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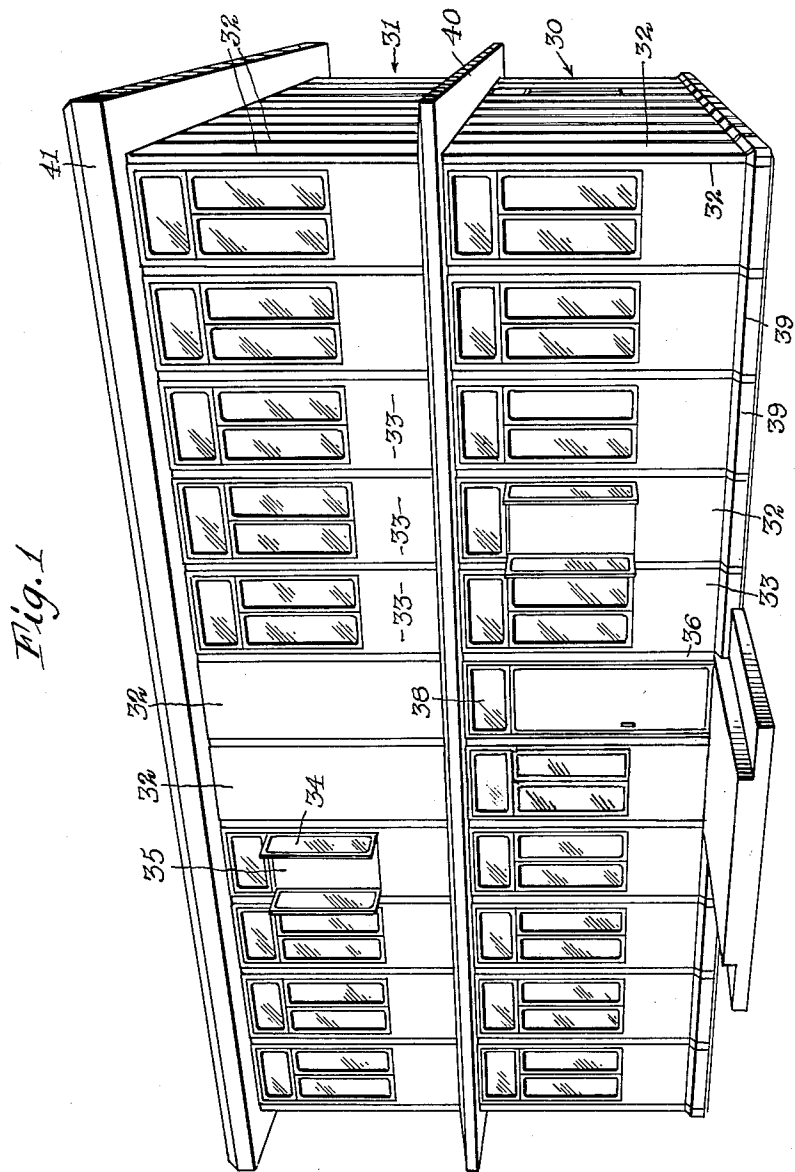
D. D. DOUGLAS, JR

