

April 28, 1959

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PREFABRICATED BUILDING CONSTRUCTION

Filed Aug. 31, 1953

4 Sheets-Sheet 1

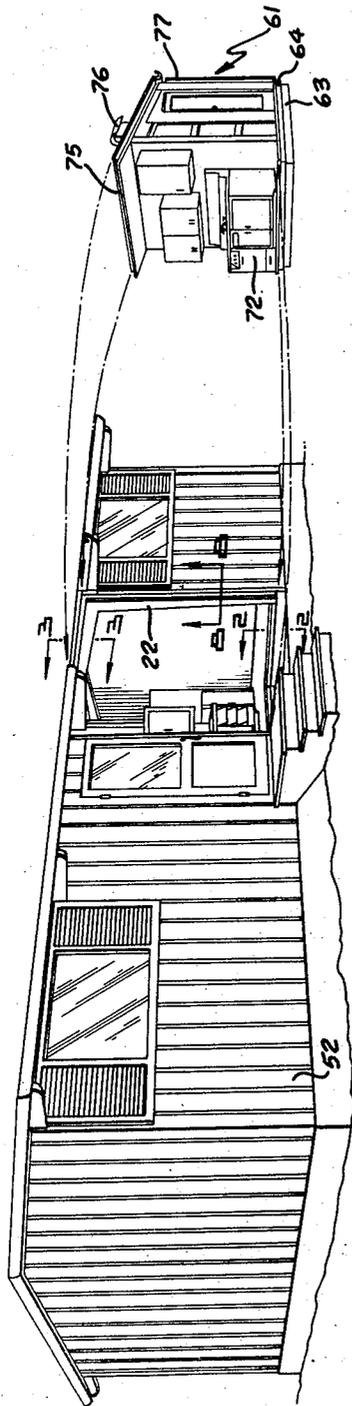


FIG. 1

