United States Patent

Tylius

[15] **3,656,266**

[45] **Apr. 18, 1972**

[54] BUILDINGS

[72] Inventor: **Adolfo Tylius,** Washington, D.C.

[73] Assignee: **Alvic Development Corporation,** Washington, D.C.

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[21] Appl. No.: **35,484**

[52] **U.S. Cl.**.....**52/30,** 52/79, 52/185, 52/236, 52/302

[51] **Int. Cl.**.....**E04f 11/00,** E04f 17/04

[58] **Field of Search**.....52/79, 236, 185, 220, 30, 302

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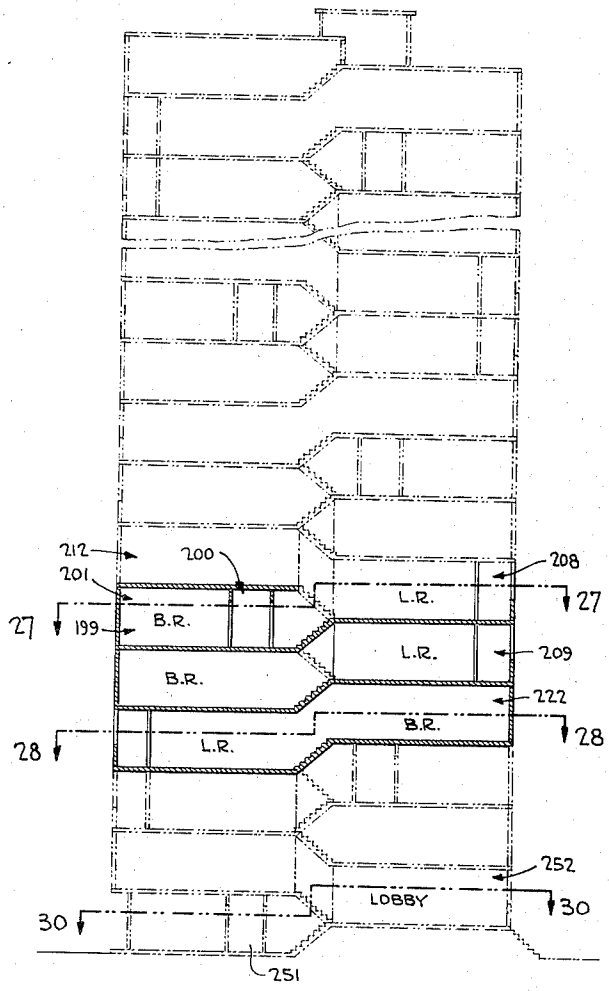
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Primary Examiner—John E. Murtagh
Attorney—Lowe and King

[57] **ABSTRACT**

Townhouse and multi-level buildings are formed by a relatively small number of precast, concrete elements, all of which, except those associated with staircases, are planar. Each building is divided into three sections; two sections are inhabitable while the third section forms a stairwell between the two inhabitable sections. Vertically adjacent inhabitable sections are displaced from each other by one half a story. The stairwell section includes a wall of a vent shaft for plumbing, electrical and heating conduits. In the high rise building, for every 2½ stories, or five inhabitable levels there is a maximum of one party or common corridor. Successive party corridors are horizontally displaced from each other. The third section is topped by a penthouse.

