

[54] MODULAR HOUSING SYSTEM

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52/220, 52/236
- [51] Int. Cl. E04h 1/04
- [58] Field of Search 52/79, 73, 236, 185,
52/220

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[57] **ABSTRACT**

A modular housing system comprises box-like units of rectangular configuration in stacked relationship, the adjoining units having interfitting utility networks and being provided on common sides with alignable staircase elements and with plumbing devices on the side opposite the staircase elements. Preferably at least some of the units are rectangularly elongated and are formed with decks on one or both ends of the unit. The units each may have a length $L = nW$ where n is an integer (1, 2, 3 . . .) and W is the width of the unit.

6 Claims, 13 Drawing Figures

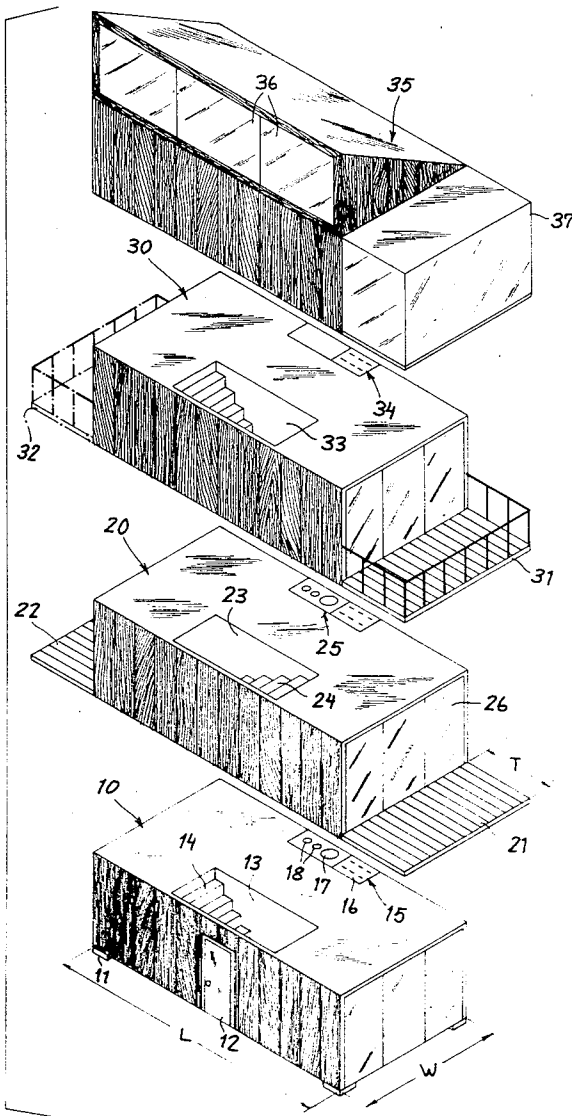
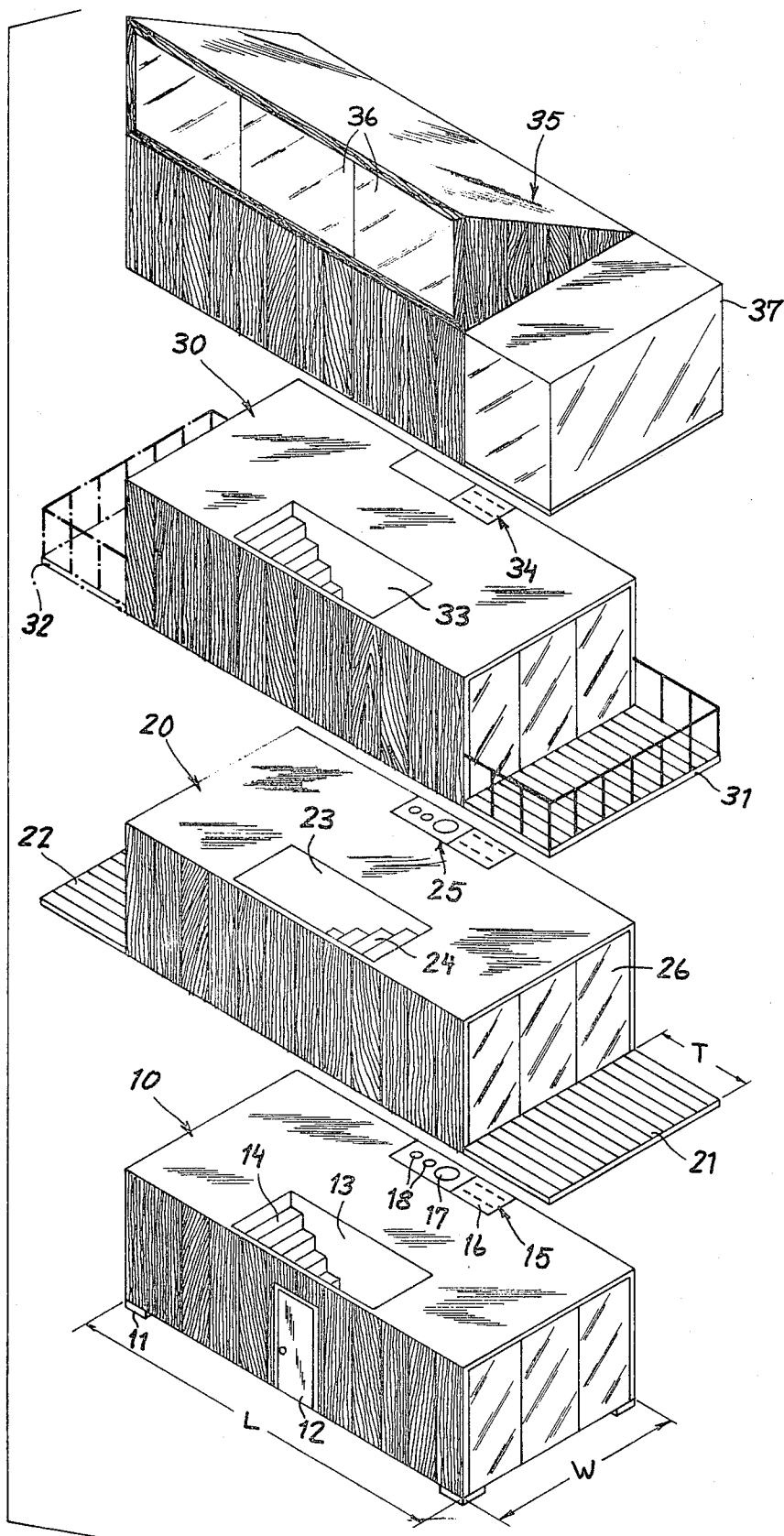