2,963,825

PREFABRICATED HOUSE CONSTRUCTION

Filed Sept. 20, 1955

7 Sheets-Sheet 1



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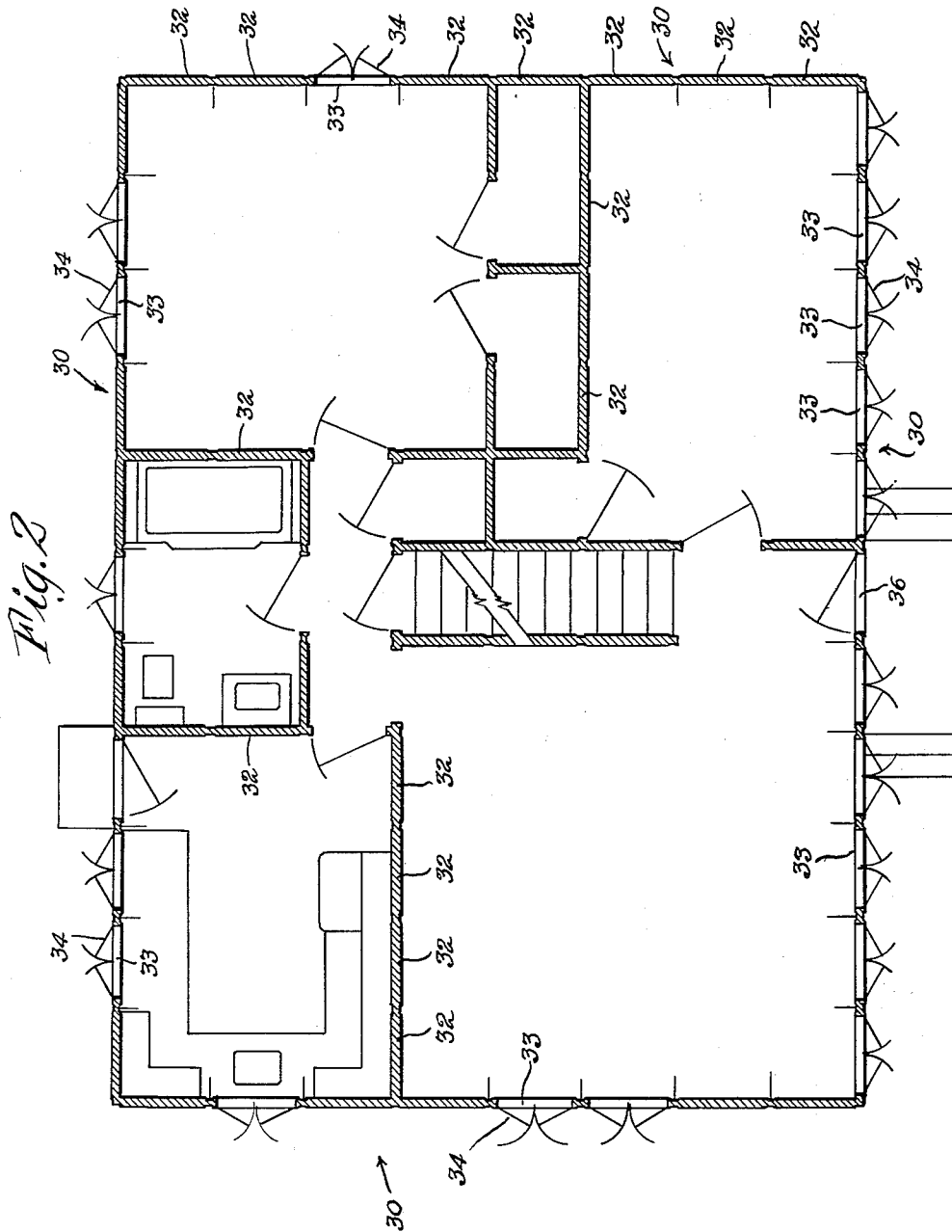
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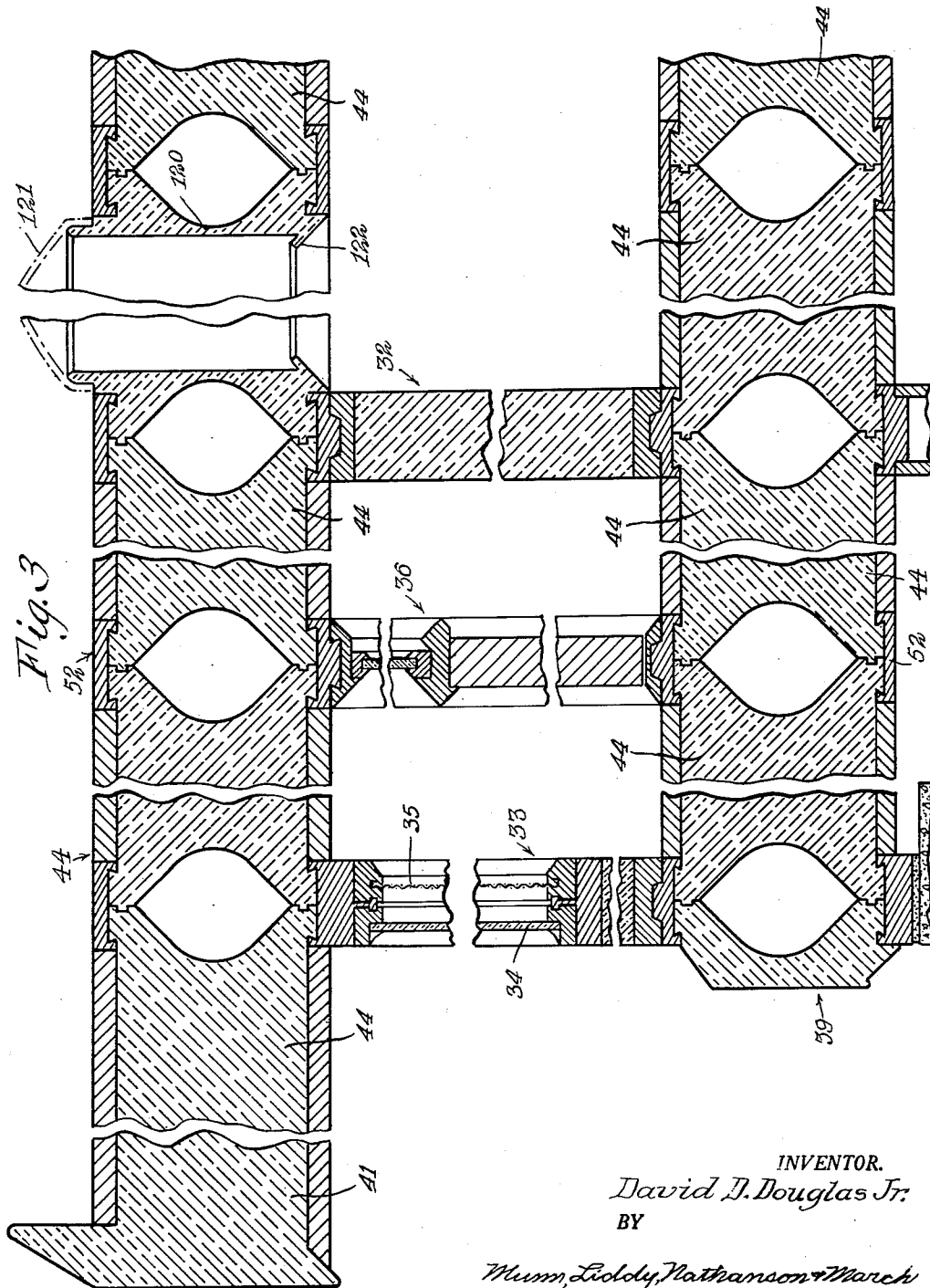
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7 Sheets-Sheet 3



