

[54] **MODULAR BUILDING AND METHOD OF MAKING SAME**

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Related U.S. Application Data

[63] Continuation of Ser. No. 38,100, May 18, 1970, abandoned.

[57] **ABSTRACT**

[52] U.S. Cl..... 52/79, 52/650, 52/236, 52/637

A modular building comprised of a living module, a utility core module and a bedroom module. The modules are arranged in a J-plan to form a complete living unit. Extra space such as covered patio and carport may be obtained by addition of panels. Each module has a steel frame construction. The invention includes the structure for and method of making and assembling the modules wherein a floor frame and a ceiling frame are affixed inside wall frames for increased rigidity.

[51] Int. Cl..... **E04b 1/348**

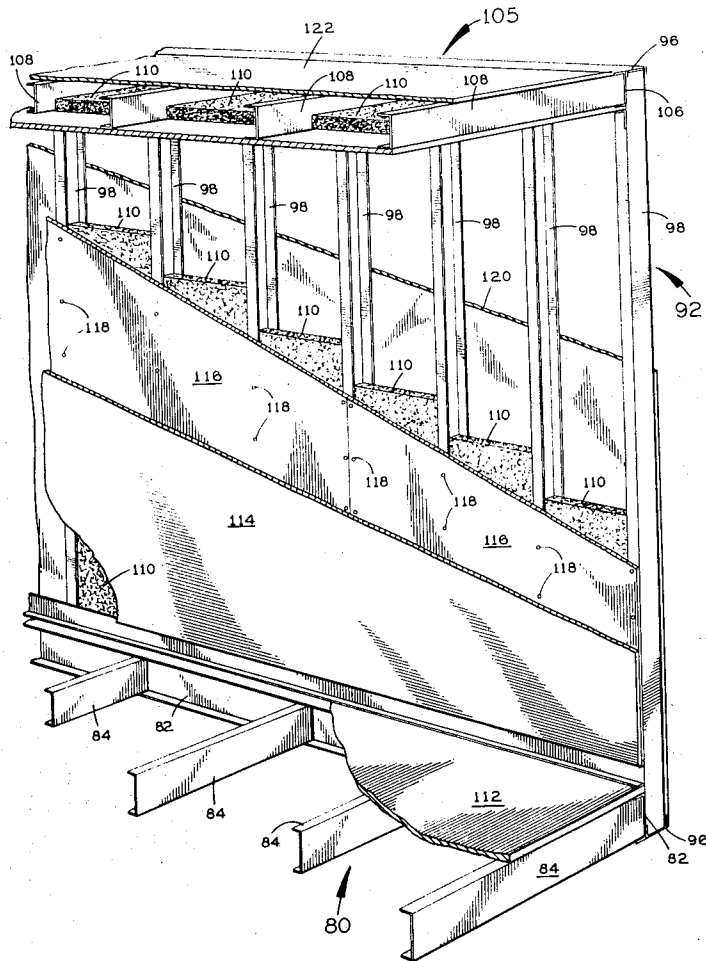
[58] Field of Search..... 52/264, 79, 474, 52/270, 236, 665, 650, 637