FIG. 1



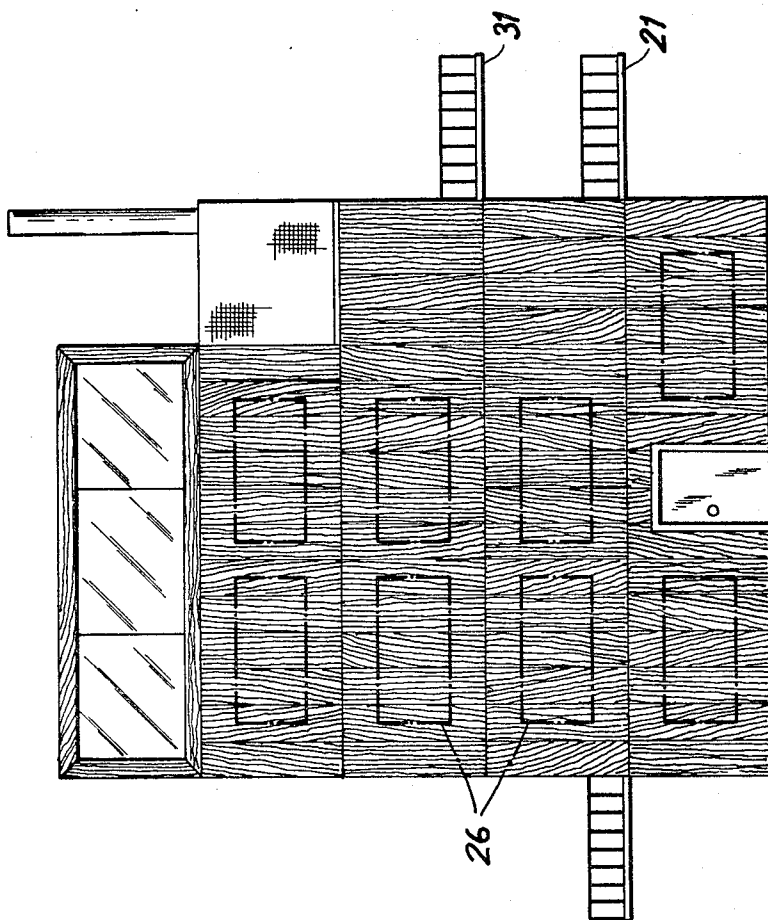


FIG. 2