22 Claims, 30 Drawing Figures



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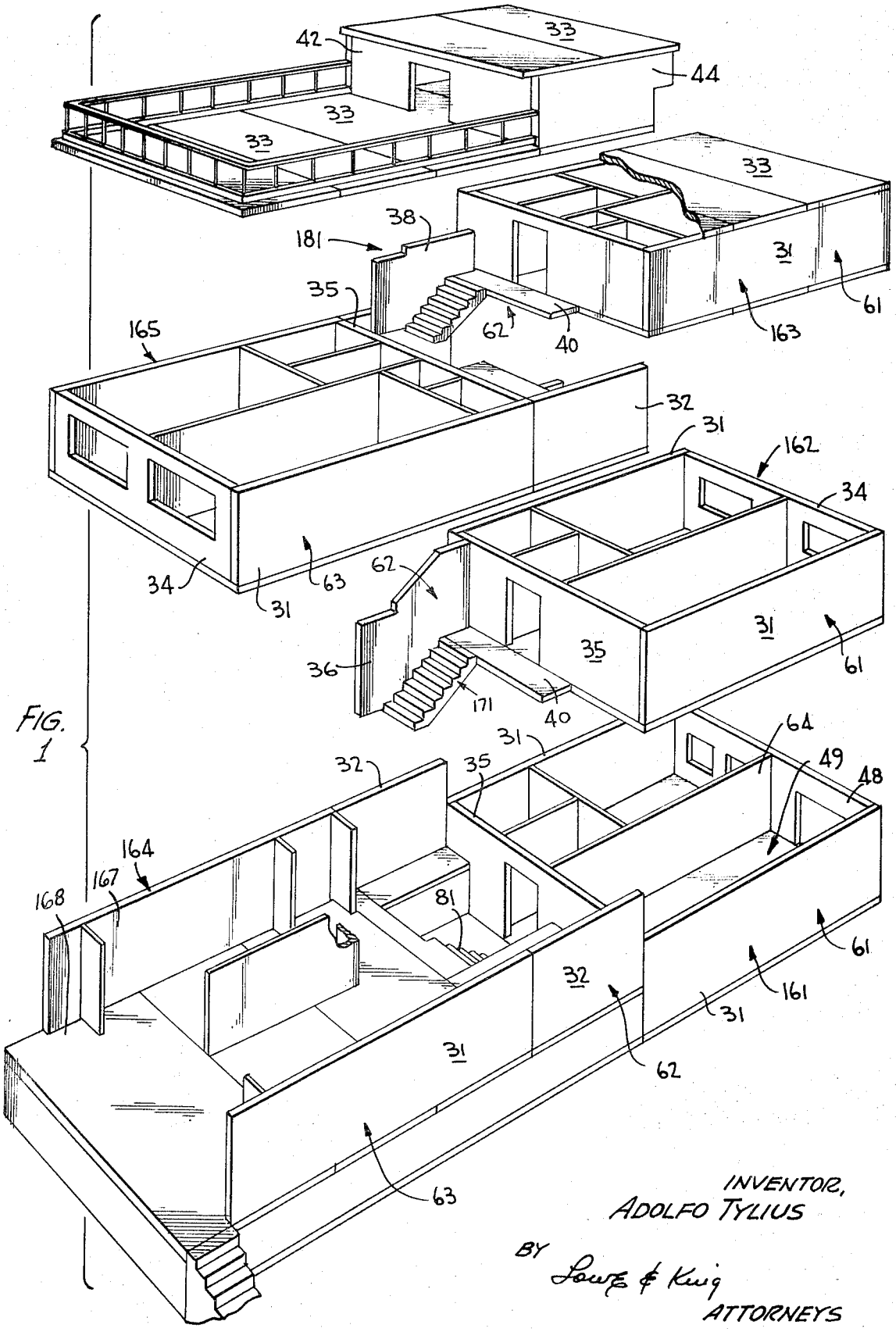
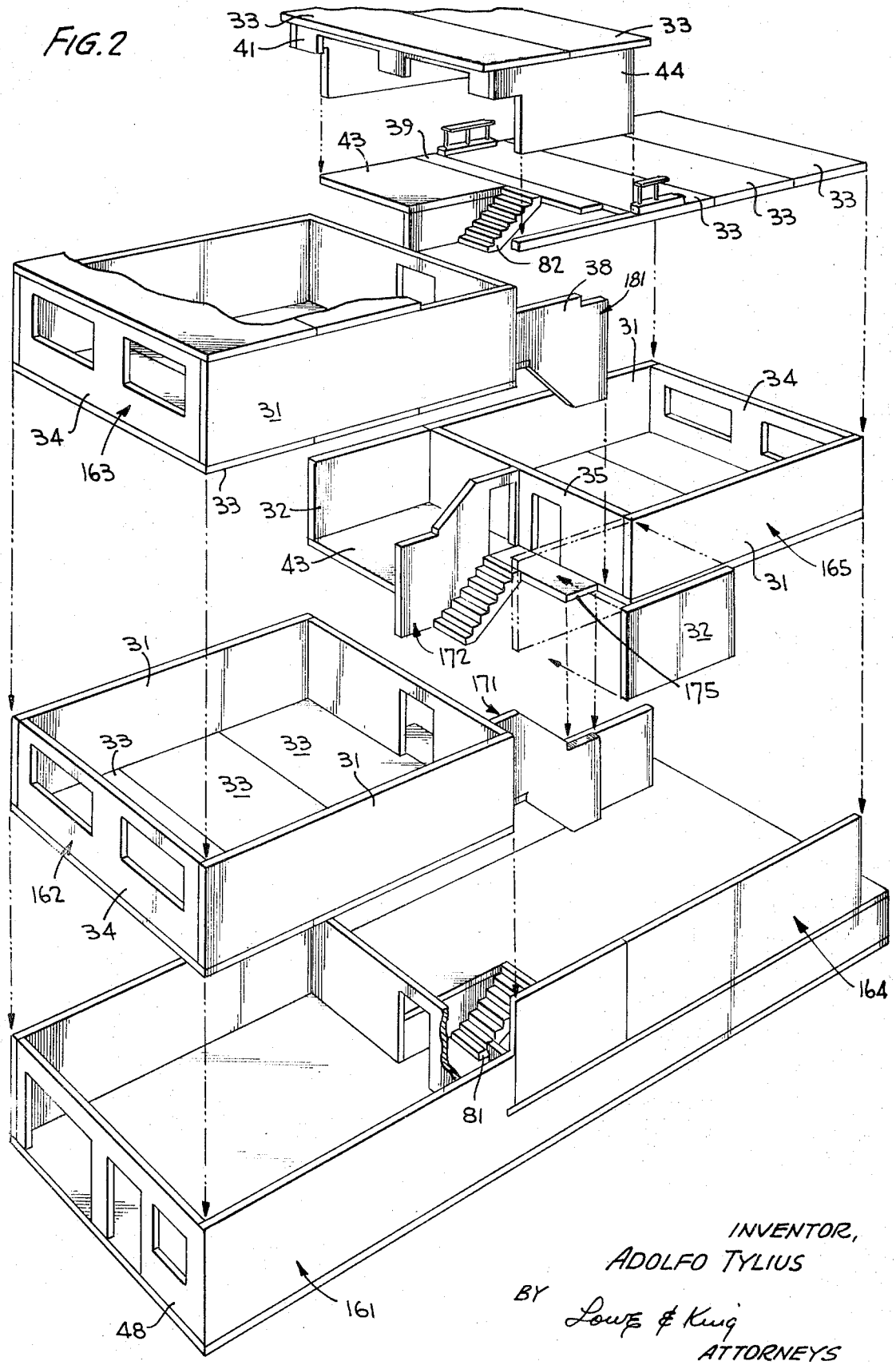