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1 Claim, 6 Drawing Figures



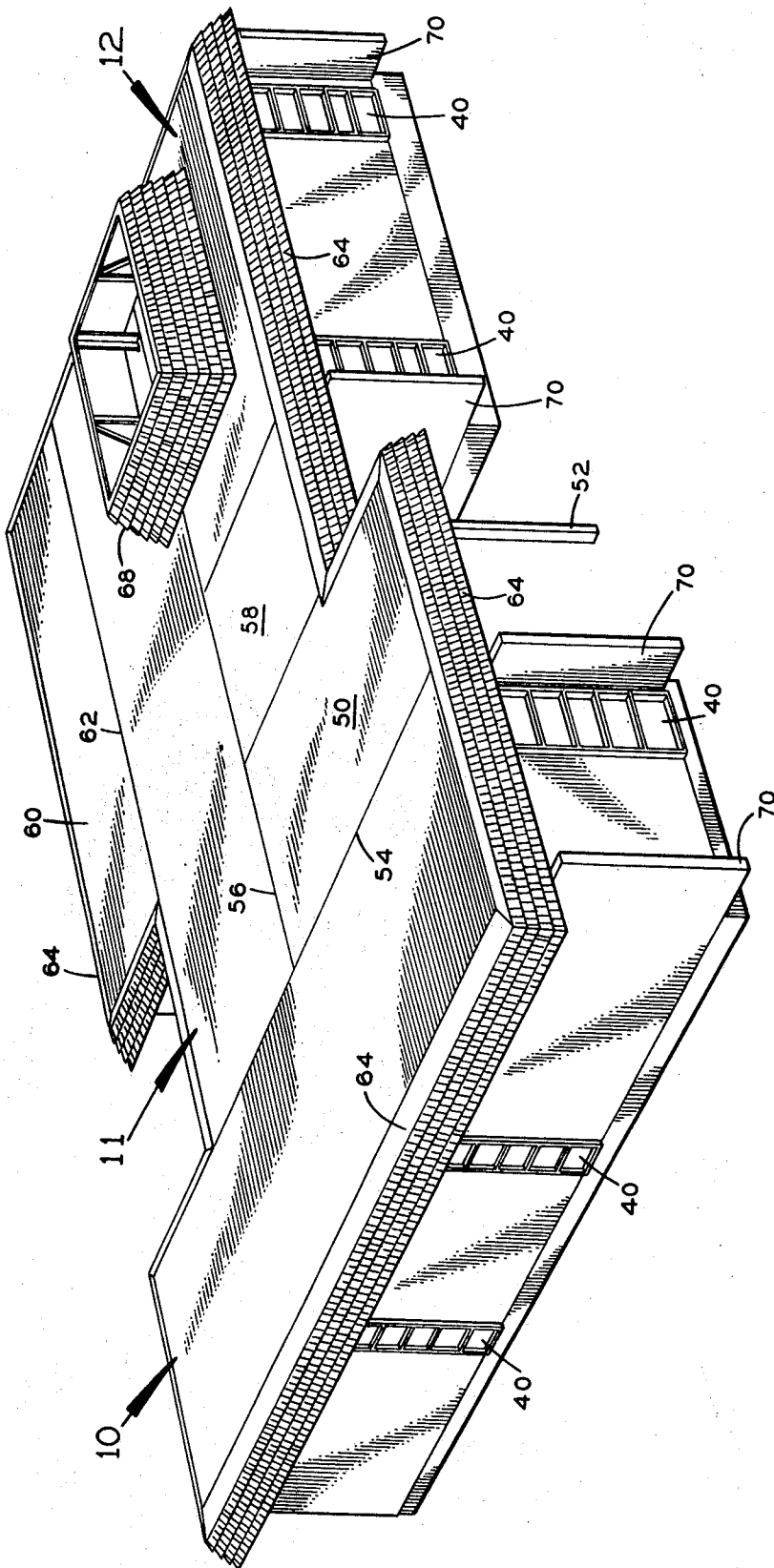


FIG. 1