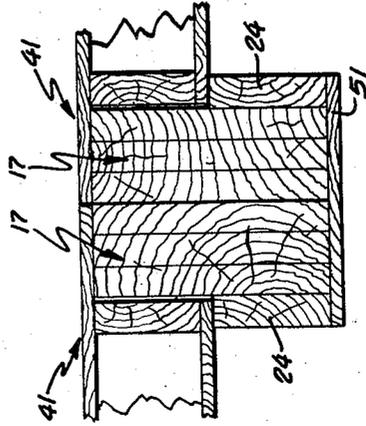


FIG. 3

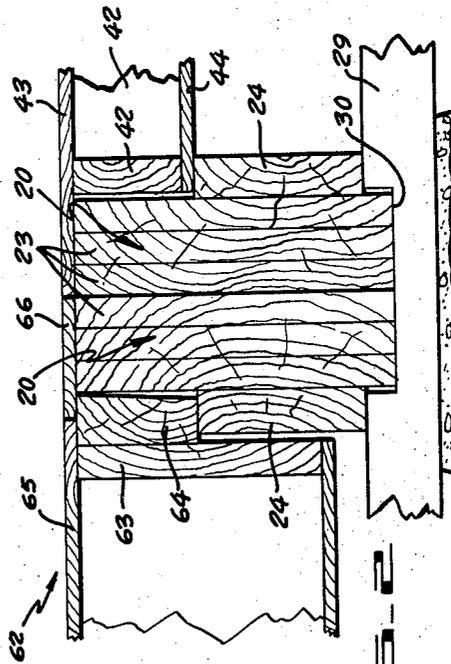


FIG. 2

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4 Sheets-Sheet 2

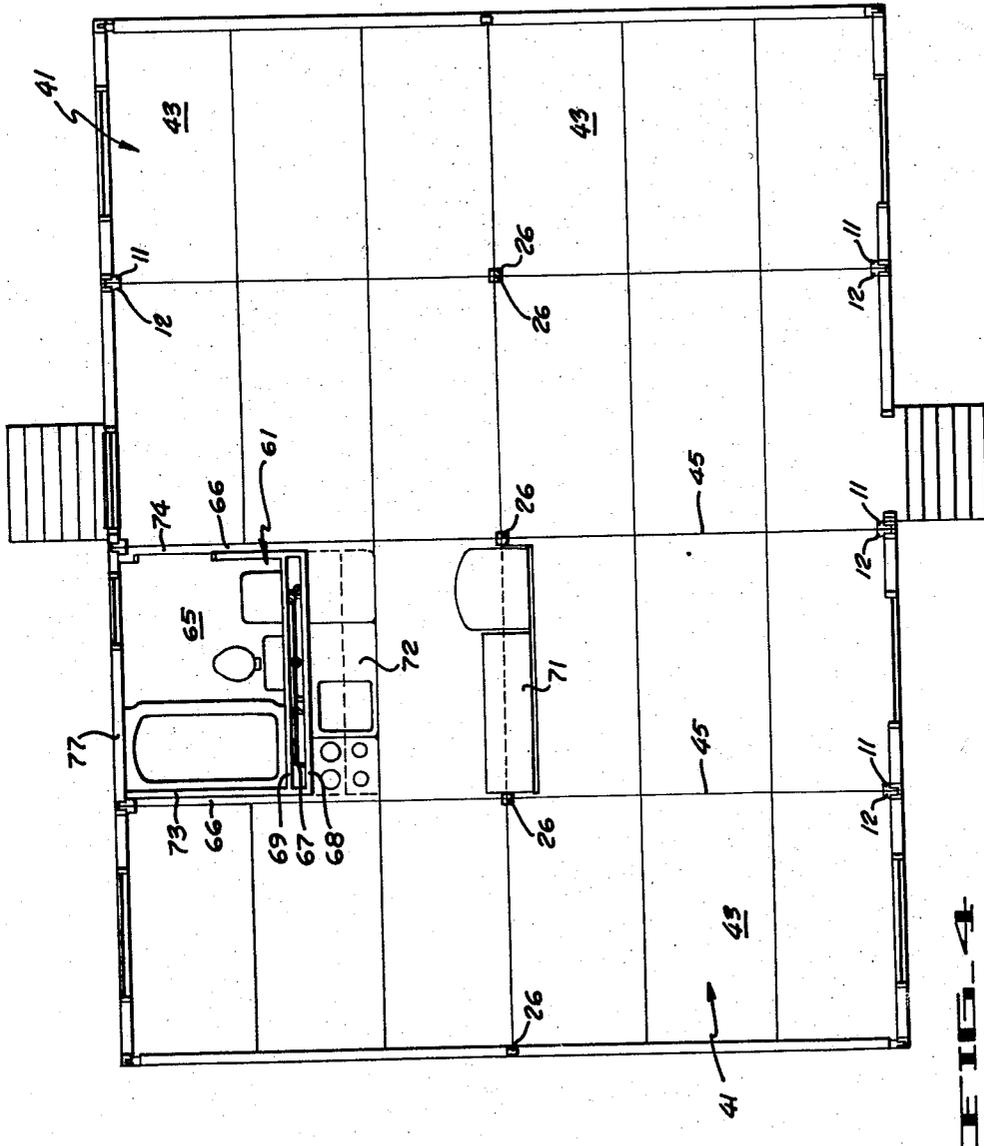