FIG. 1

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FIG. 2



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FIG. 3

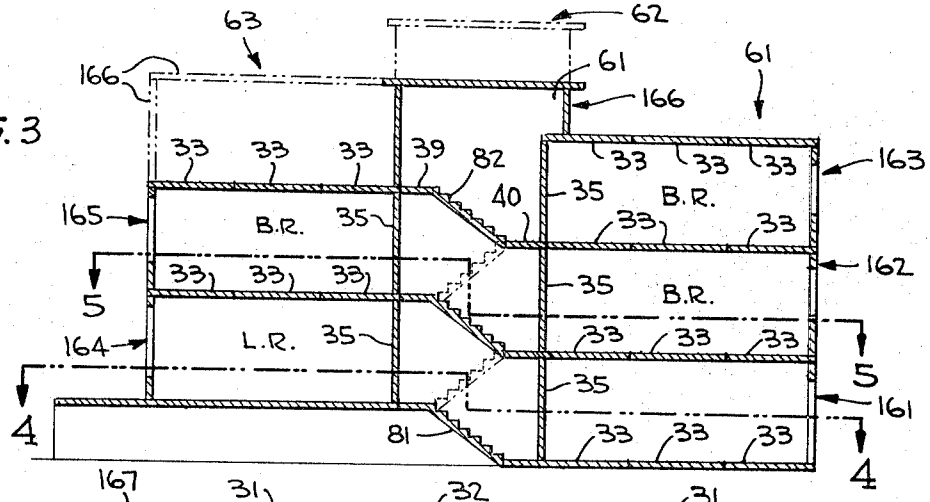


FIG. 4

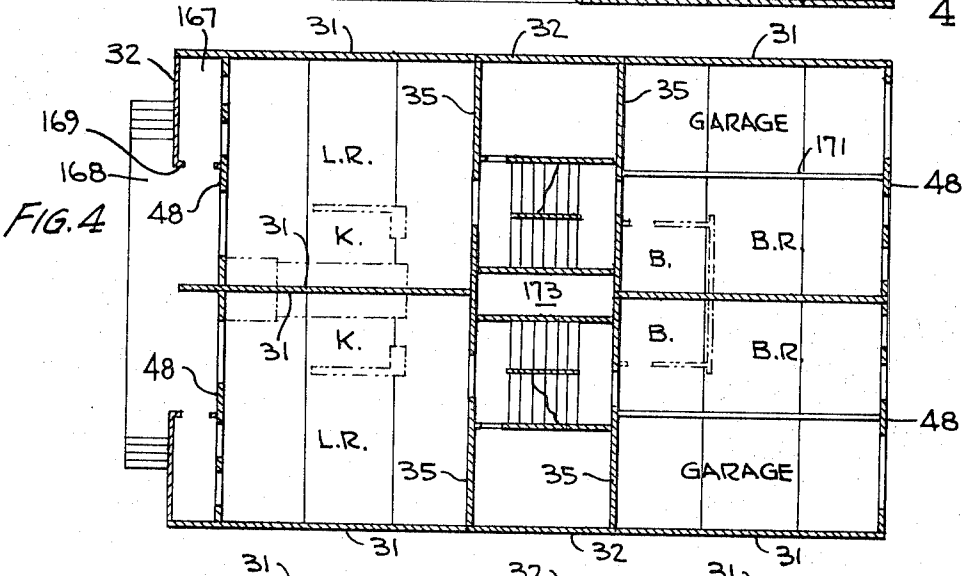
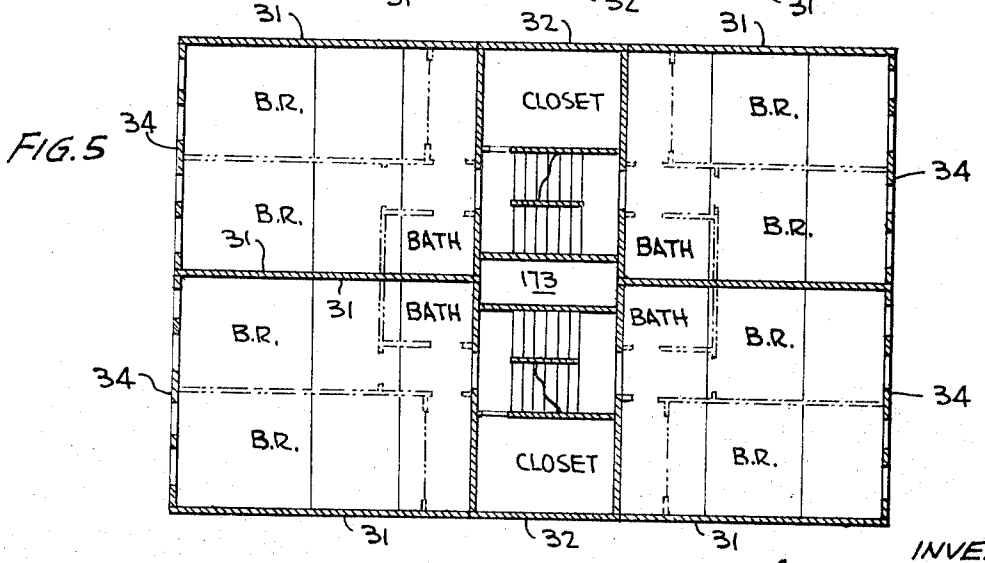