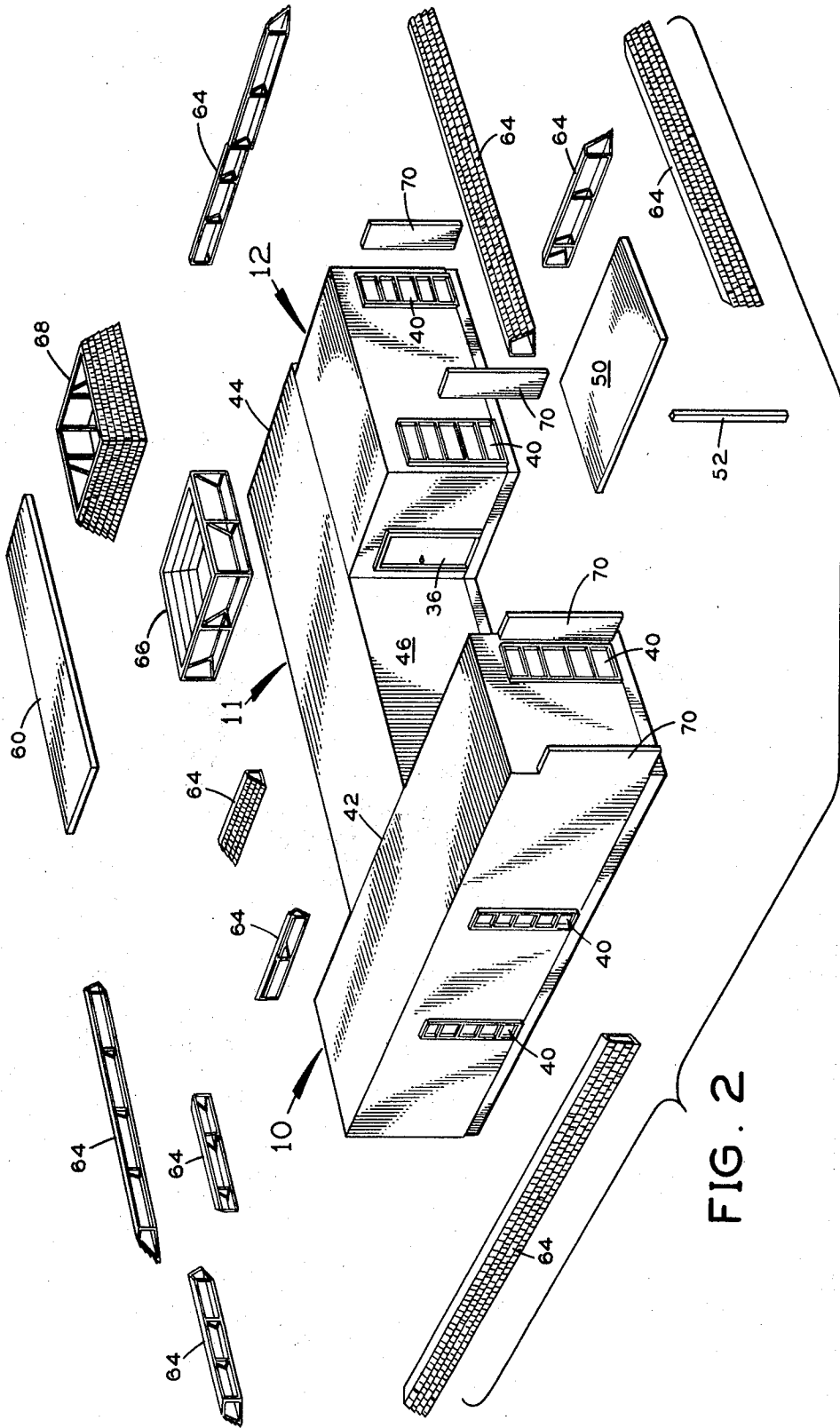
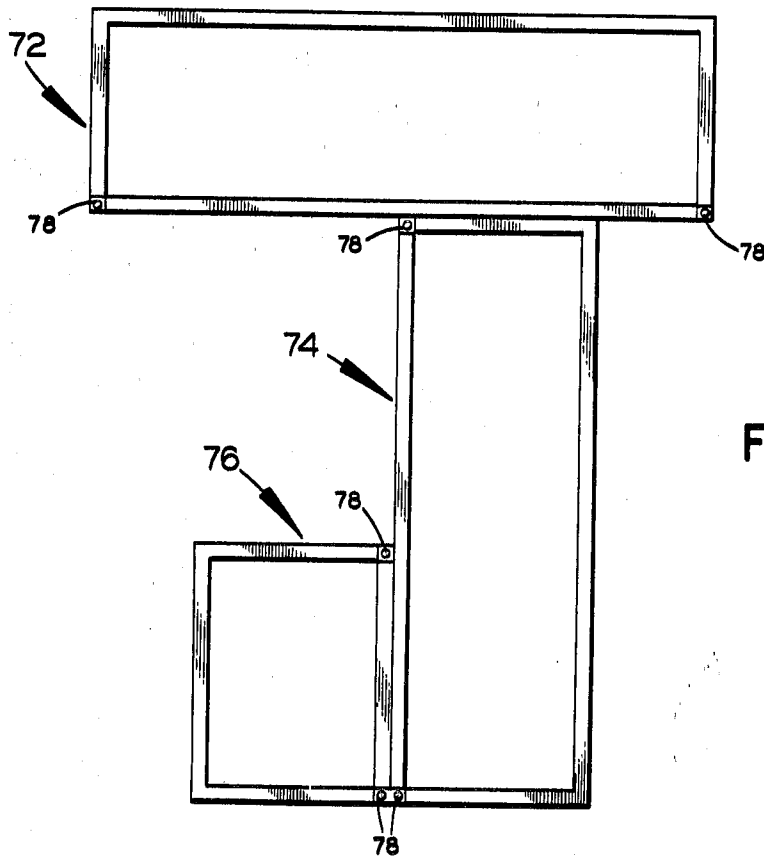
