Sept. 22, 1970 P. J. OSTENDORF 3,529,386

MULTI-LEVEL BUILDING

Filed Oct. 31, 1968 2 Sheets-Sheet 1

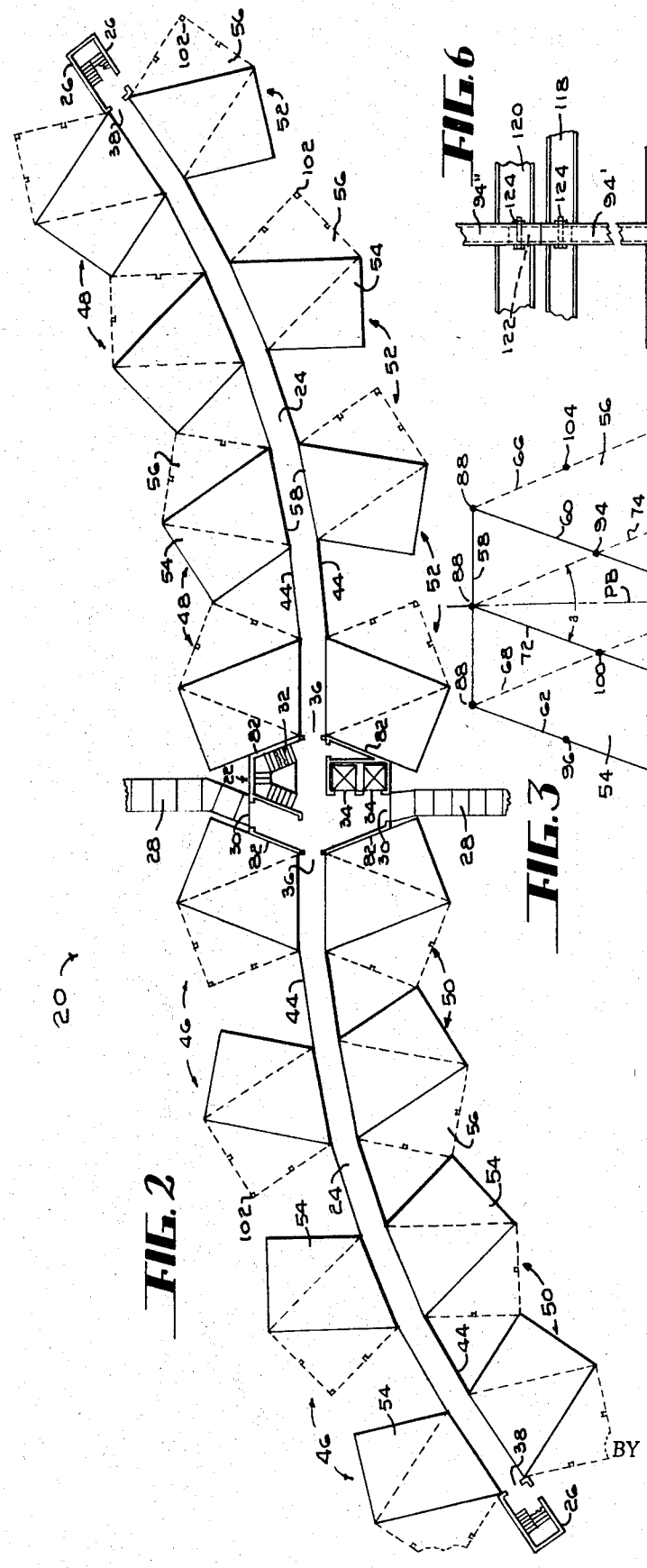


FIG. 2

FIG. 6

FIG. 3

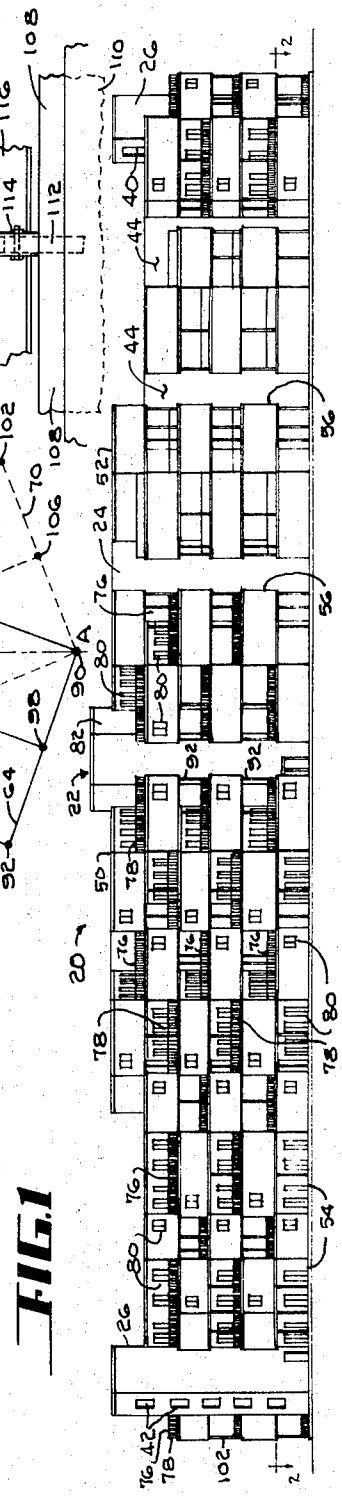


FIG. 1

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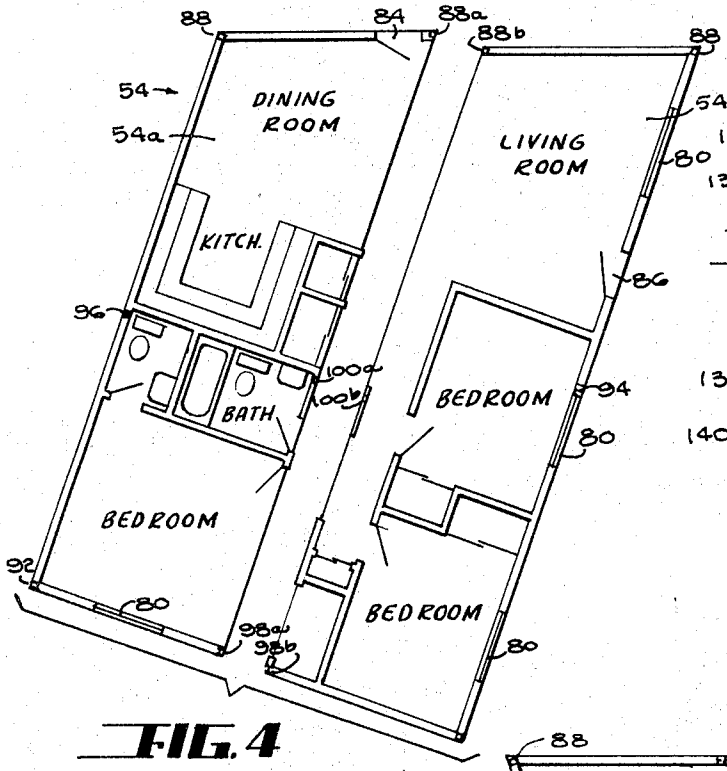


FIG. 4

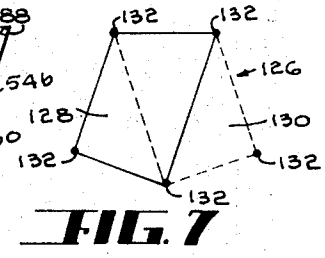


FIG. 7

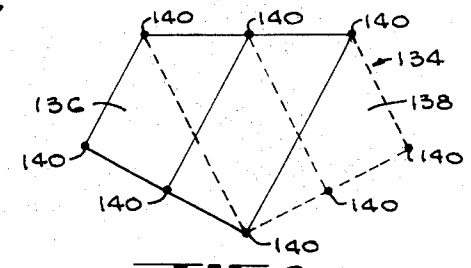


FIG. 8

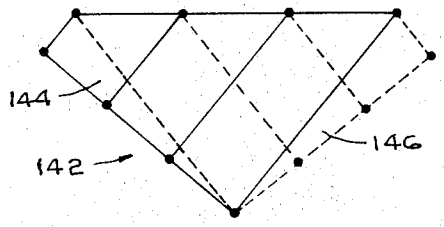


FIG. 9

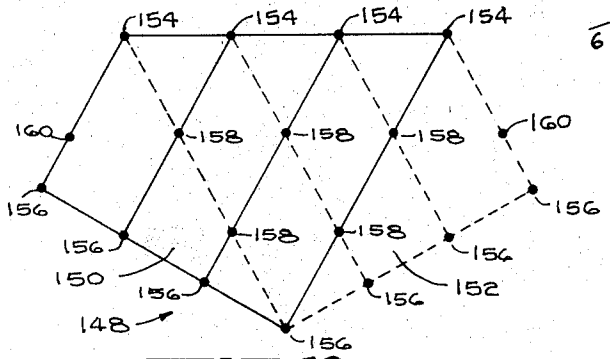


FIG. 10

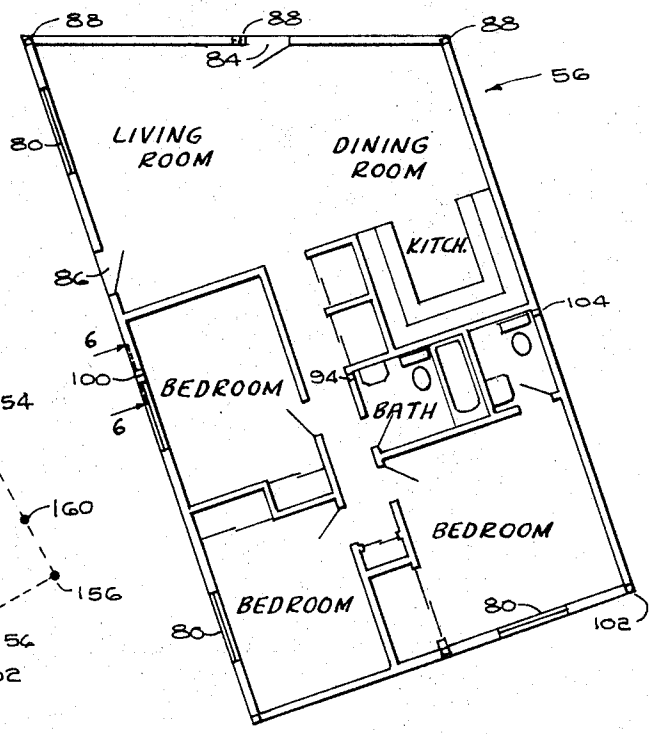


FIG. 5

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3,529,386

MULTI-LEVEL BUILDING

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Int. Cl. E04b 1/04
U.S. Cl. 52—79 19 Claims

ABSTRACT OF THE DISCLOSURE

Several layers of a building are each formed from modules arranged in a stack, the modules of each level having a wall section which is aligned with corresponding wall sections of all the other modules of the stack. The modules of the odd numbered levels are vertically aligned and horizontally coextensive as are the modules of the even numbered levels. The odd and even numbered level modules are angularly offset in plan configuration, the centerlines thereof which pass through the common wall sections intersecting at the midpoints of the common wall sections at an angle of less than 90°. An efficient column support for the several modules in a stack as well as in adjacent stacks and a building structure having plural stacks of modules are described. The modules may be made from one or more sections of transportable dimensions.