FIG. 5



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FIG. 6

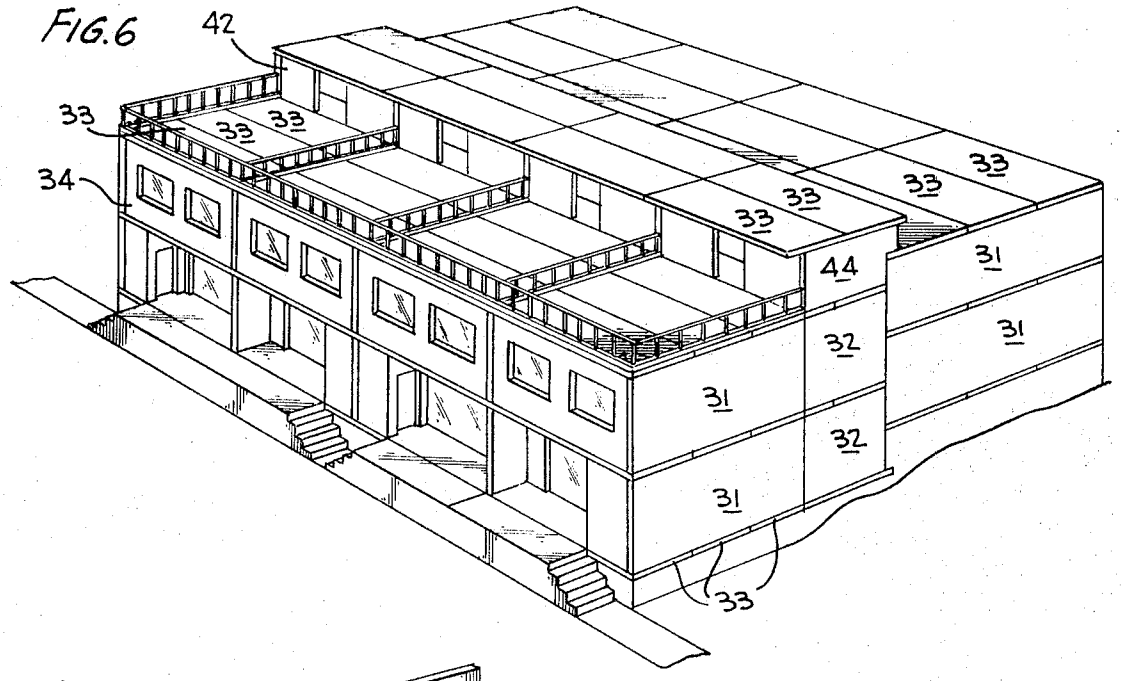


FIG. 7

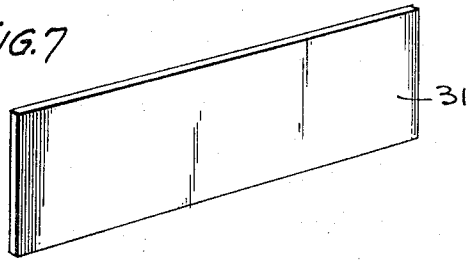


FIG. 8

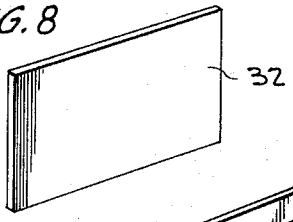


FIG. 9

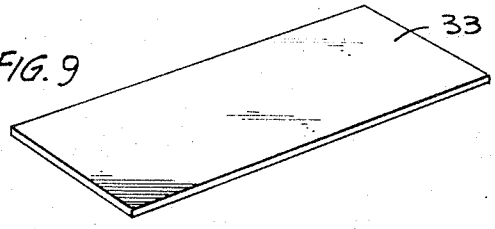


FIG. 10

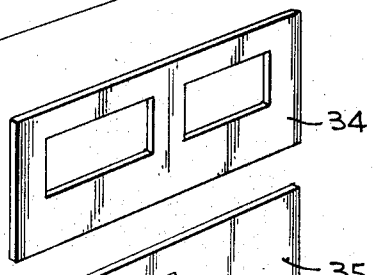


FIG. 11

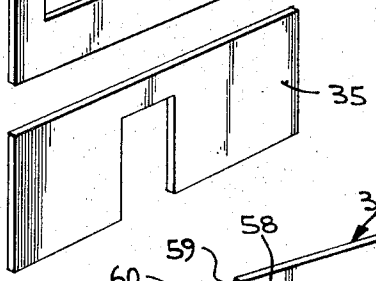


FIG. 12

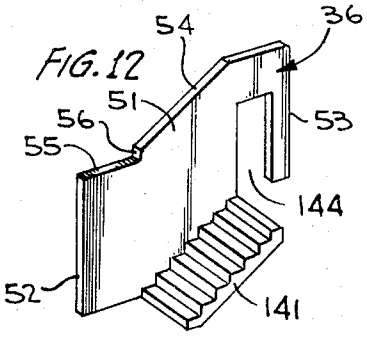


FIG. 13

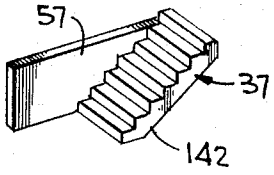
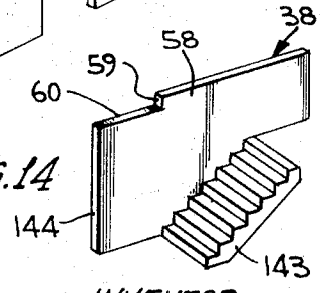