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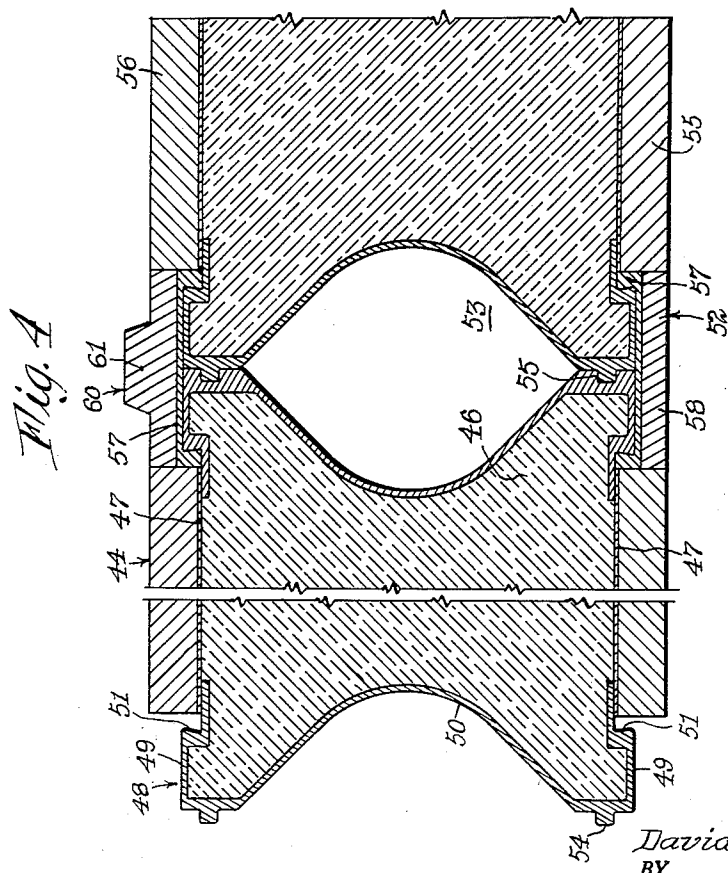
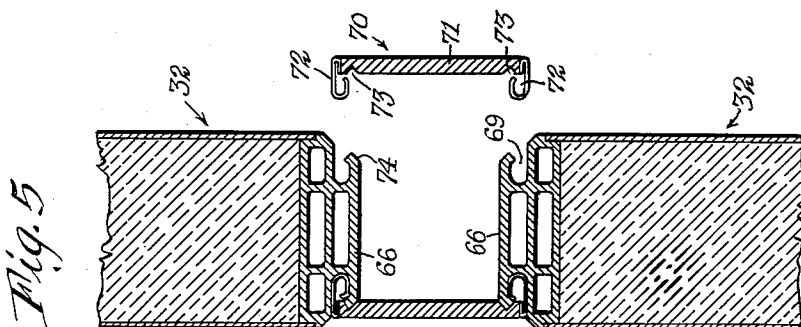
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PREFABRICATED HOUSE CONSTRUCTION