This invention relates to a multi-level building and more particularly to a multi-level building of modular construction.

The advantages of constructing buildings from prefabricated modules has long been recognized. Uniformity of quality and low material and labor costs can be obtained by ordinary factory mass production techniques which obviously cannot be obtained in conventional construction. Many of the delays, such as caused by inclement weather, are avoided when the modules are factory built.

Aside from small one-family dwellings such as mobile homes, it is impossible to completely prefabricate larger buildings because of the difficulties encountered in handling and transporting them. Therefore, several proposals have been made for constructing buildings from individual modules, each of which is about the size of a mobile home, the various modules being stacked one upon another or crosswise of one another such as shown, for example, in U.S. Pat. No. 2,154,142, which issued Apr. 11, 1939, to John J. Whelan. Modular constructions suggested in the past suffer from various drawbacks. In some cases the arrangements of the prefabricated modules were so designed that no efficient system of corridors, stairways, elevators and the like could be provided with a resultant high cost that offsets the savings resulting from the prefabrication of the modules. Some suggested constructions have a drab appearance resulting from the similarities of the prefabricated units. In addition to low cost, other features such as an esthetically pleasing structure which is fire resistant, which has adequate natural light and ventilation, and provides privacy between the modular units are important.

It is, accordingly, an object of this invention to provide a building constructed primarily of modules which can be prefabricated and then assembled at a building site in such an array that the building has a pleasing external appearance and otherwise has desirable qualities such as adequate natural light, ventilation, and maximum privacy for the occupants. In accordance with this invention a building is constructed from spaced stacks of modules, each stack of modules having odd and even numbered levels, all of the odd level modules being essentially identical and vertically aligned and angularly offset from all of the

even level modules which also are essentially identical and vertically aligned.

A further object of this invention is to provide a modular building construction in which the modules of one level are "mirror images" of those of another level in plan configuration, the mirrored or reflected image of the latter modules being obtained by rotation of the plan configuration of the first level modules about an axis which passes through the center of a wall section common to both level modules. As will become apparent, this arrangement provides for several advantages including an esthetically pleasing effect which is obtained by using modules of different configurations, but, because the modules are of the same general configuration, economies in the manufacture of the modules are made possible.

Another object of this invention is to provide for column supported modules arranged in a stack with some of the columns supporting all of the modules with a minimum of free standing columns.

Still another object of this invention is to provide a building of modular construction, each module having an unusually large outer wall area providing natural light and ventilation and arranged in an array of modules by which the occupants of each module enjoy privacy from adjacent parts of the building.

A further object of this invention is to provide a building of modular construction capable of inexpensive prefabrication with the modules of each level having private patios or balconies which can easily be enclosed and which contribute significantly to the usable space for each modular area.

Still another object of this invention is to provide a building of modular construction wherein the modules of each level can be constructed from materials and along designs familiar to mobile home manufacturers and the like, techniques used in constructing and erecting the building being familiar to those in the mobile home and in the building construction business.

Other objects and advantages will become apparent from the following description and the drawings in which:

FIG. 1 is a front elevational view with details only partly filled in of a building embodying the concepts of this invention;

FIG. 2 is a schematic plan view showing the first level of the building of FIG. 1 in full lines, as indicated by the arrows 2—2 of FIG. 1, and the modules forming the second level in dotted lines;

FIG. 3 is a plan diagrammatic view illustrating the manner in which two modules of adjacent levels are formed from four module sections and further illustrating the location of vertical support members which may be used in the building of FIGS. 1 and 2;

FIG. 4 is a schematic, exploded plan view of a module of one level of the building of FIGS. 1 and 2 and illustrating the floor plan and column arrangement thereof;

FIG. 5 is a schematic plan view illustrating the floor plan and column arrangement for the module of another level of the building of FIGS. 1 and 2;

FIG. 6 is a cross sectional view, with parts omitted and broken away, of part of the building of FIG. 1, as viewed in the direction of arrows 6—6 of FIG. 5, illustrating portions of the first and second level modules and a portion of the foundations or footings therefor and further illustrating the manner in which vertical supporting members for the buildings are formed; and

FIGS. 7, 8, 9 and 10 are plan diagrammatic views similar to FIG. 3 but illustrating other embodiments of this invention wherein the modules are formed from one, two or three module sections.