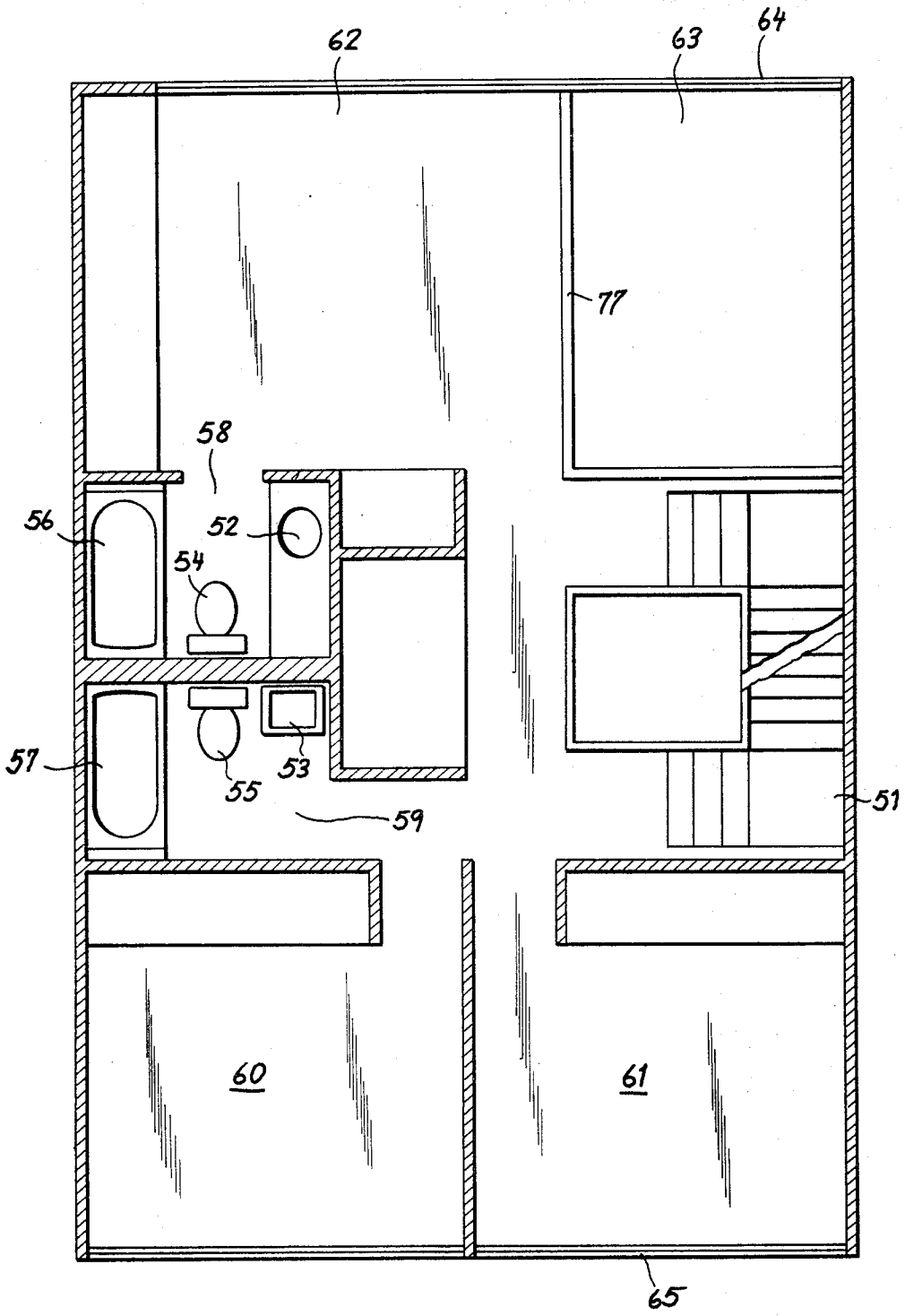
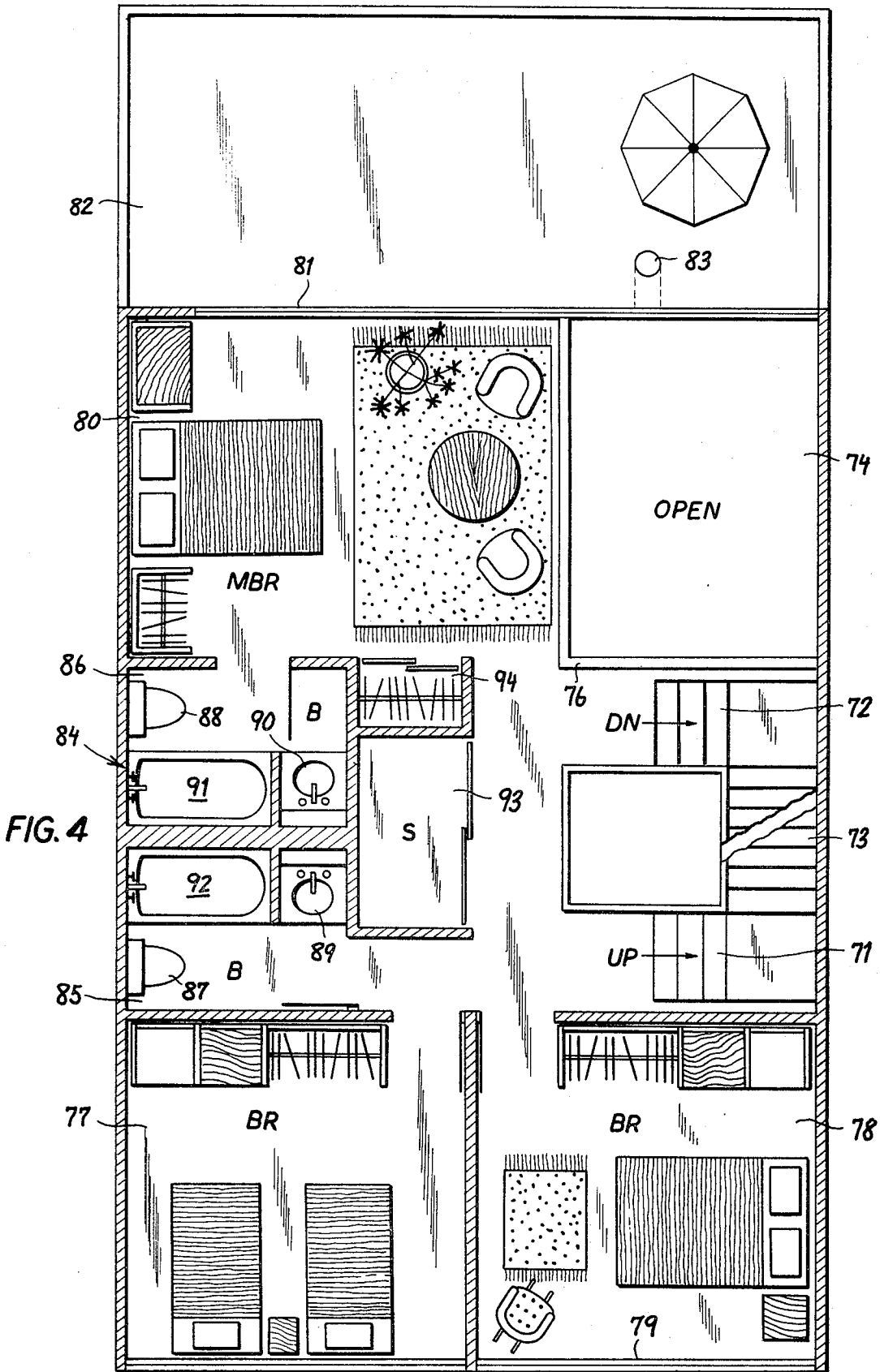