FIG. 14



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FIG. 15

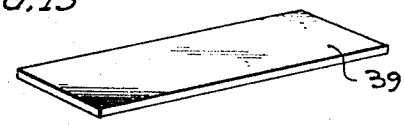


FIG. 16



FIG. 17

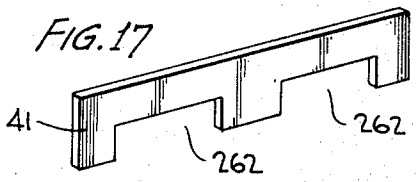


FIG. 18

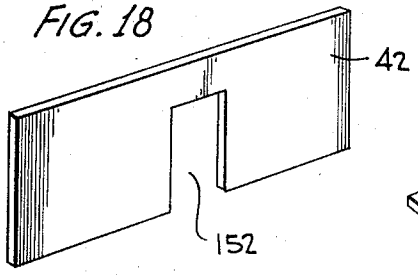


FIG. 19

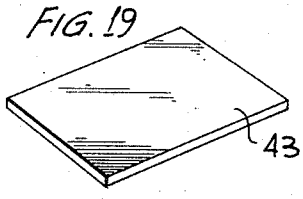


FIG. 20

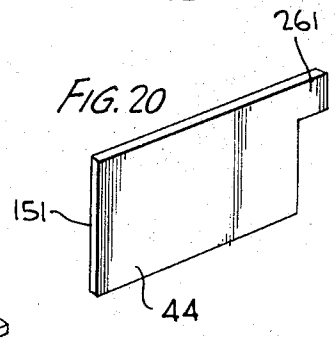


FIG. 21

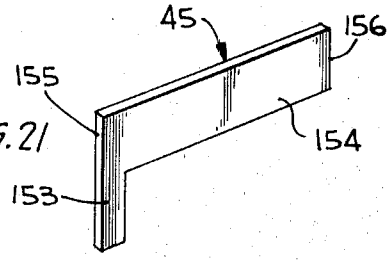


FIG. 22

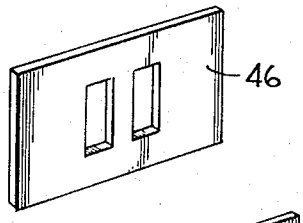


FIG. 23

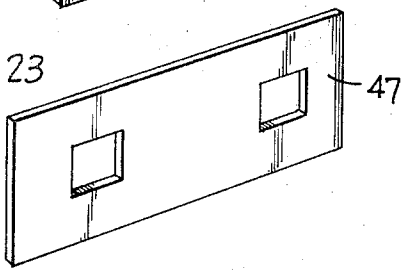


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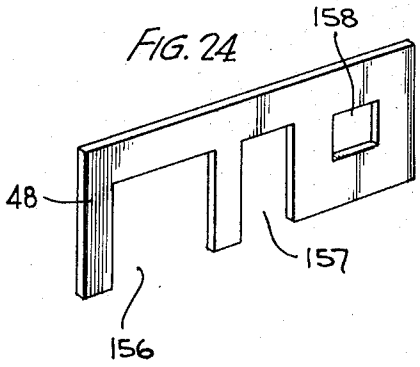
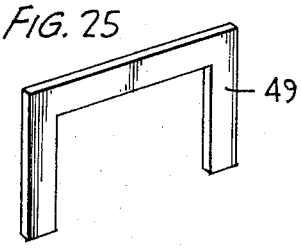