Referring to FIGS. 1 and 2, a building constructed in

accordance with the concepts of this invention is generally designated **20** and includes a centrally located service tower **22** from which a pair of elongate oppositely directed corridor systems **24** extend, the corridor systems **24** terminating at a pair of stair towers **26**. Walkways **28** are shown leading up to entries **30** to the lower level of the service tower **22**. The service tower **22** may enclose a stairway **32** as well as elevators **34**. Each level of the service tower **22** is open as indicated at **36** to provide entries to the oppositely directed corridor systems **24**. Similar openings are provided to the stair towers **26** as indicated at **38**. Access to the stair towers **26** may also be obtained from the top of the corridor systems **24** through doors **40**, one of which is shown on the right hand side of FIG. 1. The stair towers **26** may be lighted and ventilated through windows **42** illustrated on the left hand side of FIG. 1. Similar windows (not shown) may be located in the service tower **22**. The service tower **22** and the stair towers **26** may be of conventional construction although, as is well known to those skilled in the art, portions of the towers could be prefabricated. The corridor systems **24** are illustrated as comprising spaced vertical walls **44** which, of course, will be provided with floors for each level, but in practice, especially in warmer climates, the corridor systems **24** may be open walkways or the like. As will become apparent, the corridor systems **24** can be of a conventional construction but preferably would be prefabricated and erected with the rest of the building **20** which is described below.

Along each side of both of the pair of corridor systems **24** are rows of stacks **46**, **48**, **50** and **52** of odd level modules **54** (full lines in FIG. 2) and even level modules **56** (dotted lines in FIG. 2). All of the modules **54** and **56** are polyhedrons having planar floors and roofs and are of a closed, asymmetrical polygonal plan configuration. In particular, the illustrated embodiment of FIGS. 1 and 2 is shown to have modules **54** and **56** of a closed quadrilateral plan configuration. All of the odd level modules **54** are substantially identical, and when stacked in overlying relationship with other modules **54** and **56**, all of the odd level modules **54** are, in plan configuration, vertically aligned and horizontally coextensive. Similarly all of the even level modules **56** are substantially identical and when stacked are vertically aligned and horizontally coextensive in plan configuration. In accordance with this invention, the even level modules **56** are congruent to the odd level modules **54** but angularly offset therefrom when arranged in one of the stacks **46**, **48**, **50** and **52** and have a mirrored or rotated plan configuration as will be more fully discussed below.

Referring to FIG. 3, each module **54** has a first vertical wall section **58**, a second vertical wall section **60**, which at one end joins one end of the first wall section **58** at a corner having an included angle of less than 90°, and a third vertical wall section **62**, parallel to the second wall section **60**, which at one end joins the other end of the first wall section **58** at a corner having an included angle of greater than 90° but less than 180°. The second and third wall sections **60** and **62**, respectively, are joined at their opposite ends by a fourth vertical, outer wall section **64**, which in the illustrated embodiment, joins the second wall section **60** and the third wall section **62** at corners having included angles of 90°. As apparent, therefore, the second wall section **60** is longer than the third wall section **62**. The included angle between the first wall section **58** and the longer second wall section **60** is such that the outer end of the second wall section **60** meets the fourth wall section **64** at a point designated A on the perpendicular bisector, shown by phantom line PB in FIG. 3, of the first wall section **58**. The several wall sections **58**, **60**, **62** and **64** are shown to be of a straight planar configuration which, in plan view, form a right-angled trapezoid, and are shown to meet at sharply defined angles to form the corners of the module **54**. It will be appreciated, however, that the various vertical wall sections could be of constructions other than perfectly straight or planar and the corners could be rounded. Also, the fourth, outer wall section **64** could join the second and third wall sections at angles other than 90° whereupon the modules would have a different trapezoidal or even parallelogram plan configuration.

With continued reference to FIG. 3, the even level module **56** illustrated by dotted lines therein has a first wall section to which the reference character **58** applies because it is vertically aligned with and horizontally coextensive with the first wall section **58** of the odd level module **54**. Projecting from the first wall section **58** of the second level module **56** on the right side thereof is a second wall section **66** one end of which joins one end of the first wall section **58** at a corner having an included angle of greater than 90° but less than 180°. A third wall section **68** of the second level module **56** similarly has one end joining the opposite end of the first wall section **58** but at an included angle of less than 90°. As wiht the illustrated odd level module **54**, the even level module **56** has a fourth wall section **70** which joins the second and third wall sections **66** and **68** thereof at corners having included angles of 90°. The longer, third wall section **68** of the even level module **56** is the same length as the longer, second wall section **60** of the odd level module **54**. Its outer end also joins its adjacent outer wall **70** along the perpendicular bisector PB at the point A. The vertical heights of all of the wall sections of both modules **54** and **56** are the same. Thus, the two modules **54** and **56** have congruent outlines or outer peripheries.

For reasons to be discussed below, a seam line **72** is shown in full lines in FIG. 3 which corresponds to that centerline of the odd level module **54** which intersects the first wall section **58** at its midpoint. A corresponding seam line **74** is shown in dotted lines in FIG. 3 which corresponds to that centerline of the even level module **56** which also bisects the first wall section **58** thereof. It will be observed in the plan view of FIG. 3 that the centerlines at **72** and **74** are angularly offset from one another by an included angle *a*. Similarly the second wall section **66** of the even level module **56** is offset from the second wall section **60** of the odd level module **54** by the same included angle. The same holds true for the third wall sections **62** and **68**. The second wall section **66** of the even level modules **56** are the same length as the third wall sections **62** of the odd level modules **54** and similarly the third wall sections **68** of the even level modules **56** are of the same length as the second wall sections **60** of the odd level modules **54**. As can be seen, therefore, the line PB bisects the angle *a* and the plan configuration of the even level module **56** can be made to coincide with the odd level module by merely rotating the plan configuration of the even level module **56** through 180° about the perpendicular bisector PB.