FIG. 3



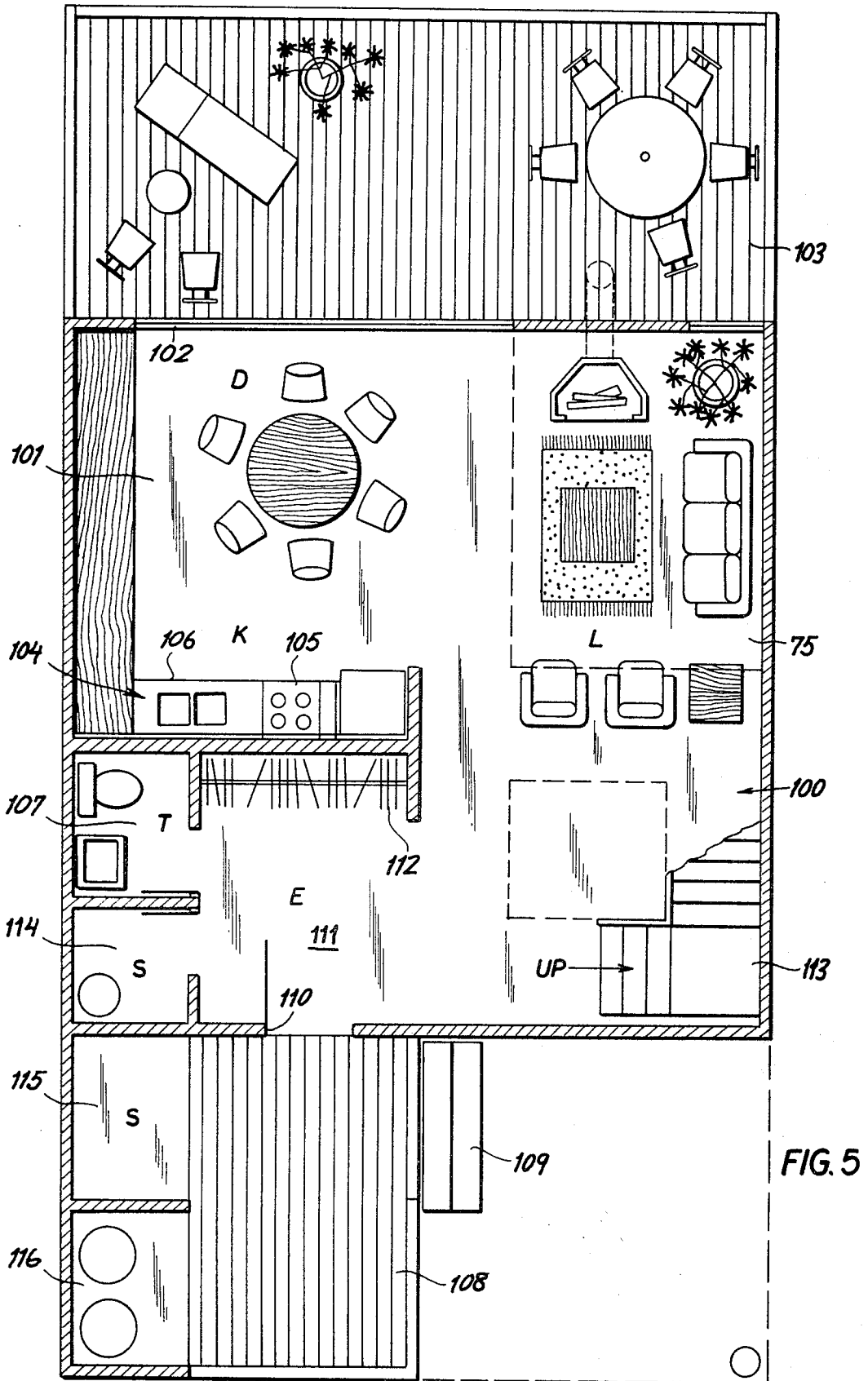
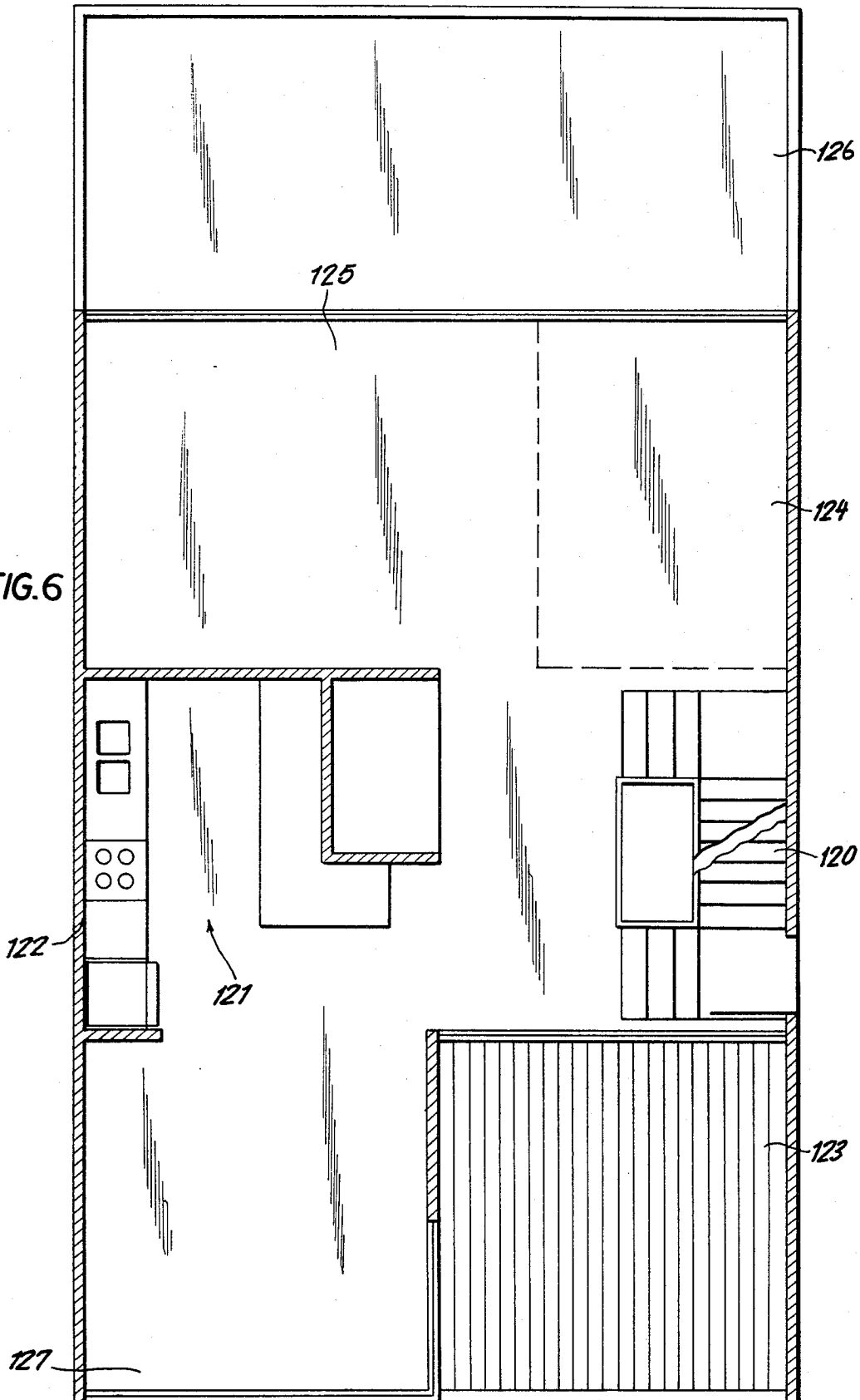