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Fig. 8

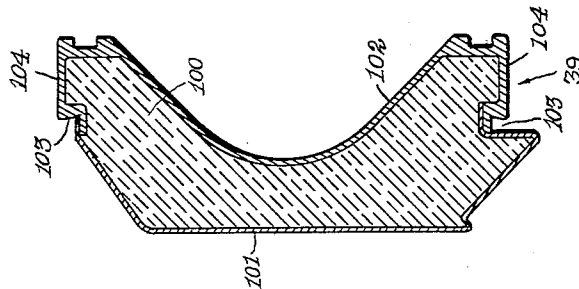


Fig. 7

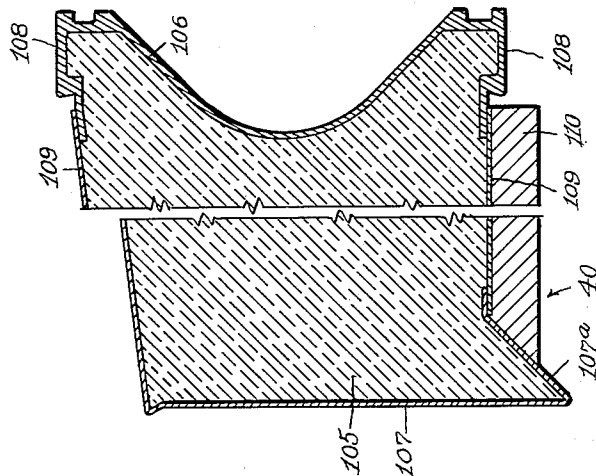
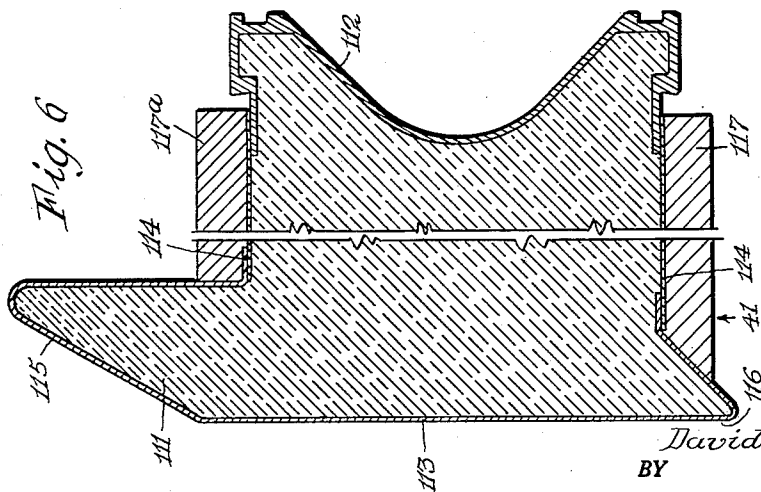


Fig. 6



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Fig. 23

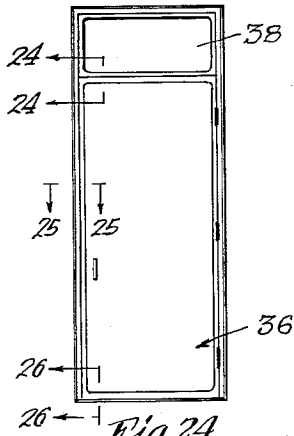


Fig. 24

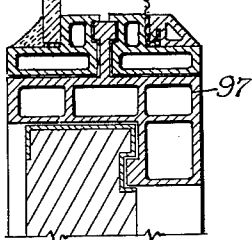


Fig. 25

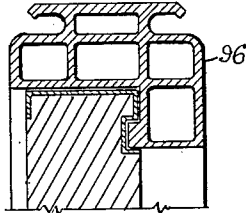


Fig. 26

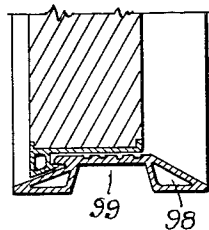


Fig. 9

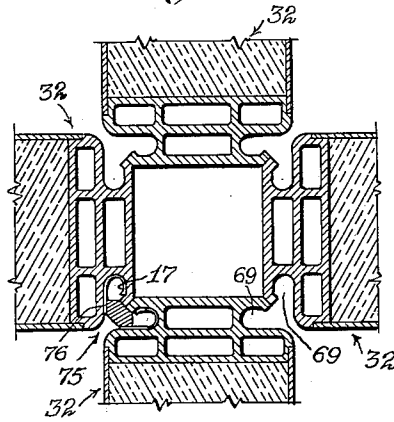
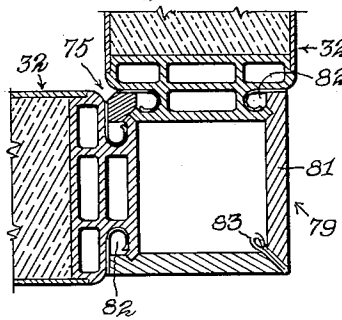