Several advantages result from the described configuration of the modules **54** and **56** and the manner in which they are stacked. Since the modules **54** and **56** have congruent peripheries, it is apparent that, especially when the modules **54** and **56** are prefabricated, many of the same parts can be used in constructing both sets of modules **54** and **56**. In fact, it should be possible to mass produce both sets of modules **54** and **56** at a cost nearly as low as the cost would be if all of the modules were identically constructed. Because inverted and because of the location of windows, doors, exterior trim and so forth, the modules **54** and **56** are not identical and the drab appearance which results from identical modules is avoided.

The angular offset of odd and even level modules conveniently makes possible patios or balconies **76** (FIG. 1) which may be bounded by protective railings **78**. With reference to FIG. 3, the patio for each even level module **56** is defined by its longest third wall section **68** and by the railings **78** which would be placed along the shorter

third wall section **62** of the odd level module **54** and the end or fourth wall section **64** thereof. Except for the top level modules, all of the patios or balconies **76** have a roof formed by the overhanging floor or the module immediately above. In colder climates these areas could be easily enclosed by glass panels or the like and, in any event, the patio or balcony areas **76** greatly increase the usable floor area of each level at a very low cost.

The specific embodiment of the building **20** illustrated in FIGS. 1 and 2 is intended for use as a multi-family apartment building, office building, hotel or motel or the like and other advantages result from the manner in which the rows of stacks of modules are arranged. The first wall section **58** of all of the modules **54** and **56** are located along the corridor systems **24** and provide convenient access thereto with a minimum of wasted space.

Windows such as those designated **80** in FIG. 1 can be located along the outer or fourth wall sections **64** and **70** and along the longest wall sections **60** and **68** whereupon more than half of the exposed area of each module can conveniently have windows which provide natural light and ventilation. The shorter wall sections **62** and **66** can be closed walls so that, considering the row of stacks **46** as an example, all of the odd level modules in each of the rows of modules **46, 48, 50** and **52** extend at generally the same angle from the corridor systems **24** as each of the other odd level modules in the same row. Accordingly, with the described window arrangement, the windows of one stack of modules do not directly face any windows of any of the other stacks on the same level. Also none of the windows **80** directly face the corridor systems **24** which is important for privacy if the corridor system is windowed or is an open system with walkways. Because of the spaced stack arrangement and also because each module partially overhangs the module immediately therebeneath, only moderate sound proofing need be employed to minimize the sound transmitted from one module to adjacent modules.

The service tower **22** is a six sided structure so that, as shown best in FIG. **2**, the shorter sides of the immediately adjacent modules can be abutted against opposed walls **82** thereof. The corridor systems **24** are shown as extending in a gently arcuate path or S curve which significantly contributes to the esthetically pleasing appearance of the building **20**. One standing in front or behind the building **20** would observe differet horizontal and vertical lines as well as shaded and lighted areas across the entire length thereof. Of course, the construction of the service tower **22** as well as the path of the corridor systems **24** will depend to a considerable extent upon the contour of the land and the amount of available space upon which a building such as the building **20** is constructed.

It may be appreciated that the modules **54** and **56** may be of a variety of constructions such as truss, stress-skin, beam-column or monolithic constructions and that they readily lend themselves to mass production in factories for later erection at a construction site. If the the corridor systems **24** are comprised of vertically spaced walkways, these walkways would be attached in any suitable fashion to the modules.

FIGS. 4 and 5 show the construction of the modules **54** and **56**, respectively, when the building **20** is designed for use as a multi-family dwelling such as an apartment building. As illustrated in FIG. 4, the module **54** may be prefabricated in two sections designated **54***a* and **54***b*. Each section **54***a* and **54***b* has the same width and each is of a width which can practically be transported along the highways for later assembly and erection at a construction site. The module **54** is shown as having a living room, a dining room, a kitchen, bedrooms and baths, as marked, with adjacent hall and storage areas. FIG. 5, which shows the module **56** with the two sections thereof already assembled together, has the same floor plan but in this case each half of the floor plan is "reflected" from the centerline of the FIG. 4 floor plan. Both modules **54** and **56** have doorways **84** to the corridor systems **24** and doorways **86** to the patio or balcony area. Of course, the floor plans can be varied to suit the desires of the builder. As conventional in other constructions, such as mobile homes, I prefer that each module have its own heating and air conditioning system (not shown). Electric and plumbing connections (not shown) can be obtained through the floor of each module, these connections extending along the corridor systems **24** to the service tower **22**.

The room arrangements illustrated in FIGS. 4 and 5 are developed for modules having a width of approximately twenty-four feet, a maximum length of approximately thirty-eight feet and a minimum length of approximately thirty-one feet. Because twelve feet is the present maximum practical width of a prefabricated unit which can be transported on the highways, the overall width of the modules **54** and **56** made from two such sections is limited to twenty-four feet.