FIG. 5

FIG. 6



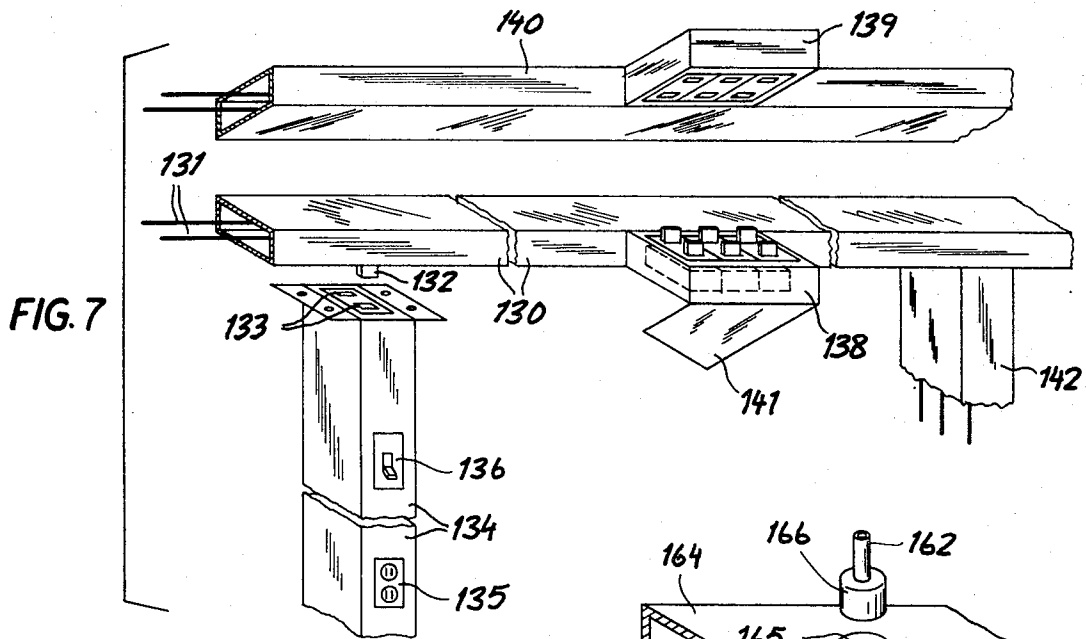


FIG. 7

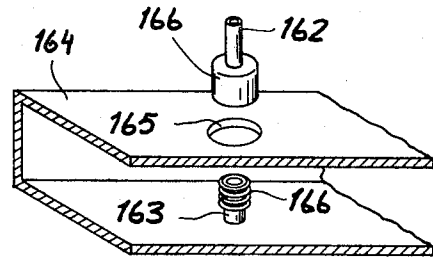


FIG. 10

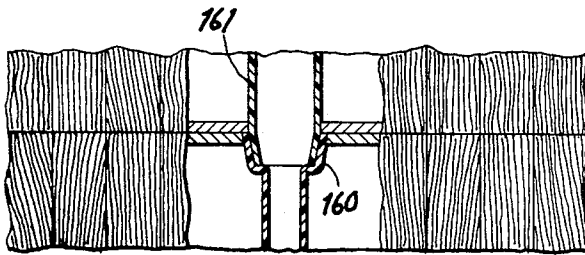


FIG. 9

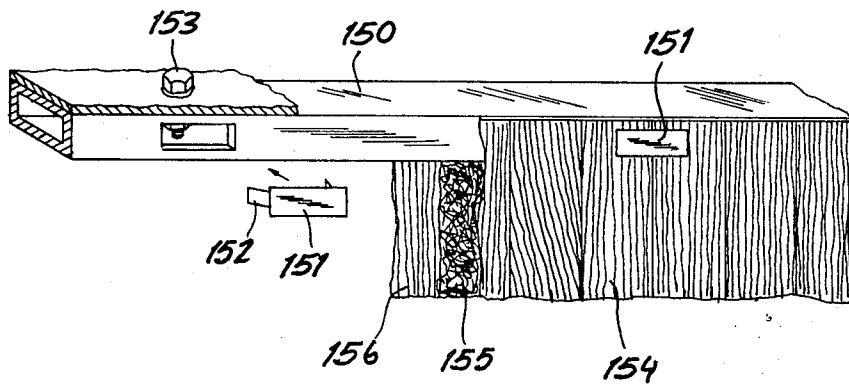


FIG. 8

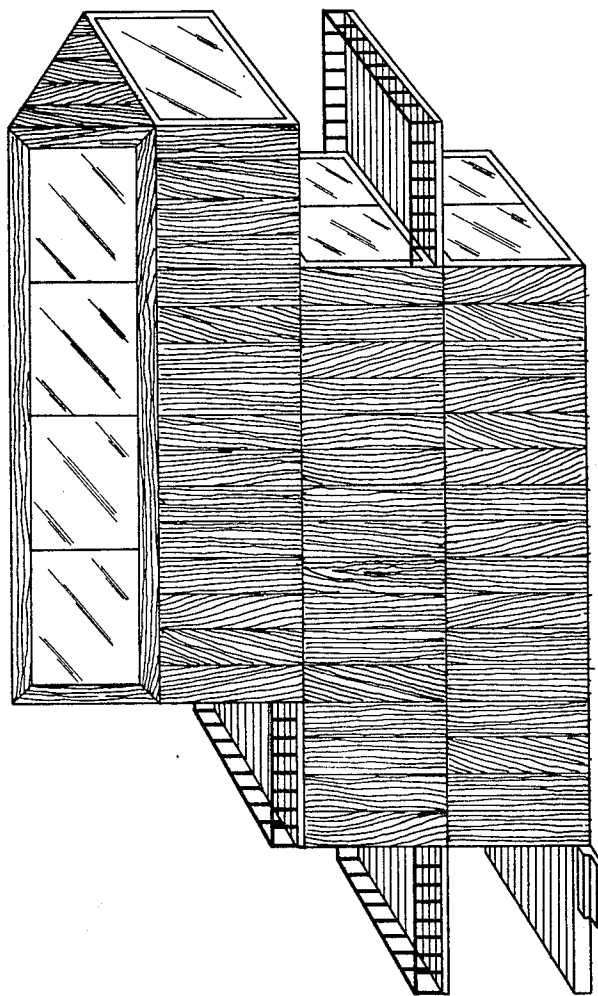
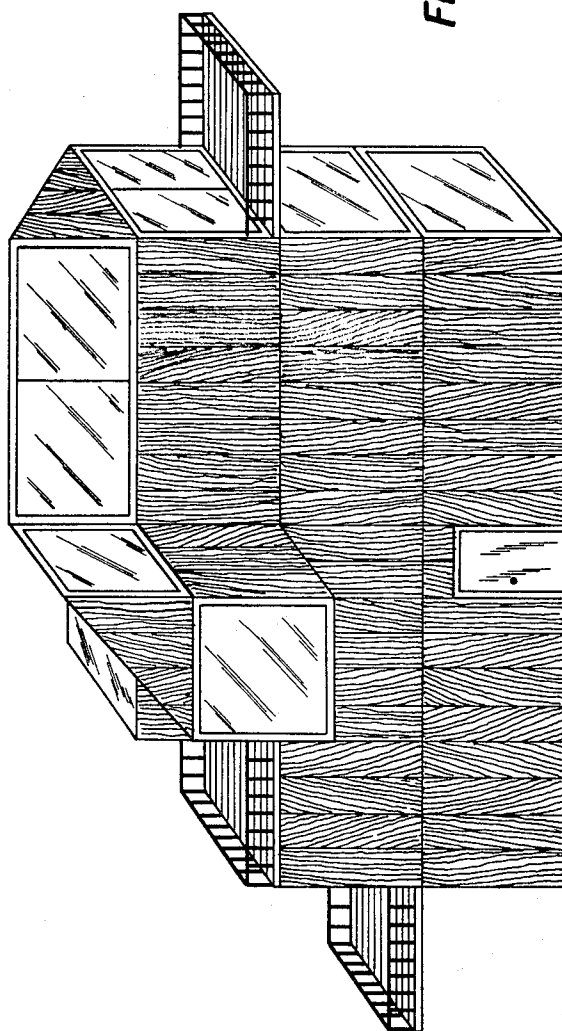