FIG. 4

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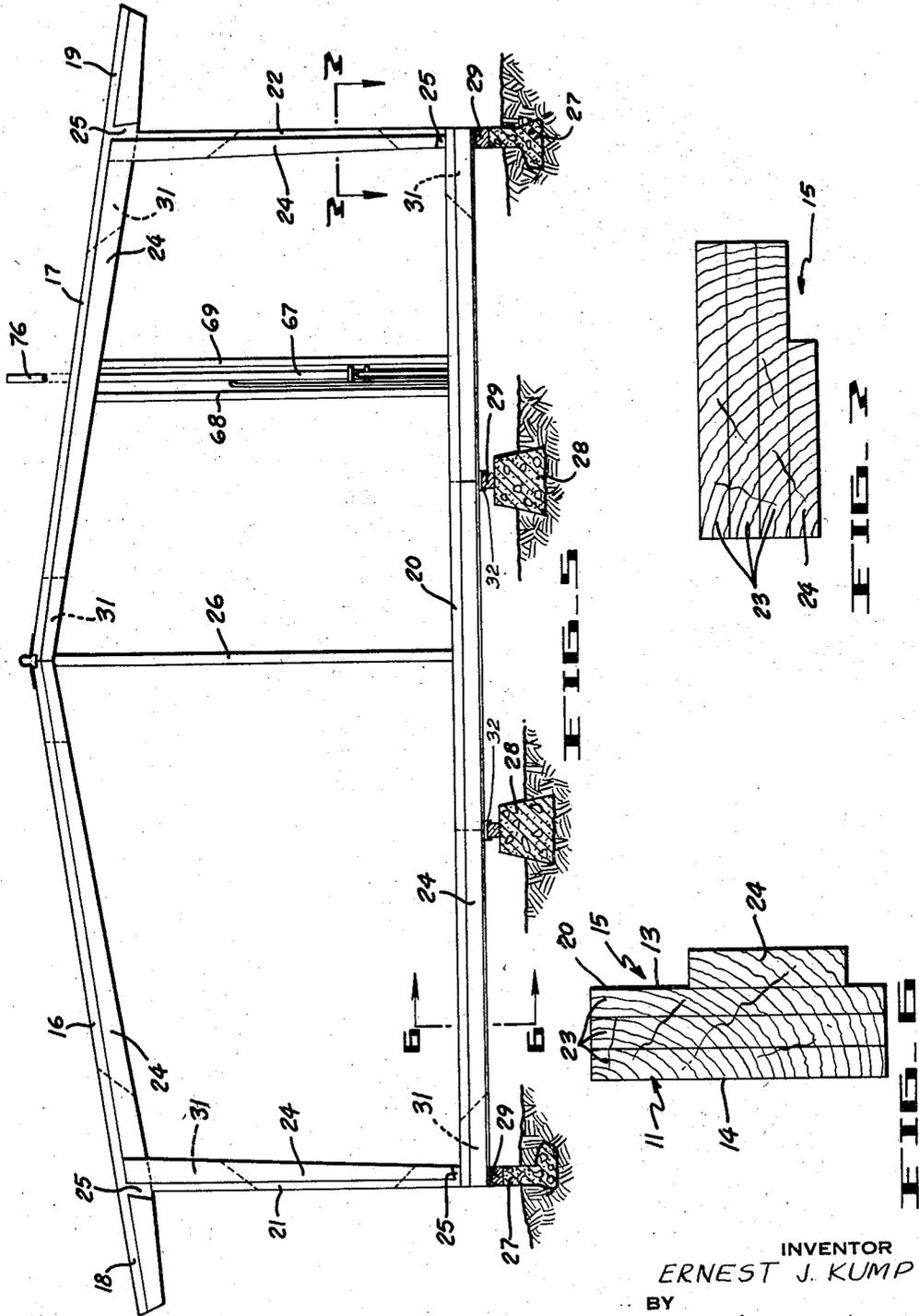
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4 Sheets-Sheet 3