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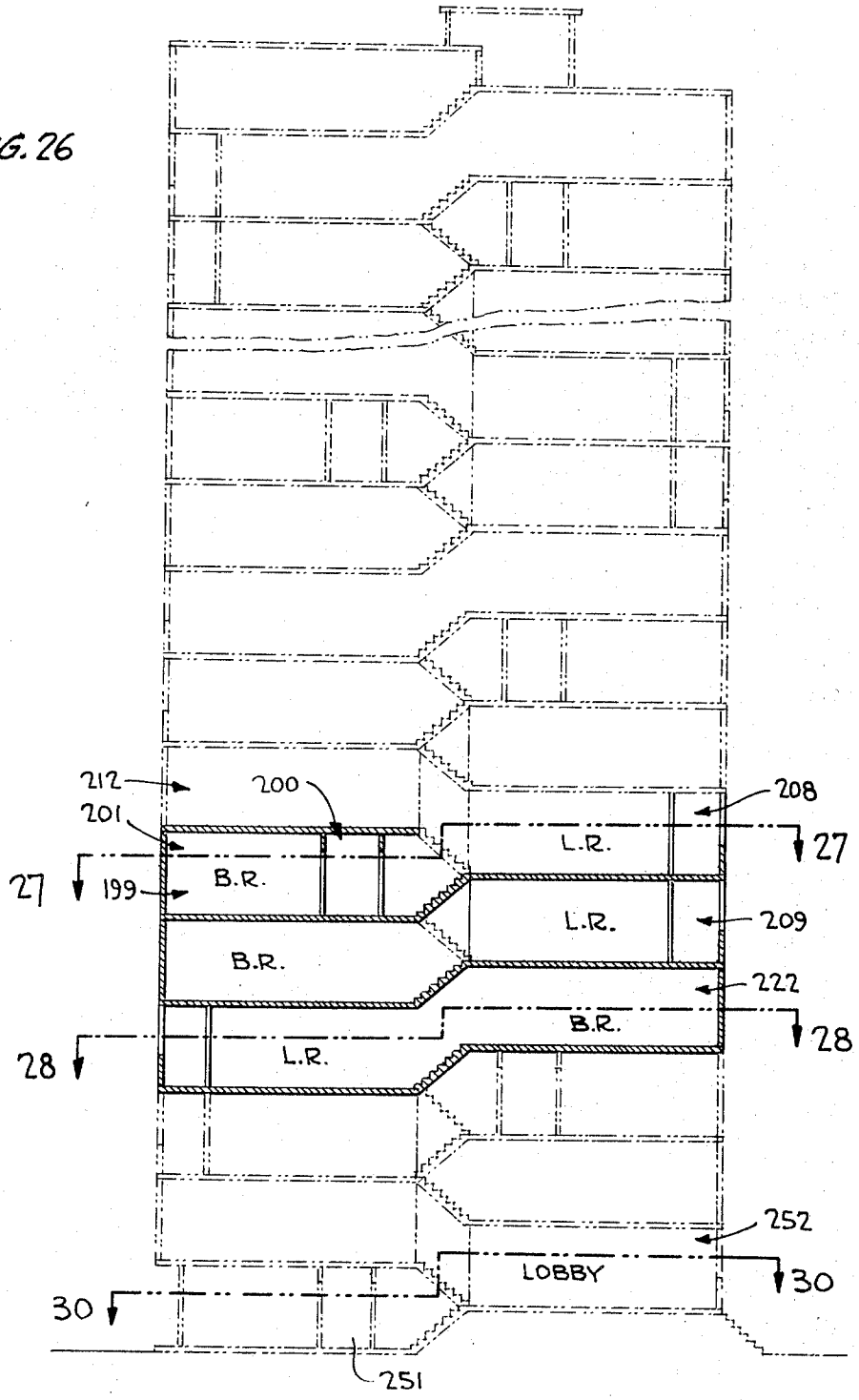