FIG. II

FIG. 12



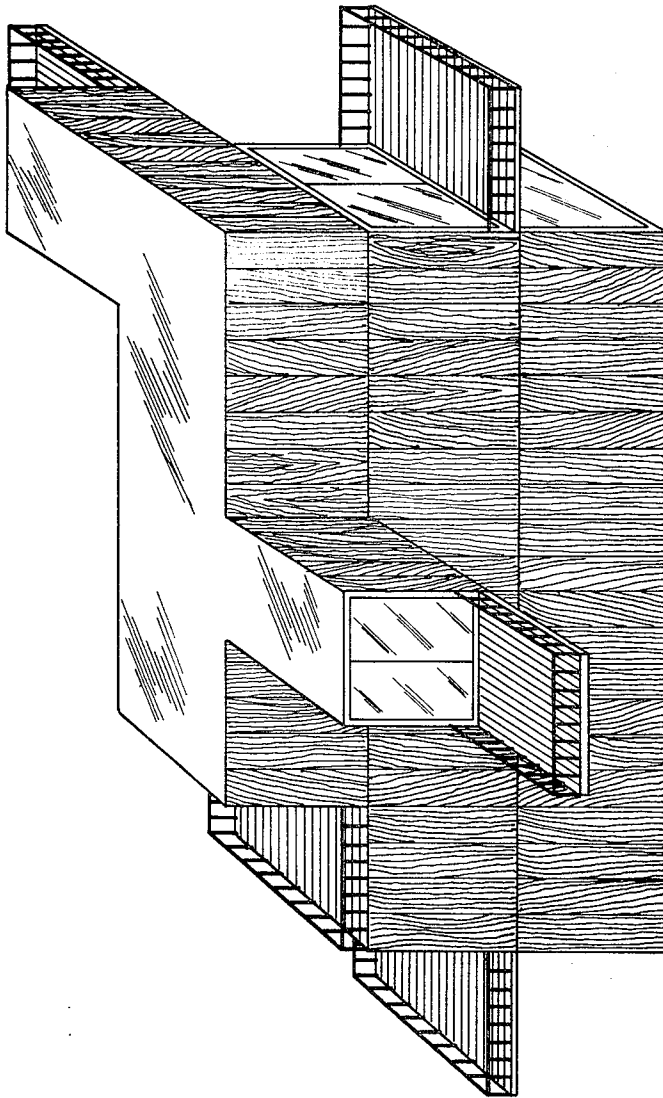


FIG. 13

MODULAR HOUSING SYSTEM

FIELD OF THE INVENTION

My present invention relates to a modular housing system and to a method of erecting the same; more particularly the invention resides in a modular housing unit adapted to be incorporated in individual or grouped structures, especially for year-round living at locations at which labor costs are high and skilled labor is unavailable, and to a system incorporating said unit.

BACKGROUND OF THE INVENTION

There have been, hitherto, numerous approaches to alleviating housing shortages in municipalities and in suburban and rural areas arising from shortages of building materials, large distances between sources of building materials and building sites, shortages of skilled labor, and high labor costs. It has been proposed, for example, to provide prefabricated units or parts thereof, partly or completely manufactured in factories, which can be shipped to a building site and erected on such sites by labor of lesser skill and cost than the labor which would be required for the construction of an equivalent unit on the site. In such prefabrication concepts, for example, wall panels are manufactured at a factory with interior and exterior coverings and are secured together in a preplanned relationship upon a foundation which has been previously set in place at the construction site.

In still other systems, prismatic or block-like units are partially or completely produced at a factory or construction site remote from the eventual building site and are trucked thereto and mounted upon the foundation. Systems of the latter type have increasingly gained attention in recent years because they offer the possibility of rapid erection in urban renewal areas where immediate housing is a problem. In practice, however, the versatility of structures built from such units has been limited and to date little construction has been undertaken using such systems.

Modular systems have also been proposed for replacement of interiors of building shells left after urban-renewal clearance, in the application of mobile-home techniques to permanent structures and in the erection of factories and other industrial installations. The principal lack in all of these systems has been that of versatility inasmuch as one potential home buyer may have requirements quite different from those of another and may need more or less room, fewer or greater utility facilities etc. Furthermore, systems in which modular arrangements contribute to a homogeneous community are few; simple block arrangements are unacceptable to some but desirable to others and the varied demands for large or small living space cannot be satisfied by existing arrangements.

OBJECTS OF THE INVENTION

It is the principal object of the present invention to provide a method of and/or a system for the economical construction of housing units of high versatility, low cost and adaptability to various economic, social and cultural circumstances.

Yet another object of this invention is to provide a modular housing system which is adapted to accommodate wide-ranging consumer needs and yet can be economically erected so as to keep the housing cost relatively low.

Still another object of the invention is to provide a modular housing system which is esthetic and permits expandable housing to suit the needs of the growing family or to accommodate other requirements of the user, without interfering with community disposition of the buildings and other community needs.

SUMMARY OF THE INVENTION

These objects and others which will become apparent hereinafter are attained, in accordance with the present invention, with a modular building system in which at least four basic rectangular parallelepipedal units are employed in stacked relationship. Each of the rectangularly elongated units, according to the present invention, may be provided at each or one end with a deck extending beyond the roof structure of the unit and is likewise provided substantially midway along the length of one rectangular side with a stairwell alignable with the stairwells of the other units when the units are stacked. Along the longitudinal side opposite the stairwell, I provide continuous utility service with interfitting connectors for electrical, waste and water-supply services so that sanitary facilities, e.g. toilets and bathrooms, and kitchen facilities are provided along this side. When one unit is positioned upon the other, quick coupling devices interconnect the electrical, water supply and sanitary conduits.

According to the present invention, each of the units adapted to be positioned below another is provided with an electrical network individual thereto and connector means for the maximum number of networks of the units intended to be disposed thereabove. Among the units intended for use, in accordance with the present invention, are an entry unit which may be the lowest unit of the stack and can be provided with entrance facilities communicating with the stairwell while the opposite wall may be provided with those hydraulic utilities (e.g. bathrooms, laundry, and sink facilities) which may be desired at this lowest level. Of course, in hilly terrains, where the entry is desired at an intermediate level, living units, according to the present invention, may be provided above and below the entry unit.

In more general terms, however, a modular structure, according to the present invention, will include at least one day-living unit whose stairwell, of course, registers with the stairwell of the entry unit there below and whose hydraulic and electrical utilities are connected along the opposite side with the utilities of the underlying unit. This day-living unit preferably has at least one deck of the type mentioned earlier and communicates therewith with transparent walls of the full width of the unit, at least part of the wall being movable or provided with doors. This unit may comprise a living room, den, dining facilities and the like and advantageously includes all of the kitchen facilities which may be required for the dwelling. In other words, this unit will generally have a cooking stove, sink, electrical wiring adapted to accommodate the range, the freezer or refrigerator and all of the other equipment necessary for maximum convenience.

The modular sleeping unit, according to the present invention, may register with the living unit and may be located above or below the latter as previously described. Furthermore, two or more sleeping units may be employed, e.g. in directly stacked relationship or with interposition of a day living unit or entry unit if separation between units of the household is desired.

Preferably, each sleeping unit is provided with bathroom, washroom and/or toilet facilities along the wall opposite its stairwell which, of course, registers with the stairwell of any units thereabove or therebelow. The sleeping units preferably also include at least one cantilevered deck extending from an end of the unit and communicating therewith through an openable portion of a transparent wall.

The final basic unit of the modular housing structure, according to this invention, is a studio unit which may be smaller than the units described above and generally is provided as the topmost unit of the structure, the studio unit being formed with a transparent roof portion preferably inclined to the horizontal. The stairwell of this unit, of course, is provided along one side of the rectangular while any utilities are located along the opposite side in the manner already described.

DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages of the present invention will become more readily apparent from the following description reference being made to the accompanying drawings in which:

FIG. 1 is a diagrammatic exploded perspective view illustrating a structure in accordance with the present invention;

FIG. 2 is an elevational view thereof;

FIG. 3 is a floor plan of the upper or skylight unit according to the present invention;

FIG. 4 is a floor plan of the bedroom unit;

FIG. 5 is a floor plan of the kitchen and utility unit embodying the present invention;

FIG. 6 is a floor plan of another unit;

FIG. 7 is a detail view, partly in perspective and in exploded form, showing the electrical connections between two units in accordance with this invention;

FIG. 8 is a perspective view partly broken away illustrating means for interconnecting two units;

FIG. 9 is a detail view of a waste connection between two stacked units;

FIG. 10 is a detail view showing water-supply connections; and

FIGS. 11 - 13 are perspective views illustrating arrangements of the units according to the invention.

SPECIFIC DESCRIPTION

In the discussion below, reference will be made to many structural elements which are intended to be incorporated in the modular building units of the present invention but which have not been illustrated in detail. For the most part, such structural details are well-known in the art and are not pertinent to the present invention. For example, it is intended to prefabricate all of the modular units to order from a catalog or the like in a factory using assembly-line techniques and providing structural units requiring minimum care. For example, sills and beams may be composed of wood, light metal or synthetic resin and may be covered or colored and textured to resemble woods. These beams simultaneously form ducts or conduits into which the utilities are built. The interior wall facing is preferably paneling in all rooms while the exterior facing may be a permanently colored weather-resistant substance such as aluminum or synthetic resin. Wood may, of course, also be employed. The exterior walls are preferably of sandwich construction on manufacture and may include the inner and outer facing members spaced

apart by a frame forming the studs and beams or sills and filled with an insulating material such as fiberglass or mineral wool. Other suitable fillers, increasing the strength of the walls and effectively transforming them into structural elements rather than mere partitions, are foamed polyurethanes and other synthetic resins, with or without mineral fillers, which span the inner and outer coverings. The floors may be of ceramic or wood tile while permanent, nonpainting ceilings may be provided. All of these techniques have been known heretofore in the construction of prefabricated buildings, mobile homes and partition systems and are intended to be exploited in the system of the present invention as well.

Basically (FIG. 1) a structure embodying the present invention comprises at least three units which are vertically stacked and are interconnected for functional harmony. These units may include an entry unit 10 as diagrammatically shown at the bottom in FIG. 1 which may be provided with fittings 11 enabling the unit to be mounted upon footings or some other suitable foundation. This unit is of rectangular configuration with a width W of, for example, 12 feet while the length L is 24 feet. In other words $L = 2W$ so that in the relationship $L = nW$, $n = 2$. The basic characteristics of the entry unit will be discussed in connection with the floor plan thereof. It should suffice to note that this unit may be provided with feed-in or discharge connection for electrical, telephone, water and waste services, not illustrated in the drawing. For the purposes of the present invention, however, it is important to observe that the entry unit is formed substantially midway along its length with a door 12 communicating with a stairwell 13 rising to the top of the unit and provided with a staircase 14. On the opposite side of the unit, there is provided a utility junction 15 which is subdivided into an electrical connector 16, a waste connection 17 and water connections 18 for hot and cold water supply. The units are all heated electrically so that no special heating connections are required, although both heating and air conditioning ducts may be included in the event central systems are provided therefor. The dimensions given earlier of the unit ensure that each unit can be trucked from the factory to the building site.

Above the entry unit, we provide a kitchen/utility unit 20 which is formed at each end with a deck 21 or 22 projecting by a length T of, say, 6 or 12 feet. In general, this length will correspond to an integral number of unit lengths, another integral number of which defines the width W . The deck may be applied in the factory, may be hinged to the basic unit to facilitate transportation and may be swung downwardly into the horizontal position illustrated upon use. The kitchen or utility unit is adapted to be mounted directly upon the entry unit (see FIG. 7) so that the stairwell 23 of the kitchen/utility unit is lined with the stairwell 13 previously described. Thus one can readily climb by stairs 14 and 24, for example, from one unit to the next. Also directly opposite the stairwell 13, is a utility connector 25 accommodating the opposing connectors of the next higher unit. A plate may be provided to cover these connectors where desired. As in the entry unit, the living unit is not provided with windows but is formed with sliding doors 26 at each extremity as illustrated in FIG. 2, however, windows 26 may be provided.

The bedroom unit 30 (FIG. 1 center) is provided with a single deck 31 but may accommodate yet an-

other deck 32 and has a stairwell 33 aligned with stairwells 13 and 23. Here again, the utility system 34 is formed directly opposite the stairwell midway along the other longitudinal side of the unit.

The uppermost unit (represented at 35) comprises a skylight arrangement 36 opening into a studio room or rooms which may communicate with an enclosed deck or porch 37 as is desired. Since the unit 35 is the uppermost unit of the structure, no utility connectors or the like are exposed at the top. However, the lower utility connectors fit into the upwardly turned connectors of the next lower units.

As is also apparent from FIG. 2, one or more of the tiers may be provided with cantilevered balcony portions or terrace units which may extend longitudinally or laterally from the basic structure. Two such terraces may be provided and, as illustrated for the upper unit, no deck may be provided.

In FIG. 3, I show a floor plan of a typical upper or skylight unit embodying the present invention. From this Figure, it will be apparent that the stairwell 51 of the unit is located at one side of the structure, while all of the hydraulic utilities include wash basins 52 and 53, water closets 54 and 55 and bathtub/shower installations 56, 57 are disposed in two bathrooms 58 and 59 along the opposite longitudinal side of the structure. The rooms 60 and 61 may, of course, be studio rooms, extra bedrooms, office or den space, while a living chamber 62 and possibly a conservatory 63 can be provided at the glass-walled floored end of the structure. A glass-wall rear end 65 is likewise provided. As noted earlier, cantilevered decks may extend from the glass-walled extremities of the structure and the glass walls may be of the movable type to afford access to this deck.

FIG. 4 discloses a suitable bedroom unit according to the present invention in which the up and down staircases 71 and 72 of the stairwell 73 are aligned with the stairwell 51 and lead to the upper level and the next-lower level respectively. An open or cutout corner 74 of this unit may be aligned with a sitting-room section 75 of the next-lower unit to avoid twice the vertical expanse of the sitting room and this expanse may be increased still further by opening a similar portion 63 of the upper level, merely enclosing this portion by the roof which is, of course, provided thereon. In other words, a balcony-like railing 76 may surround the opening in the unit of FIG. 4 (a similar railing being provided at 77 in FIG. 3) to avoid difficulties. The remaining chambers of this unit can include a pair of bedrooms 77 and 78 fronting upon a glass end wall 79 of the unit and, if desired, upon a cantilevered deck, a master bedroom 80 fronting upon a glass wall 81 which may be opened to afford access to the deck 82.