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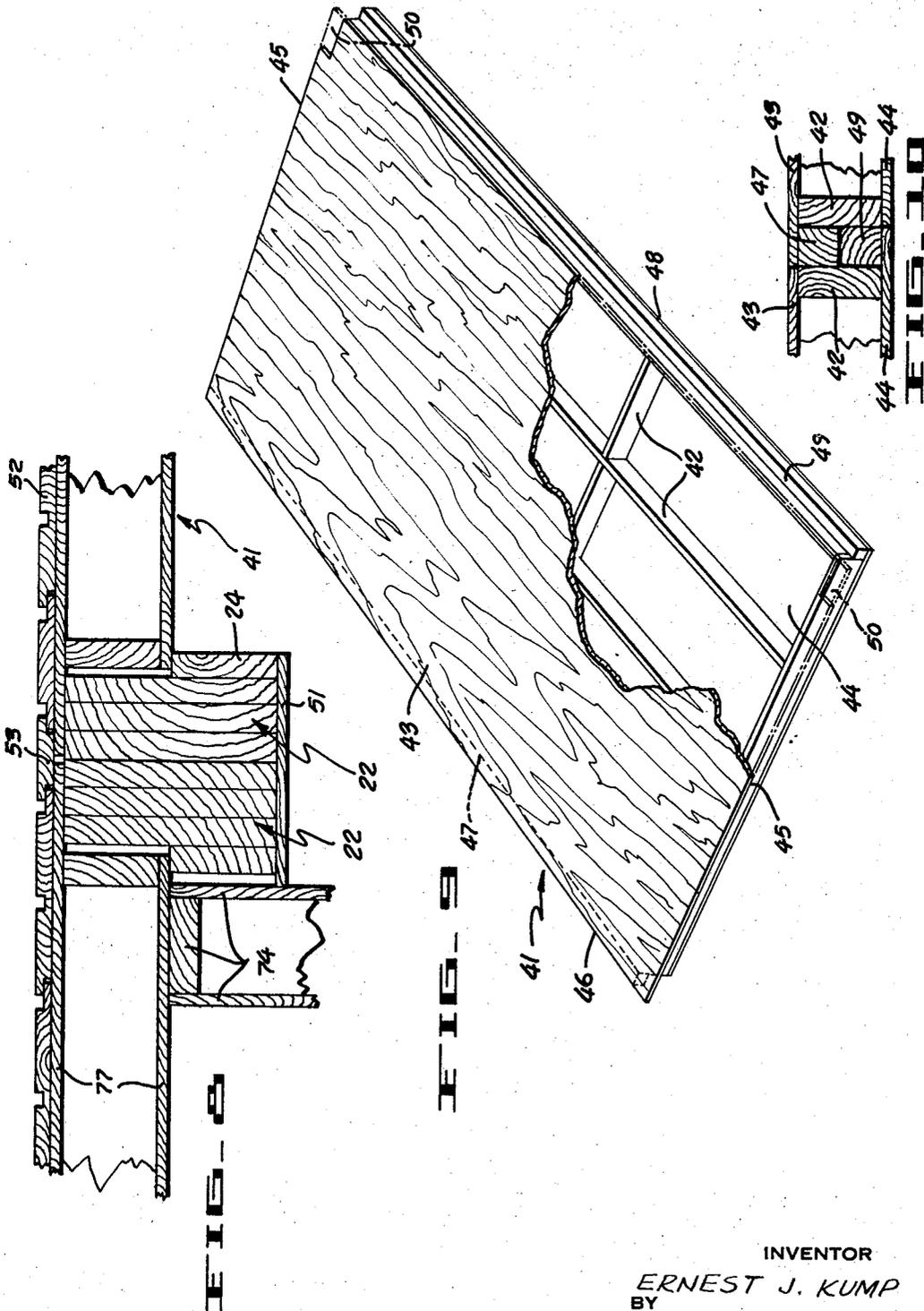
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PREFABRICATED BUILDING CONSTRUCTION

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4 Sheets-Sheet 4



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1

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PREFABRICATED BUILDING CONSTRUCTION

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2 Claims. (Cl. 20—2)

The present invention relates to building construction, and in more particular to a building construction which is particularly adapted for assembly in a shop in various selective sub-assemblies so that, dependent upon shipping, shop, and field facilities, and relative costs, the amount of shop and field assembly may be varied within wide limits and yet, the sub-assemblies made in the shop, regardless of their integration, will remain relatively uniform in size and shape.