Although other constructions are possible as mentioned above, I presently prefer a beam-column construction which is illustrated in FIGS. 3, 4, 5 and 6. For each stack of modules **54** and **56**, there is a set of vertical support members or columns **88** extending vertically along the ends and the center of the aligned first wall sections **58**. The odd level modules **54** are additionally supported by columns **90** and **92** at their outer corners and by intermediate columns **94, 96** and **98** which are located, respectively, centrally of the longer, second wall section **60**, the shorter third wall sections **62** and the outer, fourth wall sections **64**. Further support for the odd level modules **54** is provided by a column **100** passing therethrough which extends centrally of the longer wall sections **68** of the even level modules **56**. The columns **88, 90, 94** and **100** provide support for all of the modules **54** and **56** in a stack. The even level modules **56** are also supported by columns **102, 104** and **106** which are, respectively, along the corner and intermediate the wall sections **66** and **70** which overhang the odd level modules **54**. By virtue of this column arrangement, all of the columns **88, 90, 94** and **100** are enclosed within the walls of the modules throughout their length. Most of the remaining columns **92, 96, 98, 102, 104** and **106** are exposed and free standing along parts of their length as illustrated in FIG. 1, some of these columns being exposed on odd levels and some of these columns being exposed on even levels of the building **20**. The unexposed portions of all the columns are connected in any suitable fashion to the walls and/or beams of each of the modules forming the building **20** whereby each of the modules derives full support from the columns.

Where possible, the outer corners of modules of adjacent stacks are interleaved and the columns associated therewith are interconnected. The interleaving and resultant vertical alignment of the corners of adjacent stacks occurs in the building **20** along the rows of stacks **48** and **50**. The corresponding corners of the stacks **46** and **52** are not vertically aligned because of the convex curvature of the parts of the corridor systems **24** adjacent thereto.

In accordance with this invention, the columns previously discussed are each formed in separate sections, each section having substantially the same height as the modules **54** and **56**. FIG. 6 schematically illustrates the manner in which the column **94** is formed and part of the method by which the modules are erected at a building site. In FIG. 6, a foundation, or footing, **108** is shown laid in the ground, designated **110**. Embedded in the foundation **108** is a vertical mounting pin **112**, the upper end of which projects above the upper surface thereof. A lower end of a column section **94'** formed from hollow rectangular tubing receives the exposed end of the pin **112** and is preferably permanently connected thereto as by a bolt **114**. During assembly of a module **54**, its column

section **94'** will preferably be permanently connected to the adjacent wall section and may be connected by welding to a floor beam **116** and to a roof beam **118** forming part of the module **54**. Means are then provided for interconnecting the column section **94'** with a column section **94''** to which a floor beam **120** and other parts (not shown) of the vertically adjacent even level module **56** are connected. Such means for interconnecting the column sections **94'** and **94''** may be entirely conventional. For purposes of illustration, a connecting pin **122** is shown received within both column sections **94'** and **94''** and connected by bolts **124** thereto. The connecting pin **122** could be fastened to the section **94'** and/or the section **94''** at the factory or at the erection site. The parts of the columns mentioned above which are exposed and freestanding can similarly be interconnected with the unexposed parts of the same columns.

The two module sections **54***a* and **54***b* of FIG. 4 can be joined in various conventional ways which are familiar to mobile home manufacturers. Since conventional, the details and method of joinder are not illustrated or described in detail herein. As illustrated by the column halves **88***a*, **88***b*, **98***a*, **98***b*, **100***a* and **100***b* in FIG. 4, the columns lying on the lines of joinder of the module sections can be constructed in two parts and then fastened together during assembly of the two sections.

The seam lines **72** and **74** represent the lines of joinder of the two sections of each of the modules **54** and **56**. It will be appreciated, however, that the modules could be of different dimensions from that described above and, accordingly, made from either one section or more than two sections. Thus, referring to FIG. 7, a stack of modules generally designated **126** is schematically illustrated. The stack **126** includes a first level module **128** and a second level module **130**, both modules **128** and **130** being of a unitary construction. Thus, the modules **128** and **130** could be completely prefabricated at a factory and transported to an erection site for assembly. As already mentioned, however, the width of the modules **128** and **130** is, as a practical matter, limited to twelve feet. Such a construction in which the stack **126** may simply comprise two levels could be used to advantage in the erection of motels. Because the overall width of each module in FIG. 7 is only twelve feet, no intermediate end columns are required, and the lengths of the modules could be such that no intermediate columns are required along their sides. For this reason, only five columns **132** are shown in FIG. 7.

FIG. 8 shows a stack **134** of modules **136** and **138**, each of which is constructed of two sections similar to the stack shown in FIG. 3. However, the two sections have a shorter length and thus do not require columns intermediate the ends thereof. Thus, provided that the lengths of the modules **136** and **138** are sufficiently short, only the eight columns schematically indicated at **140** would be required.

FIG. 9 shows a stack **142** which is similar to the stack **134** of FIG. 8 but wherein each module **144** and **146** thereof is formed from three sections rather than from two sections.

Finally, FIG. 10 schematically shows a stack **148** of modules **150** and **152**, each of which is comprised of three sections. The stack **148** of FIG. 10 is supported by sets of end columns **154** and **156** as well as intermediate columns **158** which extend vertically along the lines of intersection of each of the sections forming the modules **150** and **152**. In addition, columns **160** are illustrated in FIG. 10 which are intermediate the ends of the shorter sides of both modules **150** and **152**. Because the intermediate columns **158** are only along the lines of intersection of various sections forming the modules **150** and **152**, it will be appreciated by architects and others skilled in the art that floor plans could be developed wherein the columns **158** do not seriously interrupt the floor plans.

The wide variety of buildings which could be constructed in accordance with this invention should be readily apparent. Although the illustrated building **20** is shown as having a single service tower **22** and a spaced pair of stair towers **26**, those skilled in the art will readily appreciate that there could be an intermediate array of service towers and that the service towers need not be centrally located. In more elaborate building complexes, for example, the corridor systems could project in several different directions from one or more service towers. There is no important limitation upon the available widths or lengths of the individual modules. As already described, the modules could be made of one or more sections. These sections could each be of the same widths, as illustrated, or could be of different widths. In summary, the possible types of buildings which may be constructed utilizing the concept of this invention wherein several levels of spaced stacks of modules are angularly offset is nearly limitless.