A chimney structure 83 may be mounted along this glass wall upon the deck for alignment with a similar length of chimney in a fireplace structure provided in the next-lower level. In this unit, as in the units already described, the utility portion 84 is located along the longitudinal side opposite the staircase structure 71 - 73. In this case, two bathrooms 85 and 86 have been provided with water-consuming units and waste-disposal units such as water closets 87 and 88, wash basins 89 and 90 and bathtub/shower units 91 and 92. The utility connections are, as previously described, provided with interfitting connections along this side of the structure. In addition to the master bedroom, a

storage closet may be provided at 93 and a clothes closet at 94. The kitchen and utility unit has been illustrated in FIG. 5 and comprises a large enclosure 100 occupying approximately half the length of the basic unit illustrated in FIGS. 3 and 4, and located centrally thereof. This enclosure is subdivided into a dining area 101 whose glass wall 102 opens into a recreation deck and is disposed alongside a sitting area 75 as previously described. The kitchen 104 is provided at the end of the dining area opposite the deck and includes a range and oven 105 whose electrical connections, along with the heating, air conditioning and like ductwork and utility connections are provided along the left-hand wall of the unit. The sink 106 has its water connections, united with the water service for a toilet 107 and disposed along the left-hand wall of the unit. In this embodiment, the kitchen and utility also constitutes the entry unit and a partial deck may be provided at 108 at the opposite end to afford access by steps 109 to the house. A doorway 110 opens into an entry foyer 111, provided with clothes and guest closets 112 and communicating with a stairwell 113 leading up to the next unit. In this arrangement, the stairwell is aligned with the stairwells thereabove. Storage compartments are provided at 114, 115 and 116 as may be desirable. An entry unit may have similar outlines, can be provided with a garage and with other rooms as may prove to be desirable.

Another variant of this type has been represented in FIG. 6 which may be a combined kitchen and entry unit. Here, the stairwell is provided at 120 in alignment with the other stairwell units and waste and water service is located in the kitchen 121 along the opposite wall 122. Entry may be provided at the stairwell unit and a partial deck may be provided at 123. Sitting-room space 124, dining area 125, deck 126 and a further utility or bedroom 127 may be provided as previously described. In all units, I prefer to provide electrical ceiling heating.

In FIG. 7, I have shown somewhat diagrammatically the utility service which may be provided in accordance with the invention. Along the upper left-hand wall of any unit adapted to be surrounded by another unit, may be provided a conduit 130 through which the electric lines 131 run to the several rooms. At each room, a plug-and-jack connection 132, 133, interfitting between the horizontal sills 130 and the vertical studs 134 affords electrical connection between these lines and the electrical units 135 provided in the studs. Any switches 136 which may be required, can likewise be prefabricated in the studs and assembled with the sills to energize them. Substantially midway along the length of the left-hand wall, a connection box 138 is provided for plug-and-jack connection with a box 139 of a bottom sill 140 of an overlying unit. The box 138 of the lowest unit may be provided with a cover 141 which can be opened to expose the circuit breakers for the electrical system. The sill 130 may receive the electrical service through a stud 142. A suitable connecting arrangement for upper and lower units according to the present invention may make use of hollow sills 150 with removable covers 151 held in place by spring clips 152 and possibly provided with or forming electrical outlets or lighting fixtures electrically connected at the clips. When the covers are removed, a nut-and-bolt junction 153 may be provided through aligned bores of the units. The walls of the structure are preferably prefabri-

cated from the sills 150, a covering or interior facing 154 of plywood paneling or some other composition while a filler 155 of a honeycomb, cellular or fibrous insulation of the load-support type is provided between the panel board 154 and an outer facing 156. The unit

In FIGS. 9 and 10, I have shown two connecting systems used in accordance with the present invention for the wastelines and water service, respectively. The former includes a tapered socket 160 in the lower member into which the tapered mail formation 161 of the upper member tightly fits. These members may be composed of a synthetic resin such as polyvinyl chloride (rigid PVC) and are connected to the drains and wastelines of the upper unit and lower unit respectively, to the lowermost units being coupled to the usual wasteline by a similar fitting. The hot and cold water service may include members 162 and 163 respectively extending downwardly from an upper member and directed upwardly from a lower member which join in a sill 164 provided with openings 165 to clear the conduit. A screw-type union 166 may fix them together. All of these fixtures are located along the wall opposite the stairwell.

FIGS. 11 - 13 illustrate various modifications of assembly of the units.

I claim:

- 1. A modular housing structure, comprising:
 - at least three vertically stacked rectangular parallel-opipedal units, each having a pair of longitudinal sides and a pair of ends, both said ends of at least two of said units being formed as glass walls with at least one of said glass walls being openable, the unit of said one of said glass walls having a cantilever deck projecting from said one of said glass walls at the bottom of the unit thereof, an intermediate one of said units being disposed between an upper one of said units and a lower one of said units
 - means forming a stairwell at an intermediate location along one of the longitudinal sides of each unit, said stairwells of said units being vertically aligned,

the stairwell of said lower unit being open at least at the top thereof, the stairwell of the intermediate unit being open at the top and bottom thereof, the stairwell of the upper unit being open at least at the bottom thereof, each of said intermediate and upper units being formed at an intermediate location along the wall thereof opposite the stairwells with plumbing fixtures requiring waste and water-supply service with the sole plumbing fixtures of said units being deposited in vertical alignment generally opposite said stairwells;

water-supply, waste and electrical service connectors on the longitudinal side of each unit opposite said stairwells coupled with corresponding connectors of a unit stacked thereon, each of said units comprising a floor and a ceiling affixed to the respective longitudinal walls and sides whereby said units may be prefabricated and transferred to a building site for stacking; and

means for connecting said units together.

2. The structure defined in claim 1 wherein one of said units is formed with an opening in its ceiling and a unit disposed thereon is formed with a registering opening in its floor to provide for the opening ceiling unit a living space of substantially twice the height of each unit.

3. The structure defined in claim 2 wherein the length of each unit is approximately $(n \times 6)$ feet and the width of each unit along said sides is $(m \times 6)$ feet and n and m are integers.

4. The structure defined in claim 3 wherein $m = 2$.

5. The structure defined in claim 4 wherein said units include an entry unit provided with means affording access to the structure, a utility unit provided with means affording access to the structure, a utility unit provided with a dining area and kitchen facilities, and a sleeping unit provided with bedroom space and toilet facilities.

6. The structure defined in claim 5, further comprising a top unit formed with a skylight extending substantially the full length thereof.

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