Fig. 10



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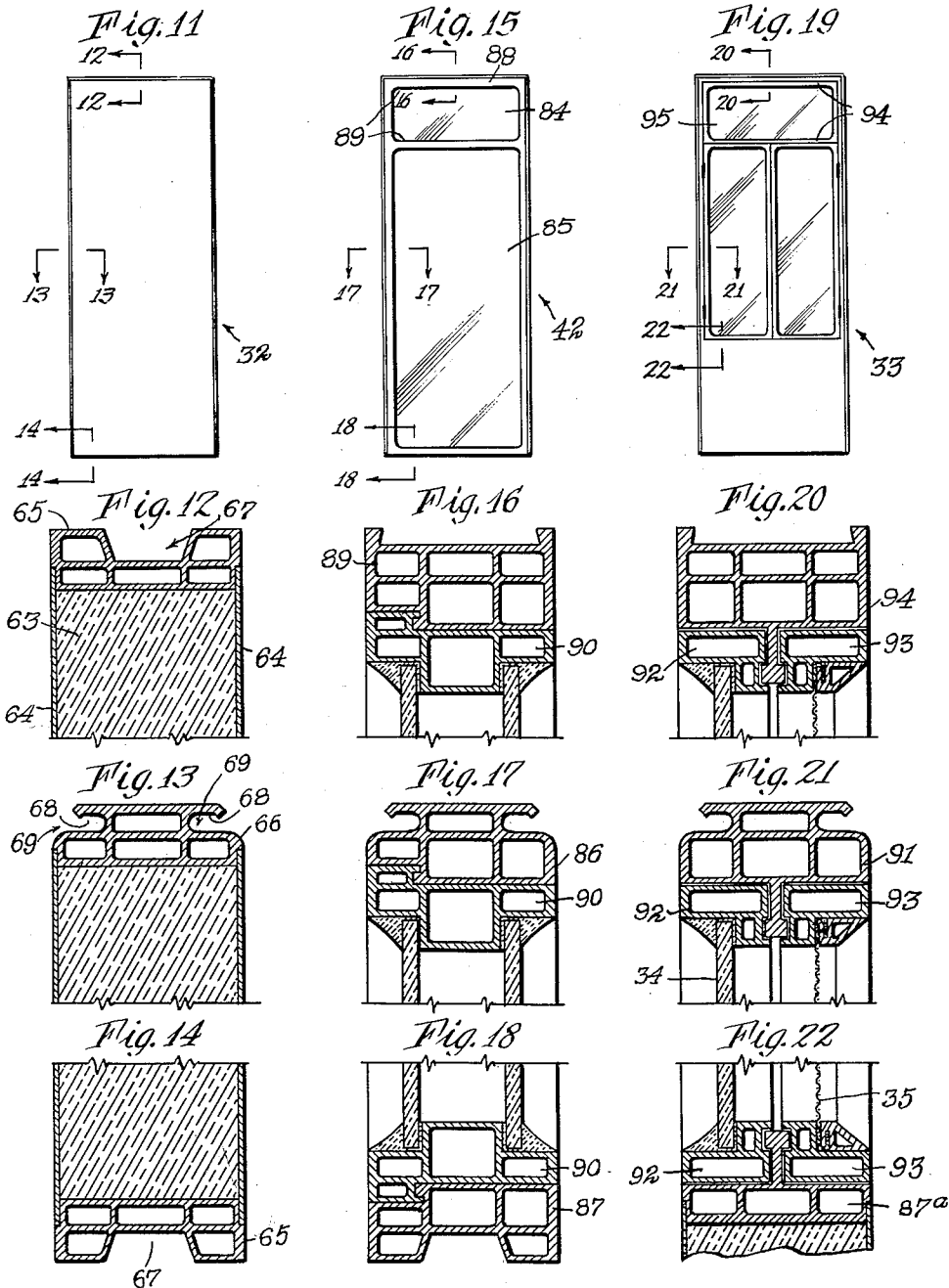
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PREFABRICATED HOUSE CONSTRUCTION

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5 Claims. (Cl. 50—66)

This invention relates to building structures, and more particularly to structures which are formed of prefabricated or preassembled units or components.

An object of the invention is to provide an improved building structure and basic or modular units therefor, which is characterized by extreme flexibility of design and ease of erection, without requiring skilled labor.

Another object of the invention is to provide improved building and unitary structures as above set forth, which require but few and simple tools, and which may be assembled and erected in a fraction of the time required for ordinary construction.

A further object of the invention is to provide a building structure as above characterized, which may be easily altered or disassembled without waste at any future time, and without necessitating skilled labor or causing damage to the structural units.

Still another object of the invention is to provide a novel and advantageous, interchangeable modular building unit which provides versatility of construction as above outlined, which is simple and economical to mass-produce, strong and light in weight, and which in conjunction with coordination modules has inherent in it the necessary strength to meet all stress requirements without dependence on framing or skeletal structures, such as floor joists, rafters, wall studs, beams and the like.

A still further object of the invention is to provide, in conjunction with the above basic modular units, novel coordination or fastening modules serving as connectors, as stress-transmission units, and as keying or splining means by which adjoining modular units may be accurately located and anchored.

A feature of the invention resides in the provision of modular units as above set forth, wherein the load-supporting elements may constitute the final finishing surfaces and insulation, thereby obviating the necessity for special finishing and inner and outer finishing materials, as such.

Another feature of the invention resides in the provision of modular units of the above type, which may be fabricated complete with the inclusion of extra ceiling, floor or wall surfaces if desired, thus obviating the need for later operations which are presently normally required to install the said finish surfaces.

Yet another object of the invention is to provide a novel and improved modular unit in the form of a mass produced, factory-finished product which satisfies all requirements of structure, utility, appearance, temperature and weather.

A still further object of the invention is to provide basic modular roof, floor and wall units which are completely interchangeable with coordination or fastening modules.

Another object of the invention is to provide a novel, segmented demountable, structurally-monolithic slab capable of resolving and transferring load stresses through joints or connectors into right-angled directions to sup-

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ports, without requiring any beams, joists, girders, or wall studs.

Other features and advantages will hereinafter appear.

In the drawings accompanying this specification, similar characters of reference indicate corresponding parts wherever possible in the several views, in which:

Fig. 1 is a perspective view of a building structure made in accordance with the invention.

Fig. 2 is a floor plan of the first floor of the building structure of Fig. 1.

Fig. 3 is a vertical sectional view made up of fragmentary sections, illustrating details of construction, particularly the joint or connector and duct structures.