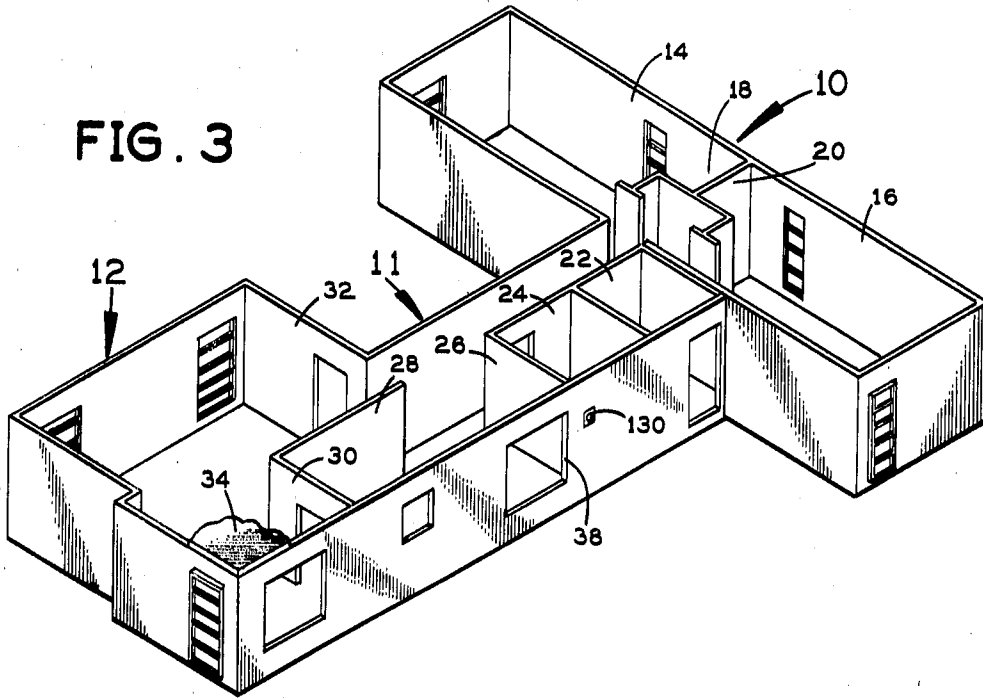
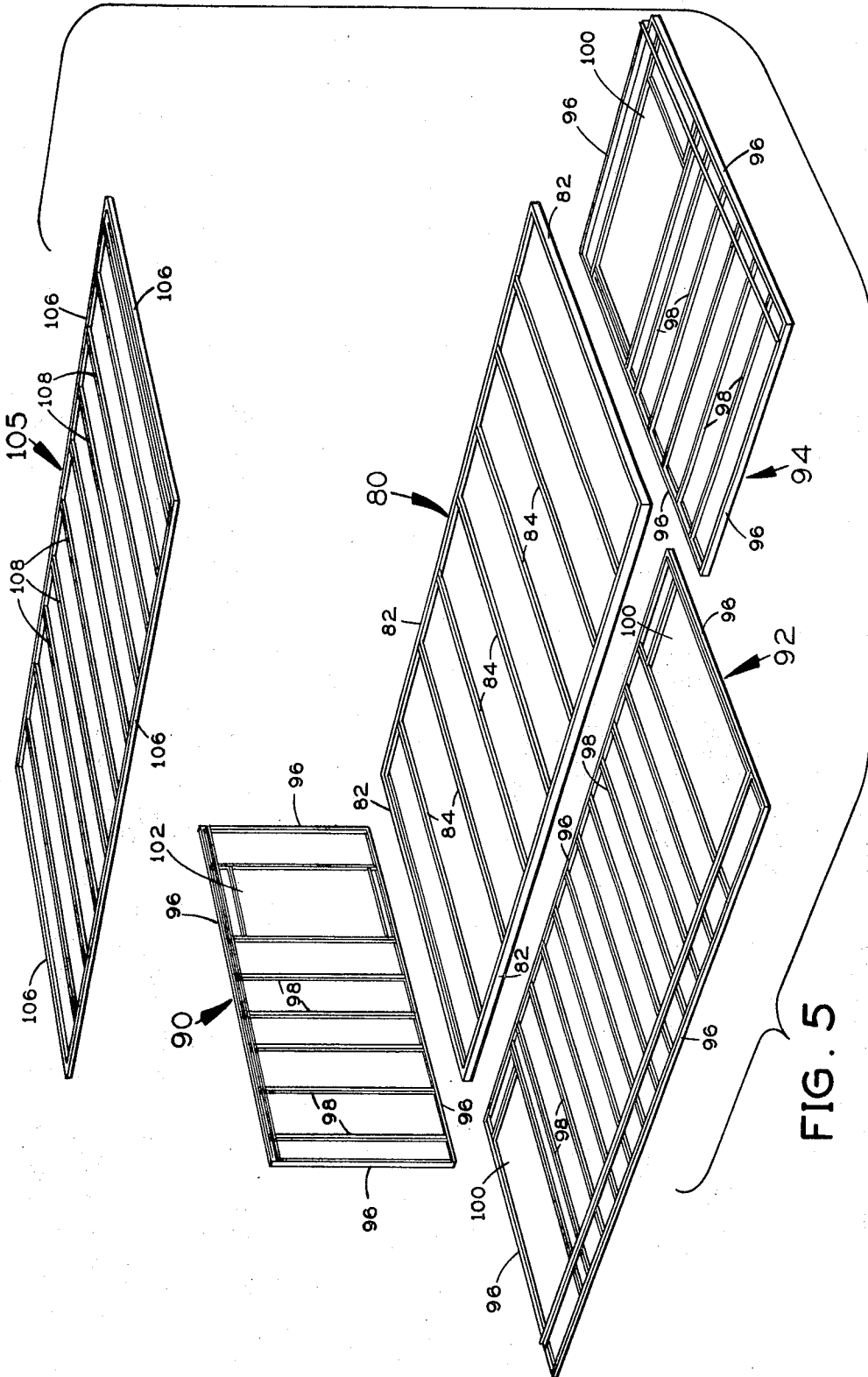