There have been many building designs which have been made with the primary purpose of facilitating the amount of work that could be done in the shop prior to final erection in the field. These designs have ranged from the shop cutting of all the pieces of a conventional wood frame house and the shop construction of steel beams and trusses, to the shop construction and assembly of a complete building and its transport to the field and site as a single unit. The mere pre-cutting of pieces is not satisfactory as it still requires much skilled labor for the field erection, with the chances for shop mistakes being in large number. The shop assembly of complete buildings is only practical when the building is small, transport equipment adequate, and the distance to the site short.

Many attempts have been made to compromise these factors inherent in the so-called "prefabricated building" business, with more or less success. In the present invention, it is believed that a form of construction has been devised which is such that it is versatile of adaption to various conditions so that, as the various factors of availability of shop and field labor vary, and transportation costs, kind, and availability vary, the relative amounts of shop and field work may be varied without change in the design of the building. Further, variations in the size of the finished structure are easily made.

Having in mind many of the defects of the prior art and the above mentioned desirable features of a building construction, it is an object of the present invention to devise a building which is made up of a small number of shop assembled parts which differ in shape and function, and which parts are small enough to be easily moved by three or four men or light rigging equipment.

A further object of the present invention is the devising of a building so that a small number of variations of box panel shapes will suffice for achieving a complete structure.

A further object is a form of construction in which there are modular and sub-modular units so that the shop fabrication may be of the sub-modular units only or these may be integrated into the modular units, and so that the modular units are of a uniform size and shape.

Another object of the invention is the devising of a form of construction so that in the process of final assembly there may be inserted in an otherwise finished building a complete room unit containing all the needed plumbing and utilities for the building.

Another object of the invention is the devising of a

2

structure using a series of uniform trusses of maximum dimensions relative to the structure.

A still further object of the invention is the design of a suitable sub-module truss for use in the present construction.

Still another object of the invention is the use of suitable box panels as sub-modules of a building.

The smaller part, or sub-module, of the present construction is a four by eight foot box panel and the larger part, or module, a sub-assembly consisting of a transverse portion, eight by twenty-four feet, of the complete building. Each of the panels is of a multicellular box construction with stressed face sheets secured to the edges of the cell walls forming the grid, or core, of the panel.

The panels are integrated into the larger module by means of two trusses, each of which may be considered to be another sub-module, one being placed on each side of the portion, and the principal members of the truss being coextensive with the outer edges of the portion. The portions may then be brought together into a single building by aligning the portions side by side so that two trusses are contiguous along their side faces, and securing such contiguous trusses together by bolts, nails or screws.

The use of these parallel trusses and panels not only gives a simple construction and assembly but has enabled the complete shop assembly of all plumbing, bath room and kitchen and the floor, walls, and roof of the bath and kitchen so that this shop assembly may be inserted into the otherwise completed building as a unit.

A construction in accordance with the above objects and outline is hereinafter described in detail and shown in the accompanying drawings, in which:

Fig. 1 is a perspective view taken from the rear side of a house embodying the present invention, and with the bath-kitchen unit extended from the house.

Fig. 2 is a view on the line 2—2 of Fig. 1 showing in section the bottom, or floor, chords of two adjacent trusses under the bath-kitchen unit with the unit in place, and the adjacent parts of the floor panels resting on such trusses.

Fig. 3 is a view on the line 3—3 of Fig. 1 showing in section the roof chords of two adjacent trusses and the edges of the roof panels resting on such trusses.

Fig. 4 is a floor plan of such house.

Fig. 5 is an elevational view of the ledge side of a representative truss used in the present construction and showing its supports, and the location of the plumbing and the plumbing cover walls of the bath-kitchen unit.

Fig. 6 is a view on the line 6—6 of Fig. 5 showing in section the construction of the floor, or bottom chord of the truss.

Fig. 7 is a view on the line 7—7 of Fig. 5 showing in section the construction of the outside upright of the truss.

Fig. 8 is a section on the line 8—8 of Fig. 1 to show details of the outer wall.

Fig. 9 is a perspective view with parts broken away of one of the panels to show its construction.