Fig. 4 is a fragmentary vertical sectional view taken through a joint or connection means as provided by the invention, said view also showing in fragmentary section a single floor or ceiling unit.

Fig. 5 is a fragmentary horizontal sectional view taken through a joint between wall panels.

Fig. 6 is a fragmentary sectional view of a roof end member as provided by the invention.

Fig. 7 is a fragmentary vertical sectional view of a floor end member is provided by the invention.

Fig. 8 is a fragmentary vertical sectional view of another type of floor end member.

Fig. 9 is a fragmentary horizontal sectional view illustrating a joint between two intersecting walls.

Fig. 10 is a fragmentary horizontal sectional view illustrating a joint between two meeting walls.

Fig. 11 is an elevational view of a solid wall panel as provided by the invention.

Fig. 12 is a fragmentary vertical sectional view taken on line 12—12 of Fig. 11.

Fig. 13 is a fragmentary horizontal sectional view taken on line 13—13 of Fig. 11.

Fig. 14 is a fragmentary vertical sectional view taken on line 14—14 of Fig. 11.

Fig. 15 is an elevational view of a glazed panel member as provided by the invention.

Fig. 16 is a fragmentary vertical sectional view taken on line 16—16 of Fig. 15.

Fig. 17 is a fragmentary horizontal sectional view taken on line 17—17 of Fig. 15.

Fig. 18 is a fragmentary vertical sectional view taken on line 18—18 of Fig. 15.

Fig. 19 is an elevational view of a modified form of glazed panel made in accordance with the invention, having operating sashes and screens.

Fig. 20 is a fragmentary vertical sectional view taken on line 20—20 of Fig. 19.

Fig. 21 is a fragmentary horizontal sectional view taken on line 21—21 of Fig. 19.

Fig. 22 is a fragmentary vertical sectional view taken on line 22—22 of Fig. 19.

Fig. 23 is an elevational view of a door and transom unit as provided by the invention.

Fig. 24 is a fragmentary vertical sectional view taken on line 24—24 of Fig. 23.

Fig. 25 is a fragmentary horizontal sectional view taken on line 25—25 of Fig. 23.

Fig. 26 is a fragmentary vertical sectional view taken on line 26—26 of Fig. 23.

Referring to Fig. 1 there is illustrated a building structure in the form of a home or residence, fabricated from the individual building units as provided by the invention. As shown the walls 30 and 31 of the lower and upper stories respectively are fabricated of solid wall units 32 (see also Figs. 11—14), glazed wall units 33 having operating sashes 34 and screens 35 (see also Figs. 19—22), a door unit 36 having an operating sash 38 (see also Figs. 23—26). The first floor level has end members 39, Figs. 1 and 8, and the second floor level has end members or

blocks 40, Figs. 1 and 7. The roof has end members or blocks 41, Figs. 1 and 6.

In place of the modular wall units 33 having operating sashes, there may be utilized wall units 42, Fig. 15, having fixed glass, and all of the said wall units 32, 33, 36 and 42 are interchangeable with each other, so that any desired arrangement of walls may be readily provided.

In accordance with the present invention there are provided novel, basic modular floor and ceiling units 44, Fig. 4, in addition to the modular wall units 32, 33, 36 and 42 mentioned above. Each floor or ceiling unit 44 is identical to the others, and preferably each is made to a standard dimension in the form of a rectangular slab. As an example, each modular floor or ceiling unit 44 may have a planar dimension of 3 ft. x 3 ft. That is, it may be 3 ft. sq. and contain an area of 9 sq. ft.

As shown in Fig. 4 each modular floor or ceiling unit 44 comprises a relatively thick inner section 46 of rigid insulating material having appreciable compressive strength and thickness. Secured to the upper and lower faces of the inner section 46 are relatively thin, skin members 47 of high-tensile strength, the term "skin member" being used to designate thin sheeting applied to any surface of the thick inner sections. Extending along the periphery or edge of the modular unit or slab 44 are edging members 48, each edging member having marginal portions 49 and central portions 50 disposed intermediate the marginal portions, said central portions being displaced inwardly of the slab 44 to present outwardly a recessed surface along the edges of the slab. The edging members 48 have shoulders 51 on their marginal portions 49, for cooperation with fastening elements or members 52 which have a channel-shaped cross section, whereby a plurality of slabs 44 may be joined together edge to edge, to extend in four different directions.

The skin members 47 are preferably metallic and may be advantageously formed of aluminum, and the edging members 48 may be of extruded aluminum construction, with their marginal edges welded to the aluminum skin members 47. The modular slab 44 may be formed according to approved laminating procedures, being characterized by a low density core or inner section 46, high-density, stressed skin members 47, and the edging members 48. The members 46, 47, and 48 may be bound to each other by gluing and welding techniques to make a complete solid block which is produced and finished at the factory. Where desired, rivets may be employed, if they are found suitable.

It will be particularly noted that by the present invention the recessing of the edges of the slabs 44 provides ducts or passages 53 through which piping, electric wiring, cable, etc. may be placed, to supply the various utilities.

The ducts or passages 53 intersect each other at the corners of the slabs 44, whereby any desired location within a 3 ft. distance may be reached through the ducts. It will be understood that certain of the ducts may be closed off or incorporated in a prearranged plan, for carrying air for heating and cooling purposes, where desired.