FIG. 2





MODULAR BUILDING AND METHOD OF MAKING SAME

This is a continuation, of application Ser. No. 38,100 filed May 18, 1970 and now abandoned.

BACKGROUND OF THE INVENTION

Modular homes composed of prefabricated room units have been proposed previously, and considerable effort has been put forth recently to develop modular construction for use in constructing buildings, such as homes and apartments, in large quantities. It is widely believed that economies in materials and labor, standardization of some components, and improvements in the speed of construction can be achieved. However, many known modular buildings and plans for modular buildings have not had as much appeal to buyers as desired. For example, known modular homes have often had a boxy structure with little architectural design incorporated in them. One limitation which may have contributed to this deficiency is that the modules must be so constructed in a factory that they can be transported to the building site and assembled together to form buildings. If modules are transported over roads, the width of the module is limited by the width of the roadway. Also, some known modules have not been as strong and rigid as desired.

SUMMARY OF THE INVENTION

The present invention includes a modular home which, despite design limitations, has appealing architectural qualities. A feature of the home is a J-shaped arrangement of a bedroom module, utility core module, and a living module. This J-plan gives the home angles and lines which avoid boxiness and also creates spaces which can be utilized for additional features such as carport, garage, patio, entranceway and the like. The modules have a steel frame construction, and each module is made by constructing wall, floor and roof frames, assembling the frames into a module, and welding the frames together. The invention includes the particular structure of these frames.

Accordingly, it is an object of the present invention to provide a modular building with improved architectural qualities.

Another object of the invention is to increase the rigidity and strength of a module by means of recessing floor and ceiling frames between partially covered wall frames and welding the frames together at access areas.

Another object of the invention is to arrange modular room units by a plan which gives the resulting living unit angles and broken lines to create indented and broken spaces around the living unit.

A further object of the invention is to assemble three modules together in a J-plan to provide a modular home.

Still another object of the invention is to provide a method of and structure for prefabricating modules and assembling modules together on an economical, mass production basis.

Another object of the invention is to provide a method of constructing and assembling modules wherein each step can be performed at a station on a mass production line.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part

of this specification wherein like reference characters designate corresponding parts in the several views.

On the drawings:

FIG. 1 is a perspective view of a modular home in accordance with one embodiment of the invention;

FIG. 2 is an exploded perspective view similar to FIG. 1, but showing add-on units to the modules separated from the modules themselves;

FIG. 3 is a perspective view of the modular home with the roof removed showing the floor plan of the home;

FIG. 4 is a plan view of the foundation for the modular home;

FIG. 5 is a perspective exploded view showing wall frames, a roof frame, and a floor frame for a module of the home; and

FIG. 6 is a perspective view, partly broken away, showing the assembled construction of one wall of one of the modules.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

As shown on the drawings:

Referring first to FIGS. 1 through 4, there is shown a modular home comprised essentially of three modules 10, 11 and 12 arranged in a J-plan and secured to each other to form a complete living unit. As shown particularly in FIG. 3, module 10 is a bedroom module and contains two bedrooms 14 and 16 with respective closets 18 and 20 for these bedrooms. Module 11 is a utility core module which contains several rooms. There are two bathrooms 22 and 24, and a family room space 26, a kitchen 28 and a dining area 30. Module 12 is a living module and contains the living room space 32. It may be noted that only a corner of the roof 34 is shown in FIG. 3, the rest being removed to reveal the interior layout of the rooms. There is a front door 36 at one side of the living module 12 (FIG. 2) and a back door 38 in the utility core module. Several windows such as 40 (FIGS. 1 and 2) are provided in the various modules.

Referring particularly to FIG. 2, it may be seen that one end 42 of the utility core module 11 butts against a medial portion of the bedroom module 10, and the utility core module 11 extends perpendicular to the bedroom module 10. This gives the two modules 10 and 11 a T-shaped configuration. Then the third or living room module 12 butts against one side of the utility core module 11 at the end 44 thereof remote from the bedroom module 10 so that the overall configuration of the three modules 10, 11 and 12 as assembled is J-shaped. This gives the overall living unit, which is in this case a module home, angles and broken lines that make the home architecturally appealing. It may be noted that there is a recessed space at 46 in the center of the J-plan which forms a natural entranceway, and may also be utilized to provide a carport. Also there is space behind the utility core module 11 for a patio. These spaces have been utilized in the complete structure as shown in FIG. 1 wherein a Roof unit supported by a post 52 is affixed to modules 10 and 11 and joins

them at 54 and 56 to create a carport space under the Roof unit 50. The space at 58 is still a useful entranceway, and may either be left uncovered or be covered with a Roof unit as desired, an uncovered space being shown.

Similarly, a Roof unit 60 is connected to module 11 at joint 62 and is supported by a post (not shown), and the space under this Roof unit 60 is accessible through a back door 38 to provide a patio space. Thus, the J-plan has exterior spaces which can be incorporated into the modular home.

All around the roof of the house mansards are attached to the roof, and the various sections of these mansards are all designated 64 in FIG. 2. A separate mansard 66 having four sides may be used over the entranceway 58, if desired, but this is not essential. Another structure 68 similar to a mansard is mounted on the roof of the home as an additional feature. Wings such as 70 are fixed at corners of the house if desired.

