel members secured respectively to adjacently disposed webs of adjacent roof panels, an inverted U-shaped nut having the leg portions thereof disposed respectively within the channels of said J-shaped members, and a bolt for said nut secured to one of said header, gable, and ridge beam structures, said J-shaped channel members and webs being apertured to receive said nut and bolt.

21. In a modular building construction the combination of spaced gable and eave walls each comprising an all steel load-bearing framework and a plurality of non-load-bearing, foam-cored wall panels each having the core thereof mounted yieldably in free floating, weather sealing, and interlocking relation with respect to framing members of said framework, said framework comprising a plurality of tubular studs set on module and enclosed by the foam-cores of adjacent panels and a composite header beam connecting the upper ends of said studs and including upper and lower interconnected tubes, the framework for each of said gable walls comprising gable beams and gable studs aligned with certain ones of said first mentioned studs and secured at their upper ends to said gable beams and at their lower ends to the upper header tube individual thereto, the upper header tubes for said eave walls having an upper wall sloped in conformance with the slope in said gable beams, a composite ridge beam interconnecting and supported on said spaced gable walls, and a composite roof comprising a plurality of panels interlocked together and secured to said gable and ridge beams and to said upper eave header tubes in spanning relation between said header and ridge beams.

22. A modular building construction as in claim 21, said wall and roof panels each having a foamed plastic core and facing skins bonded thereto.

23. A modular building construction as in claim 21, said composite ridge beam comprising a plurality of ridge beams connected end to end, and a plurality of stud supports for said ridge beams and connected thereto at the junctions thereof respectively.

24. A modular building construction as in claim 23, each said ridge beam comprising a composite of interconnected box and I beams.

25. In a modular building construction as in claim 21 and further including a ceiling structure comprising a plurality of interconnected paper honeycomb panels, said upper header beam tubes having the inner face of each slotted along the length thereof to receive and clamp the edge portions of certain of said ceiling panels therewithin, said roof panels having interengaging portions disposed in spaced relation along adjacently disposed sides thereof, figure 7-shaped hooks each suspended on one of said interengaging portions and locked between said one and the adjacent one of said interengaging portions, fastener means secured to certain of said ceiling panels and disposed respectively beneath and aligned with said figure 7-shaped hooks, and flexible suspension means respectively interconnecting said aligned hooks and fasteners.

26. In a modular building construction as in claim 25 and further comprising inner panelled walls including tubular metal studs set on module and a tubular header therefor having one side face slotted along the length thereof, said lower composite header beam tubes each having the inner face thereof slotted along the length thereof and constituting with said inner and outer wall studs and inner wall header tubes metal conduit for passing electrical wiring, said inner wall header tubes also serving to support certain of said ceiling panels, and fastener means for securing said supported ceiling panels to said inner wall header tubes.

27. In a modular building construction, as a modular component, a shear lock roof panel comprising a foamed plastic core and sheet metal skins and interconnecting webs bonded thereto, means secured to said webs to receive channelled members for interlocking adjoining ones of said panels together, means secured to said webs to receive fastener means to secure said adjoining ones of said panels to each other and to supporting structure, and means on said webs for interfitting engagement with complementary means on said adjoining panels.

28. In a modular building construction, the combination of a pair of adjoining panels, each said panel comprising a fully factory fabricated and integrated floor-to-ceiling unit having a foamed plastic core and facing skins bonded thereto, said core being grooved on the sides thereof and forming an elongated opening between said adjoining panels, a metal tube disposed within said opening and forming metal-to-foam weather sealing interfaces with each core of said adjoining panels, the skins on one side of said adjoining panels meeting substantially centrally of said tube, the skins on the other side of said ad-

joining panels extending in overlapping relation to said metal tube and in spaced relation with respect to each other thereby to define a space therebetween exposing said tube, at least one fastener clip disposed within said space and secured to said tube, and a trim strip bridging said space and engaged by said clip with a snap action thereby to apply pressure of said trim strip on said spaced skins.

29. In a modular building construction, the combination of a foundation structure, inner and outer panelled walls supported on said foundation structure and secured thereto and comprising a metal framework structure and foam-cored sandwich panels having the core thereof interlocked and held by said framework structure in position on said foundation structure, at least one unitized bathroom unit comprising a plastic fiber glass inner shell and a wood studded exterior framework structure lashed thereto, and panel means simulating said inner and outer panel walls for integrating said bathroom unit into said inner and outer panelled walls and including panels secured to said wood and metal frameworks and to said foundation structure.

References Cited by the Examiner

UNITED STATES PATENTS

96,793	11/69	Gatling	189—37 X
849,819	4/07	Tresidder	189—42 X
1,590,569	6/26	Fisk	50—127 X
1,762,756	6/30	Braunstein	189—1
2,010,552	8/35	McDermott	189—1
2,058,543	10/36	Woolridge	189—1
2,104,870	1/38	Levy	50—64 X
2,137,767	11/38	Betcone	50—168
2,138,291	11/38	Callaghan	189—34
2,155,709	4/39	Patterson	189—1
2,157,233	5/39	Geib	189—37
2,158,081	5/39	Morrell	50—404
2,185,384	1/40	Rafter	189—37
2,187,148	1/40	Fisher	189—1
2,372,200	3/45	Hayes	50—186 X
2,447,272	8/48	Parkes	189—34
2,730,210	1/56	McLaughlin et al.	189—34
2,741,342	4/56	Etten	189—34
2,982,380	5/61	Rose	189—34
3,009,549	11/61	Miller	189—34
3,022,869	2/62	Radek	189—34
3,111,207	11/63	Braddon	189—37

FOREIGN PATENTS

750,027	5/33	France.
540,322	10/41	Great Britain.

FRANK L. ABBOTT, *Primary Examiner.*

RICHARD W. COOKE, JR., *Examiner.*