For the purpose of accurately positioning the modular units 44 with respect to each other the edging members 50 are provided with tongues 54 and grooves 55, the latter being adapted to receive the tongues 54, thereby to accurately key the units to each other.

By the present invention the modular units 44 may be provided with finishing materials secured to the skin members 47, as for example, acoustic ceiling sheets 44 and wooden or other floor surfacing 56. The floor surfacing may be oak flooring, or plywood where wall-to-wall rugs are contemplated, or plastic or other tile as desired.

Also, by the present invention I provide a number of

different styles of connector members or fastening elements.

In Fig. 4 a fastening element 52 is provided, comprising essentially a metallic channel 57. The connector member 52 may have a facing 58 of acoustical ceiling material, or where it is used as a flooring surface it may have the same type of flooring material as provided on the slabs 44. Where the connector members occur at a partition they may be provided with wedge-like projections for keying purposes, and a connector member 60 is shown in Fig. 4 having the channel portion 57 and a keying wedge or projection 61 adapted to be cooperable with a corresponding groove in the edge of the wall sections.

In accordance with this invention it is contemplated that modular floor and ceiling units 44 as above constructed, in conjunction with the connector members or fastening elements 52, 60 will be able to stand sufficient stress, shearing and compressing in the inner sections 46 and tensile and compressive in the skin members 47, to eliminate the necessity for floor joists, girders and other framing or skeletal structures. High strength metals or metal alloys as provided by present day research, in conjunction with improved low-density insulating materials, make such construction possible. In conjunction with this concept of absence of framing and supporting structures as such, placement of inner walls or partitions may be so chosen as to keep stresses within permissible limits.

Referring to Figs. 11-14 showing the solid wall panel or modular unit 32, it will be noted that this unit has a relatively-thick, inner, insulating section 63 provided on its opposite sides with skin members 64 and along its edges with edging members 65 and 66, the latter being vertically disposed on the panel and the members 65 being horizontally disposed at the top and bottom edges of the panel. The edging members 65 and 66 may be formed of extruded or fabricated aluminum or other metal, the member 65 having longitudinally-extending grooves 67 for receiving keying or wedging projections such as the projection 61 shown in Fig. 4. The side edging members 66 are provided with shoulders 68 by which an interlock may be effected with fastening members, and preferably the shoulders 68 are formed by providing grooves 69 in the members, in the manner indicated.

Referring to Figs. 5, 9 and 10 there are shown vertically-extending connecting members by which the wall panels may be joined to each other in various arrangements. In Fig. 5 a connector member 70 is shown, comprising a flat strip 71 having resilient marginal portions or clips 72 arranged to be received in the grooves 69 of the edging members 66. The strips 70 preferably have V grooves 73 to accommodate V edges 74 of the strips 66, as illustrated. The connector 70 is thus adapted to join together two adjacent wall panels, such as the panels 32 shown in Figs. 11-14, and as will hereinafter be disclosed, other styles of wall panels such as the panels 33, 36 and 42 mentioned above may be interchangeably used with the panels 32 insofar as the connectors 70 are concerned.

Referring to Fig. 9 four wall panels 32 are shown coming together at a common junction point, said wall panels being joined by connectors 75 in the form of elongate strips 76 having resilient marginal portions or clips 77 adapted to be received in the grooves 69 of the wall panels.

In Fig. 10 two wall panels 32 are shown, meeting to form a corner, said panels being joined by a connector 75 and by a second connector 79 comprising a strip of angular cross section, having flange portions 80 and 81 carrying resilient clips 82. The flange portions 80 and 81 may be rigidly secured to each other, or may be yieldably secured together by a flexible web 83, as shown.

A wall panel having a pair of fixed glasses or panes 84 and 85 is shown as the panel 42 in Figs. 15-18. The

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panel 42 has side edging members 86 provided with a groove and shoulder configuration similar to the edging member 66 shown in Fig. 13, and has a base edging member 87 having a grooved edge surface similar to the base edging member 65 shown in Fig. 14. The uppermost or top edging member 88 of the panel 42 is similar to the top edging member 65 shown in Fig. 12, having the longitudinal keying groove 67. In Fig. 16 a framing member 89 is shown of hollow or tubular construction, arranged to accommodate a frame 90 carrying the fixed glass 85. It will be understood that the fixed glass 84 is carried in the frame member 89.

The wall panel 33 shown in Figs. 19-22 has side edging members 91 provided with shoulders and grooves similar to the side edging member 66 shown in Fig. 13. Tubular frame members 92 and 93 carry respectively the sash 34 and screen 35, said framing members being hingedly carried for movement with respect to the panel 33. The panel 33 has a frame member 94, Figs. 19 and 20, for carrying the upper glass 95 of the panel 33 and for cooperating with the hinged frame members 92 and 93, as shown.

The wall panel 33 has a base edging member 87a provided with a groove (not shown) similar to the groove 67 shown in the member 65 of Fig. 14.