FIG. 4 shows the foundation for the modular home, there being three sections 72, 74 and 76 as shown. Section 72 receives the bedroom module 10, section 74 receives the utility core module 11, and section 76 receives the living room module 12. These foundation sections may be concrete, blocks, or pre-cast beams. In any case, the modules 10, 11 and 12 are prefabricated in a factory or the like, whereas the foundation is constructed on the home site. The prefabricated modules are transported as on trucks to the home site, and are lifted from the trucks, as with a crane, and lowered on to the respective foundation sections. Guides 78 may be provided on the foundation section as shown to assist in guiding the modules into position on the foundation, but this guiding feature is not a part of the present invention. In assembling the modules, first one module is lowered onto the respective foundation section, then another module is lowered and connected to the first module, and finally the third module is lowered and connected to the adjoining module. The modules are secured to the foundation as with anchor bolts to firmly secure the modules in place.

FIG. 5 and 6 illustrate the basic steel framework construction of each of the modules, the main difference between different modules being in dimensions. Thus, this view of one module 12 serves to illustrate the basic framework construction of all of the modules. It may be seen that the module has a floor frame 80 which consists of metal perimeter beams 82 in the form of channels welded to each other at corners to form a rectangular perimeter, and cross beams 84 also in the form of metal channels welded at opposite ends to the respective perimeter beams 82.

Each of the walls 90, 92 and 94 consists of perimeter beams 96 in the form of channels welded to each other at corners in a rectangular plan exactly the same as the floor frame 80. There are also cross beams 98 in the form of metal channels welded to respective perimeter beams 96 as shown. Openings 100 may be left for windows, and an opening 102 left for a door in frame 90. The illustrated module has only three walls, the fourth side being left open to abut against the module 11.

A roof frame 105 has the same basic construction. It consists of perimeter beams 106 in the form of metal channels welded to each other at corners, and cross beams 108 welded to respective perimeter beams.

The respective wall, floor and roof frames are assembled and welded together individually. Thus, the roof

frame 105, the floor frame 80, and the wall frames 90, 92 and 94 are constructed as prefabricated units. Then the wall frames 90, 92 and 94 are assembled with the floor frame 80 in the manner shown in FIG. 6, and the perimeter beams 82 of the floor frame 80 are welded to lower portions of the cross beams 98 of the wall frames to secure the units together. Then the roof frame 105 is assembled with the wall frames at the top thereof, and the perimeter beams 106 of the roof frame are welded to upper portions of the cross beams 98 of the wall frames as shown in FIG. 6 to secure the roof frame in place. FIG. 6 is a fragmentary view of a portion of wall frame 92 with adjoining portions of the floor frame 80 and the roof frame 105.

Before the roof, floor and wall frames are welded together, they may be covered with sheathing of the type shown in FIG. 6. Thus, a wooden panel 112 may be secured to the cross beams 84 as with metal screws. Panels 114 and 116 of gypsum board may be secured to the wall frame 92 and the other wall frames with screws 118 as shown. Composition board 120 may be secured to the outside of wall frames as shown. Roofing material 122 is applied to the roof frame 108 either before assembly or after assembly as desired.

As part of the overall construction process, utilities are constructed in the modules. This includes wiring conduit for electrical service, plumbing pipes for plumbing, and air-conditioning ducts and an air-conditioning unit for heating and cooling purposes. The plumbing is all incorporated in the utility core module 11. Also, the meter panel 130 and distribution box for electrical wiring are also incorporated in the utility core module 11, as well as the air-conditioning unit. Of course, sinks are incorporated in the kitchen and bathrooms, along with cabinets as needed, and various other finishing structures are included in the modules before they are transported to the building site. Then once completed at the factory, the modules are transported on trucks to the building site and lowered into place on the foundation sections shown in FIG. 4 and described previously.

Important structural aspects of the modules and the particular way they are assembled are shown particularly in FIG. 6. As previously mentioned, the individual frames are each prefabricated as a unit and then assembled together and welded. The sheathing panels 114, 116 and 120 are applied before these frame units are assembled. However, some access should be left to allow welding.