Fig. 10 is a view showing in section parts of two panels at their abutting edges, and taken across such panels.

The present construction is based upon a modular concept, and so, before describing the complete construction shown in Fig. 1, it is desired to explain the two basic parts, or sub-modules, out of which the disclosed house structure is formed. The structure is outlined by a plurality of parallel right 11 and left 12 trusses (Fig. 4), even in number, each of which is identical with the others and has its principal parts formed to be coextensive with the perimeter of an elevational section of the house, such section being taken from side to side of the house. An elevational view of one of these sub-module trusses is shown in Fig. 5. The two sides, or faces, the inside

3

13 and the outside 14 of the truss are not the same. Fig. 5 is a view of the inside, or ledge side 13 of the truss. This is called the ledge side because the juncture of the inside 13 and one edge is formed with a rebate 15 which extends along the upper edges of the two slopes 16, 17 of the roof chord including the cantilevered overhangs 18, 19 which support the eaves of the roof, and the upper edge of the bottom, or floor, chord 20 as well as along the outer edges of the webs, or uprights 21, 22. This rebate 15 is shown in the truss sections of Figs. 2, 3, 6, 7 and 8. Each truss is of laminated construction so as to form a single rigid piece, and in the present instance is made up of 1" x 8", nominal, boards 23 mostly 8' or 16' in length, with the joints staggered. Each corner of the truss, including the ridge, is reinforced with one or two plywood knees 31. If only one knee is used, it is placed in the middle of the lamination, but if two are used, one would be placed on each side of a truss. In either case, the knee takes the place of one of the boards 23 of the lamination throughout the length and breadth of the knee. The ledge board 24 is narrower than the others to provide the rebate 15. A gap 25 is provided in each roof slope ledge at the juncture of each roof slope ledge and its upright support, and in each upright ledge at the juncture of each upright ledge and the floor ledge. These gaps allow the wall panels to butt the underside of the roof panels, and allow the outer edges of the floor panels to be flush with the outer edge of the uprights 21, 22. These panels 41 are later described. A center post 26 is placed and secured between the ridge and the floor chord of each truss, although with proper increase in structural strength, this center post may be omitted.

In the erection of all or a part of the house, an outside foundation 27 is provided or piers 28 may be used for both the outside and the inside ground supports. A spacer strip 29 extending from end to end of the house is placed on each side foundation and each row of piers and may be provided with a cap 32. At each end of each strip and at eight foot intervals the spacer strips are notched 30 (Fig. 2), to receive the bottom edge of the floor chords 20 of the trusses. This provides the proper spacing of the trusses. Each end of the house has a single truss but at the other eight foot stations there is placed a right and a left truss with the outside faces 14 of the trusses contiguous, so that when so placed the rebates 15 are outwardly of the two trusses. The contiguous trusses are secured together by any suitable means such as bolts or screws. In the present disclosure each truss is 24 feet wide between the outer edges of the uprights 21, 22. The house shown employs eight of these trusses and so is 32 feet long between the outside faces 14 of the end trusses.

The other sub-module of the construction is a 4' x 8' box panel 41, which is shown in Fig. 9 in perspective with parts broken away. The multicellular core of the panel is formed of a grid 42 made up of rectangularly arranged and secured together strips of wood which in the shown construction are $\frac{3}{4}$ " x $2\frac{1}{2}$ " in section. Each face 43, 44 of the panel is made from a sheet of 4' x 8' plywood which may be secured to the edges of the grid by any suitable means such as gluing and/or nailing. One face 43 of the panel may be made thicker than the other and used as the wear face. The wear face 43 of the panel is the full 4' x 8' size, and the grid 42 is enough smaller so that each end 45 of the wear face 43 extends beyond the grid 42 a distance equal to the combined thickness of the boards 23 of a truss, in this showing $\frac{1}{4}$ ", plus a small clearance; and one side edge 46 only extends beyond the grid a distance which in the present showing is $1\frac{1}{2}$ ". Under this side edge extension, the under side of the wear face, and to the grid is secured a block 47 that is as long as the grid and half as thick. The non-wear face 44 of the panel is of a length equal to the length of the grid 42 and is a full four feet wide, in the