In Figs. 23-26 the wall panel 36 has side edging members 96 having shoulders and grooves similar to those of the edging member 66 shown in Fig. 13. The panel 36 has a framing member 97 to carry the upper glass 38 of the panel and for cooperating with the door 37 thereof. At its bottom the panel 36 has a sill member 98 having a groove 99 to accommodate a wedging projection such as the projection 61 shown in Fig. 4.

A schematic representation of a building structure employing the floor, ceiling and wall units provided by the present invention, is shown in Fig. 3, and it will be readily seen that the various modular units, connector units, etc., are interrelated and utilized to fabricate the desired structure.

Considering the first floor structure shown in Fig. 3 it will be noted that the floor end members 39 are employed as a finishing surface which is exposed at the exterior of the house. In Fig. 8 there is revealed the construction of the floor end members 39. Each such member comprises an inner relatively thick section 100 to the opposite sides of which are adhered a skin member 101 and an edging member 102 the latter being preferably of extruded aluminum and the skin member 101 being formed of sheet metal. The marginal portions of the members 101 and 102 are secured together, as by welding, and shoulders 103 are provided on the marginal portions 104 of the member 102, for cooperation with fastening or connector members.

A modified form of floor end member is shown in Fig. 7. In this figure the floor end member 40 comprises a relatively thick inner section 105, edging member 106 and skin member 107 having marginal portions 108 and 109 respectively, secured to each other as by welding. The marginal portions 109 of the skin member 107 preferably are in the form of deep flanges, and if desired the lower of said flanges may be formed as a separate piece attached to the member 107 by a welding or other process. A finishing member 110 may be secured to the underside of the end member 40, to constitute a soffit, and a depending taper 107a may be incorporated in the member 107, to constitute a drip edge.

In Fig. 6 details are given of the roof end members or blocks 41. Each such member comprises a relatively thick inner section 111 having an edging member 112 and a skin member 113 attached to it, the member 112 being in the form of an extrusion and the member 113 being preferably fabricated of sheet metal, with marginal portions 114 in the form of deep flanges which are welded to the marginal portions of the member 112. The skin member 113 is formed with an upward tapered extension

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115 constituting a splash board, and with a downward tapered extension 116 to constitute a drip edge. A finish member 117 may be provided, to constitute a soffit, on the lower flange 114 of the member 41, and an insulation member 117a may be provided on the upper flange 114, to meet flush with roof insulation.

Referring again to Fig. 3, end members 120 are provided, in accordance with the invention, to accommodate a sky light structure 121. The end members 120 may be in general constructed like the member 41 shown in Fig. 6, except that a lip 122 is provided adjacent the lower portion, to act as an inner gutter where such may be considered desirable.

The novel and improved modular units 32, 33, 36, 42 and 44 as above described may be readily utilized to provide various designs of building structures, and one such design is shown in layout, in Fig. 2. The exterior and interior walls, partitions, etc., are formed of the wall panels described above, and the floor and ceiling structures are formed of the modular units 44, in conjunction with the various connector units disclosed.

It will be understood that extreme flexibility is provided through the use of the modular building units of this invention, and that the building structure may have any external shape within wide limits, and may have innumerable combinations of rooms and partitions on the interior, to suit practically all needs. The modular building unit as provided herein comprise a unique, segmented, demountable, structurally-monolithic slab which, by virtue of its tensile skin members, is capable of transferring load stresses bi-directionally, thereby obviating the need for beams, joists, girders, and other skeletal supports. The various stresses involved are transferred from slab to slab through the joints and connectors provided. In the case of wall panels, the stressed skin members may constitute the finished surfaces, thereby obviating the need for additional finishing materials required merely for ornamentation, weathering, etc. In the case of the roof structure, sheets of insulation and a watertight covering in the form of a membrane may be employed said materials being laid over and/or adhered to the units 44 to render the roof weather proof.

It will be understood various wall panels may be made up as interchangeable units, incorporating fireplace and furnace flues, air vents, drains, sky lights and hatchways, utility passageways, stairways, etc. All such special units will be interchangeable with the regular units illustrated and described above, and the various units may be placed in any desired sequence or arrangement.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim:

1. A rigid, structural building unit comprising a laminated, elongate structure having a relatively thick inner section characterized by compressive strength and insulating properties; and a pair of relatively thin members of high tensile strength secured to opposite sides of said inner section, one of said members intermediate its marginal portions being displaced laterally and the other member intermediate its marginal portions being displaced laterally in the same direction as the first member, the marginal portions of the members being secured respectively to each other, one member having shoulders on its marginal portions for cooperation with fastening elements whereby it may be secured to an adjoining building unit, and having elongate key means adapted to interfit with a dissimilar, mating key means of an adjoining building unit.

2. The invention as defined in claim 1 in which the marginal portions having the shoulders also have longitudinally extending grooves constituting the said key means, for receiving tongues of an adjoining building unit.

3. The invention as defined in claim 1 in which the

said other member has a pair of deep flanges constituting its marginal portions.

4. The invention as defined in claim 3 in which the said other member has an upward extension formed in one deep flange, constituting a splash board.

5. The invention as defined in claim 1 in which the said other member has a downward extension formed in its marginal portion, providing a drip edge.

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