For practical considerations, the constructional details of the building **20** disclosed herein heve, for the most part, been omitted. Suffice to state that these constructional details can and will depend upon several factors, including climate, building codes and the availability of materials. For this reason the methods of sound proofing, insulation and fire proofing of the parts of the building **20** are not disclosed herein, such methods being fully familiar to those skilled in the art. It is contemplated, for example, that the column sections and means be constructed from steel and protected by gypsum insulating material or the like. The column sections of one module may have different physical properties, such as strength, thickness or formulation of steel, than the column sections of another module on a different level in the same stack.

Having thus described my invention, I claim:

1. A building including plural levels of modules, each module having a closed, geometrical plan configuration with a first wall section and parallel second and third wall sections joined to the opposite ends of said first wall section at included angles of less than 180° and other than 90°, the modules of even numbered levels having vertically aligned corners, and the modules of odd numbered levels having vertically aligned corners, and each said module above the bottom said module overlying the top of the module immediately therebeneath with said first wall section of each module vertically aligned and said second and third wall sections of one module angularly offset from said second and third wall sections of the module immediately therebeneath whereby a portion of each said module above the bottom said module overhangs one of said second or said third wall sections of the module therebeneath.

2. A building including plural levels of modules, each module having a right-angled trapezoidal plan configuration, the modules of even numbered levels having vertically aligned corners, and the modules of odd numbered levels having vertically aligned corners, and each of said module above the bottom said module overlying the top of the module immediately therebeneath and having outer wall sections overhang an edge of the module therebeneath.

3. A building including plural levels of modules in a vertical stack, wherein each said module has a closed polygonal plan configuration, with all said modules having first wall sections vertically aligned and horizontally coextensive, and all said modules of said stack having parallel wall sections joining the opposite ends of said first wall sections thereof at included angles of less than 180° and other than 90°, some of said modules having identical plan configurations, and all others of said modules having identical plan configurations, each of said last mentioned plan configurations being identical to said first mentioned plan configurations but rotated relative thereto through 180° about a horizontal axis extending

perpendicularly through the midpoint of said first wall sections.

4. A building including plural levels of modules in a vertical stack, wherein each module has a right-angled trapezoidal plan configuration, with all said modules having first wall sections vertically aligned and horizontally coextensive, and all said modules of said stack having wall sections joining to the opposite ends of said first wall sections thereof at included angles of less than 180° and other than 90°, some of said modules having identical plan configurations, and all others of said modules having identical plan configurations, each of said last mentioned plan configurations being identical to said first mentioned plan configurations but rotated relative thereto through 180° about a horizontal axis extending perpendicularly through the midpoint of said first wall sections.

5. A building having stacked first and second level modules, said first level module having a closed polygonal plan configuration including a first wall section and a second and third parallel wall sections joining to the opposite ends of said first wall section at included angles of less than 180° and other than 90°, said second level module having a first wall section vertically aligned and horizontally coextensive with said first wall section of said first level module and second and third wall sections joined to the opposite ends of said first wall section, said first wall sections of both said first and second level modules being vertically aligned, and said second level module having a plan configuration which is identical to the plan configuration of said first level module but rotated through 180° about the perpendicular bisector of said aligned first wall sections.

6. A building having stacked first and second level modules, each module having a right-angled trapezoidal plan configuration, said first level module including a first wall section, said second level module having a first wall section vertically aligned and horizontally coextensive with said first wall section of said first level module, and said second level module having a plan configuration which is identical to the plan configuration of said first level module but rotated through 180° about the perpendicular bisector of said aligned first wall sections.

7. A building of modular construction including a first level module and a second level module, said first level module being a closed quadrilateral in plan configuration and having a first vertical wall section with opposite ends, a second vertical wall section having one end joining one of said opposite ends at an included angle of less than 90°, a third vertical wall section parallel to said second wall section and having one end joining the other of said opposite ends at an included angle of greater than 90° and less than 180°, and a fourth vertical wall section joining the outer ends of said second and third wall sections which are remote from said first wall section, said second level module having a periphery congruent to said first level module and having a first wall section vertically aligned and horizontally coextensive with said first wall section of said first level module the plan configuration of said second level module being rotated relatively to the plan configuration of said first level module through 180° about the perpendicular bisector of said aligned first wall sections.

8. A multi-level building including a stack of modules, each said module having a closed polygonal plan configuration including a floor, a roof, a first vertical wall section, and parallel second and third vertical wall sections joined to the opposite ends of said first vertical wall section, the said first vertical wall sections of all modules being vertically aligned and said second and third wall sections of said modules of each level being angularly offset from said second and third vertical wall sections of modules of adjacent levels whereby a portion of each said module above the bottom said module overhangs, one of said second or third wall section of the module therebeneath, each said module having vertical support column sections connected thereto, and said modules being so constructed and stacked that some of said support column sections of each module remote from said first wall sections are vertically aligned and interconnected with said support column sections of others of said modules to form vertical support columns for all levels of said stack of modules.

9. The building of claim 8 wherein at least some of said modules above the first level module overhang a side of a lower level module and wherein the overhanging portion of said some of said modules include vertical support column sections aligned with column sections spaced from said lover level modules.