4

present showing. This non-wear face has one side edge 48 only extending beyond the edge of the grid in a similar manner and distance to the wear face side edge extension 46 but on the opposite edge. Similarly there is secured above this non-wear face extension and to the grid a block 49 that is as long as the grid and half as thick. The thickness of the grid plus the non-wear face is equal to the depth of the rebate 15 of a truss. Corners 50 of the wear face 43 of the panel may be cut out to remove a part of the end extensions 45 for purposes to be later mentioned. The side extensions 46, 48 of the panel and the blocks 47, 49 are so arranged and constructed that two panels may be placed in side edge abutment to form a joint such as shown in section in Fig. 10.

These two sub-modules are integrated together to form the greater part of a complete house. The only exceptions in the presently disclosed construction being the outside endwalls, portions containing doors and windows, interior walls, and parts of the bath-kitchen unit. The two sub-modules are associated by erecting the trusses, illustrated in and described in connection with Fig. 5, in side by side and spaced apart relation. The panels 41 are then placed on the floor chords of the trusses to form the floor plan shown in Fig. 4. The floor panels along one of the sides of the house will require the removal of a side extension 46, 48, and the block 47, 49 secured to the extension, either from the wear or non-wear face, preferably from the non-wear face, as the sum of the width of the panels is greater than a multiple of four feet by the amount of an edge extension. Further, end extensions of some of the panels must be notched in the corner 50 of the wear face to accommodate the uprights 21, 22 and the center posts 26 of the trusses. When the ends of the panels are fitted in the rebates of the floor chords of the trusses, the end extensions of the panels will overlie the upper edges of the floor chords 20 of the trusses and butt against each other in the plane of the outside faces 14 of the contiguous trusses. The slots 25 in the base of the uprights 21, 22 formed by the discontinuance of the ledge boards 24 at the base of the uprights 21, 22 make it easy to insert the row of panels along each side of the house so that the edges of these panels extend out to the outer edges of the uprights.

The outside wall panels of the house may then be put in place between the uprights 21, 22. Again, the slots 25 at the juncture of the eaves and the uprights facilitate insertion of the top panels. The length of the upright is such that the width of two panels will cover the wall from floor level to the rebate 15 of the eaves 18, 19. It is desirable to remove the wear side extension 46 and block 47 of the panel resting on the floor so that the edge of the non-wear face 44 will rest on the floor. If this is done, then with four foot panels, the overall height of the outer wall panels will be eight feet. With the insertion of the endwalls, and window and door sections, the outside walls of the house are complete.

The roof panels are inserted between opposed trusses and rested on the ledge boards 24 in the same manner as for the floor. If a full panel gives too wide eaves, a section or strip may be removed from an edge of each of the eaves panels. The rebate 15 of the roof chords 16, 17 is continuous with the rebate of the eaves part of the truss so that it is not necessary that the joints between the roof and eaves panels come at the outer face of the house side, but will come inside the face of the house a distance depending upon the pitch of the roof.

Typical sections through the contiguous trusses and parts of the adjacent panels are shown in Figs. 2, 3, 8. The left side of Fig. 2 is a portion of the floor panel of the bath-kitchen unit and the right side is of a typical floor panel. Fig. 3 is a typical section through the roof chords of contiguous trusses with parts of the adjacent panels. A cover strip 51 may be placed over the inside edges of the roof chord and the uprights of the contiguous trusses to enhance the appearance of the trusses.

Fig. 8 shows a section through two of the contiguous uprights and adjacent parts of the outer wall panels. Siding 52 has been applied over the panels. If this siding is to be shop applied, then the sidewalls of the house may be made up in 8' x 8' sections and in the field a siding cover strip 53 is applied to cover the joint. The left side of Fig. 8 illustrates a corner of the bath-kitchen unit with an interior wall butting the exterior wall.