It may be noted that the roof frame 105 and the floor frame 80 both butt against and are welded to the inside face of the wall frames such as frame 92. The perimeter beams 106 and 82 of the roof and floor frames respectively are welded to inwardly facing vertical flanges of the studs 98. Once these welds have been made, the module is rigidized and very strong. With this structure, the wall frames such as 92 rest on the foundation at the bottom and receive the roof at the top. Loads are transmitted directly through the vertical studs 92 to the foundation, and this helps to provide a strong module. The fact that the frames are made entirely with steel members aids strength.

The outside panels 120 extend fully to the bottom of the wall frame, but terminate just short of the top of the wall frame. Thus, a welder working outside the module has access to the perimeter beam 106 and the studs 98 to weld the perimeter beam and studs together as with

a spot welder. The inside panels 114 and 116 terminate at or just short of the roof frame and the floor frame. Since the studs 98 are covered by panel 120 outside the perimeter beam 82, welds should be made at the inside face of the perimeter beam 82 to fasten the perimeter beam to the studs. This can be done under the floor frame 80. Although only one wall of the module is shown in FIG. 6, it will be understood that the other walls in all modules are constructed in the same way.

Thus, the invention provides a modular home and a method of constructing the same, which home has good architectural qualities and yet can be constructed economically on a mass production basis. Each of the assembly and welding steps described in connection with the construction of the module can be arranged at spaced stations on a mass production line to speed construction of the modules and make efficient use of labor. The particular structure of the frames aids mass production and affords great structural strength. Very little work is done at the building site other than laying the foundation and assembling the modules. Modules can be stacked vertically if desired.

The J-plan comprised of three modules is a base plan which affords not just one house model but as many as fifty models. For example, the number of bedrooms in the bedroom module can be varied, the dimensions of the modules can be varied, carport and patio space can be added, and other variations are possible. Thus, the modular building and method have considerable flexibility.

Having thus described our invention, we claim:

1. A modular room unit for a building comprising a horizontal ceiling frame and a horizontal floor frame, each having a perimeter provided by rigidly interconnected channel beams, each with a vertical wall and top and bottom flanges projecting laterally inward from said vertical wall, each of said horizontal frames also having cross beams extending between an opposite pair of said perimeter beams and having their opposite ends received snugly in the respective channels of the perimeter beams, resting on the latters' bottom flanges, and welded to the perimeter beams at said channels; and vertical wall frames extending up from said floor frame to said ceiling frame at the outside of the pe-

rimeter beams on the latter, each of said wall frames having top and bottom channel beams and vertical cross beams extending between said top and bottom channel beams, said top channel beam having a horizontal top wall and vertical flanges extending down from said top wall at the laterally outward and inward edges of the latter to provide a downwardly-facing channel along the length of said top beam, said bottom channel beam having a horizontal bottom wall and vertical flanges extending up from said bottom wall at the latter's laterally outward and inward edges to provide an upwardly-facing channel along the length of said bottom beam, said vertical cross beams having their upper ends received snugly in the downwardly-facing channel of the respective top beam and having their lower ends received snugly in the upwardly-facing channel of the respective bottom beam, resting on the latter's bottom wall, and said vertical cross beams being welded to the respective top and bottom beams at the latter's channels;

said vertical cross beams on the wall frames having transverse flanges at their laterally inward edges; said vertical walls on the perimeter beams of the horizontal frames extending substantially contiguous to said last-mentioned flanges on the vertical cross beams of the adjoining wall frames vertically beyond the respective downwardly-facing and upwardly-facing channels of the top and bottom channel beams thereof and being welded directly to said transverse flanges;

and an outside panel and an inside panel on each wall frame having their respective upper ends spaced below the ceiling frame to permit the adjacent perimeter beam of the ceiling frame to be welded to said transverse flanges on the inside of the vertical cross beams of said wall frame by a worker positioned outside the modular room unit;

said inside panel having its lower end spaced above the floor frame to permit the adjacent perimeter beam of the floor frame to be welded to said transverse flanges on the inside of the vertical cross beams of said wall frame from below the floor frame.

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