10. The building of claim 8 further including a second stack of modules adjacent to said first mentioned stack of modules, some of said modules of said second stack having corners vertically aligned with corners of some of said modules of said first mentioned stack of modules.

11. A multi-level building including at least two adjacent stacks of modules, each said module including two module sections joined together, each said module including a first wall section and said first wall sections of all of said modules in each of said stacks being vertically aligned, each said module including a first vertical support column section remote from said first wall section thereof and along the plane of joinder of said module sections thereof and each said module including a second vertical support column section remote from said first wall section thereof along a second wall section thereof, and said modules being so constructed and stacked that said first vertical support column section of each module above the lowest level in each of said stacks is vertically aligned with said second vertical support column section of the immediately lower level module in the same said stack, some of said modules of one of said stacks having corners vertically aligned with corners of some of said modules of the other of said stacks.

12. A multi-level building including at least two spaced stacks of modules arranged in vertical levels, each of said modules having a first vertical wall section and all of the first vertical wall sections in each stack of modules being vertically aligned and each of said modules having parallel second and third wall sections, the second and third wall sections of modules of each vertical level extending from said first wall sections at angles of less than 180° and at angles different from the angles through which the second and third wall sections of vertically adjacent modules extend from said first wall sections whereby each of said stacks of modules includes modules which overhang the sides of said modules of a lower level in the same stack, a plurality of support columns for each of said stacks of modules and some of said modules of each of said stacks being interleaved with said modules of the other of said stacks, the interleaved portions of said modules being supported by a support column for both of said stacks.

13. A multi-level building comprising a utility core including elevators and stairways, corridor systems projecting from said utility core at all levels, a plurality of spaced stacks of modules, each module of each stack having an entry to one of said corridors through a first wall section of each said module, said first wall section of each module being vertically aligned and horizontally conextensive with the corresponding first wall section of all modules of the same stack, each said module having a closed polygonal plan configuration including parallel wall sections joining to the opposite ends of said first wall sections, the plan configuration of all said modules of even numbered levels in each of said stacks being vertically aligned, the plan configuration of all of said modules of odd numbered levels in a stack being also vertically aligned, said parallel wall sections of all said modules of even numbered levels in each of said stacks

being angularly offset from said parellel wall sections of odd numbered levels in the same stack.

14. A multi-level building comprising a utility core including elevators and stairways, corridor systems projecting from said utility core at all levels, a plurality of spaced stacks of modules, each module of each stack having an entry to one of said corridors through a first wall section of each said module, said first wall section of each module being vertically aligned and horizontally coextensive with the corresponding first wall section of all modules of the same stack, each said module having a right-angled trapezoidal plan configuration, the plan configuration of all said modules of even numbered levels in each of said stacks being vertically aligned and angularly offset from said modules of odd numbered levels in the same stack, and the plan configuration of all said modules of odd numbered levels in a stack being also vertically aligned.

15. A multi-level building including corridors at all levels, a plurality of spaced stacks of modules, each module of each stack having an entry to one of said corridors through a first wall section of each said module, said first wall section of each module being vertically aligned and horizontally coextensive with the corresponding first wall section of all modules of the same stack, each said module having a closed polygonal plan configuration including parallel wall sections joining to the opposite ends of said first wall sections, said parallel wall sections of all said modules of a level above the first level in each of said stacks being angularly offset from said parallel wall sections of the module immediately therebeneath in the same stack.

16. The building of claim 15 wherein each module further includes a fourth wall section joining to the ends of said parallel wall sections thereof remote from said first wall section thereof and wherein one end of said fourth wall section of each module above the lowest module in a stack is vertically aligned with the corresponding opposite end of said fourth wall section of the module immediately therebeneath.

17. The building of claim 15 wherein each said module has a plan configuration which is identical to the plan configuration of the said module of an immediately adjacent level in the same stack but rotated relative thereto through 180° about a horizontal axis extending perpendicularly to the midpoint of said first wall sections thereof.

18. A building including at least two modules in a stack, both of said modules having a closed geometrical plan configuration with a first vertical wall section and parallel second and third wall sections joined to the opposite ends of said first wall section, the first wall sections of said modules being vertically aligned and said second and third wall sections of said modules projecting to one side of a vertical plane containing said aligned first wall sections, said parallel second and third wall sections of one of said modules projecting from said aligned first wall sections at included angles different from the included angles by which said second and third wall sections of said other of said modules project from said aligned first wall sections.

19. The building of claim 18 wherein each of said two modules further includes a fourth wall section joining to the ends of said parallel wall sections thereof remote from said first wall section thereof and wherein one end of said fourth wall section of said one of said modules is vertically aligned with the corresponding opposite end of said fourth wall section of said other of said modules.

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JOHN E. MURTAGH, Primary Examiner

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,529,386 Dated September 22, 1970

Inventor(s) Philip J. Ostendorf

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 21, "wiht" should be ---with---.
Column 5, line 4, "or" should be ---of---.
Column 8, line 21, "heve" should be ---have---.
Column 8, line 47, after "each" and before "module" insert ---said---.
Column 8, line 58, after "each" and before "said" delete ---of---.
Column 8, line 61, "overhangs" should be ---overhanging---.
Column 9, line 21, after "and" and before "second" delete ---a---.
Column 10, line 15, "lover" should be ---lower---.
Column 10, line 66, "conextensive" should be ---coextensive---.

SIGNED AND
SEALED
DEC 8 1970

(SEAL)
Attest:

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