Fig. 4 illustrating the floor plan of the house, also shows the plan of the bath-kitchen unit 61 which is also shown in Fig. 1 removed as a unit from the house. This unit is preassembled on an approximately 8' x 8' floor panel 62 which differs from the standard panels 41 only in that it takes the place of two such standard panels, is deeper so as to carry the heavy load of plumbing and utilities, and is less than eight feet in the direction between trusses so that it may be inserted into the house after other parts of the house have been assembled and completed. To do this, each end strip 63 of the grid has placed along it a support strip 64 in position to rest upon the ledge board 24 of a floor chord 20 of an adjacent truss. Because of the necessity for the bath-kitchen unit to be insertable from the exterior of the house after the separate completion of both the house and the unit, the wear surface sheet 65 does not butt the adjacent wear sheets 43 over the floor chords 20, and so it is necessary to lay a wear strip 66 between these edges of the wear sheets to fill therebetween and to cover the exposed floor chords.

In Fig. 5 there is shown in end elevation the location of the plumbing tree 67 for the unit 61, which tree contains all of the plumbing for the house and unit, and may be shop assembled. This plumbing is housed between two cover walls 68, 69 placed on the floor panel 62 and connection of the utilities thereto may be made through both of the walls, that to the kitchen through the kitchen wall 68 and that to the bath through the bath wall 69. The kitchen cabinets 71 are not part of the bath-kitchen unit 61, but the other cabinets and utilities 72 of the kitchen may be preassembled as a part of the unit. The end walls 73, 74 of the bath are preassembled and placed in the unit, and extend from the floor to the roof so that they may carry the roof panels 75 with all vents 76 inserted therethrough. Also, the outside wall panels 77 are preassembled to the unit. These roof and outside wall panels may be of the same construction as the standard panel 41.

With this general type of construction the preassembly, or shop assembly, of a complete bath-kitchen unit becomes practical as it is a unit based upon a basic modular design, and the overall construction is such that it may be inserted as a unit.

It is also to be observed that any two of the spaced apart adjacent trusses and the panels which space them apart and integrate them, constitute a separable portion having floor, outside walls, and roof. These portions may be shop assembled and then moved to the site or if several houses of this type are to be placed on a site, the portions may be assembled at a central location and then

moved into position and by bolting the trusses together the house is completed. Whatever the method of assembly, the shop assembly of the bath-kitchen unit as a package, is highly desirable. Fig. 1 shows the ease with which the unit may be inserted in a completed house.

Fig. 1 also shows a perspective view of the assembled house with the bath-kitchen unit in position to be inserted therein.

The above specifically described structure and operation is not to be construed as restrictive of the invention as it is obvious that minor changes in design may be made without departing from the scope of the invention as defined in the following claims:

I claim:

1. A truss adapted for integration into a building in which the principal parts of the truss would be coextensive with the perimeter of a section of such building, comprising; a floor chord adapted to support a portion of a building floor, an upright connected at each end of said floor chord and each upright adapted to have secured thereto a portion of the side of such building, a roof chord resting at each of its ends upon the upper end of one of such uprights and connected thereto and such roof chord adapted to support a portion of the roof of such building, said floor chord, uprights, and roof chord being prefabricated and integrated to form a single structural piece for stress purposes, and on one side of said floor chord, uprights and roof chord at the edge thereof a rebate formed in each for the reception, retention, and support of such portions.

2. A building construction unit comprising: a pair of opposed, spaced, parallel trusses, each prefabricated into a unitary, integral structure for stress purposes including a floor chord, a pair of opposed uprights extending upwardly from opposite ends of said floor chord, and a roof chord extending between the upper ends of said uprights, a plurality of prefabricated panels in side by side engaging relationship extending between said trusses and forming the floor, walls, and roof of said unit, and oppositely inwardly opening rebates formed in the edges of said trusses and receiving the edges of said panels for supporting said panels on said trusses.

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