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FIG. 26



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FIG. 27

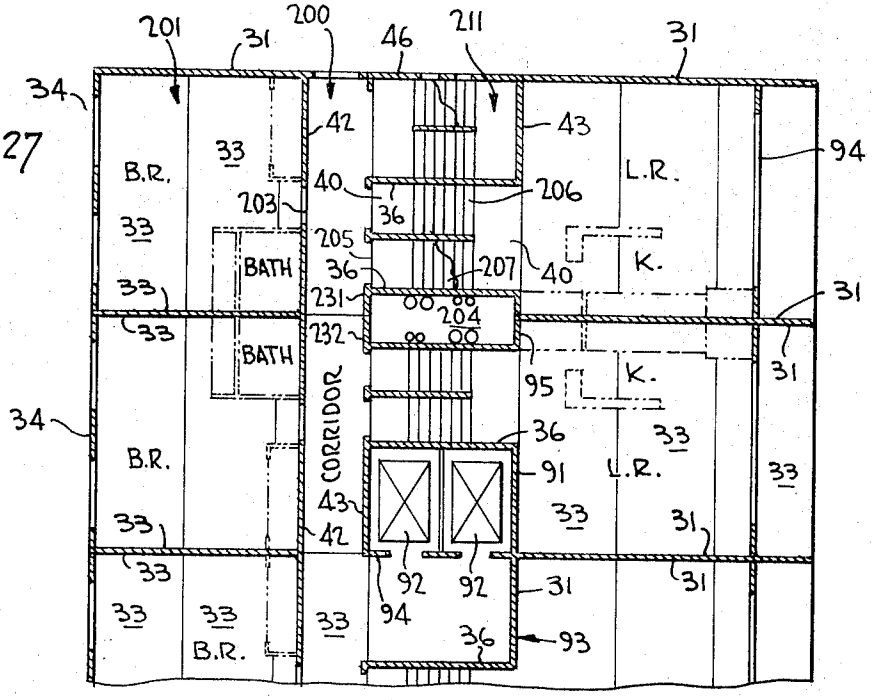
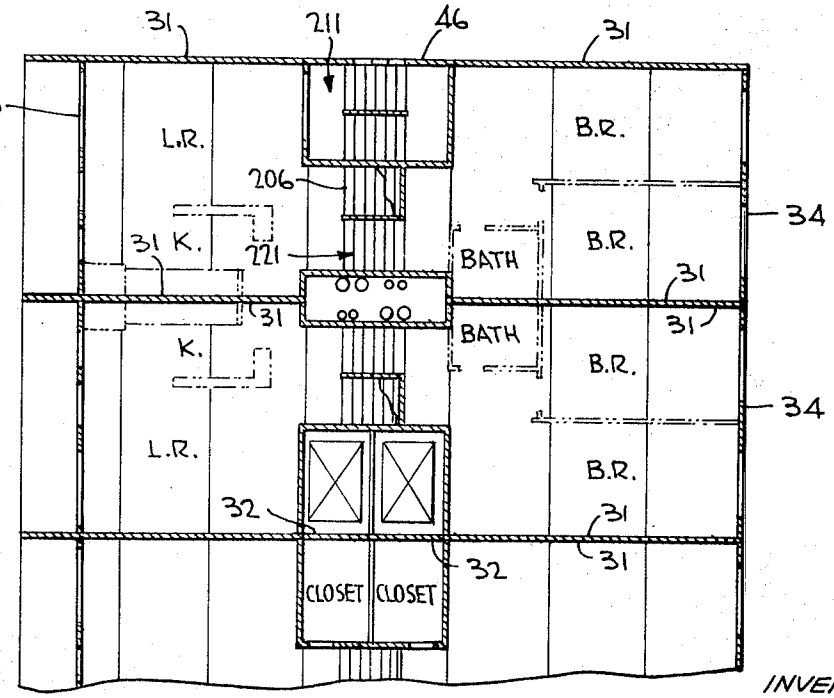


FIG. 28



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FIG. 29

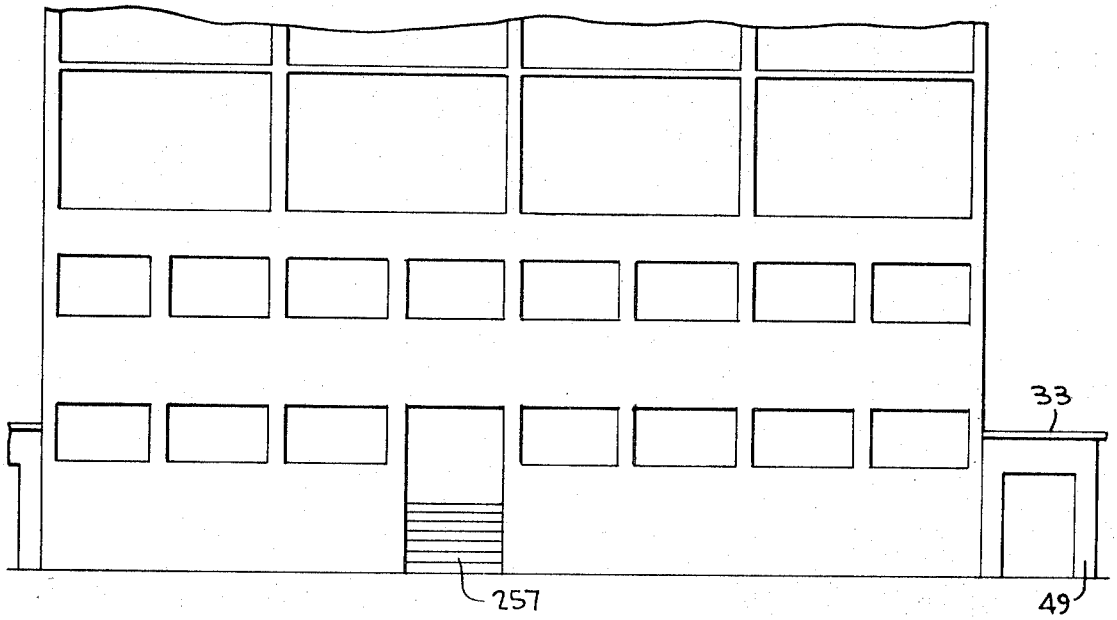
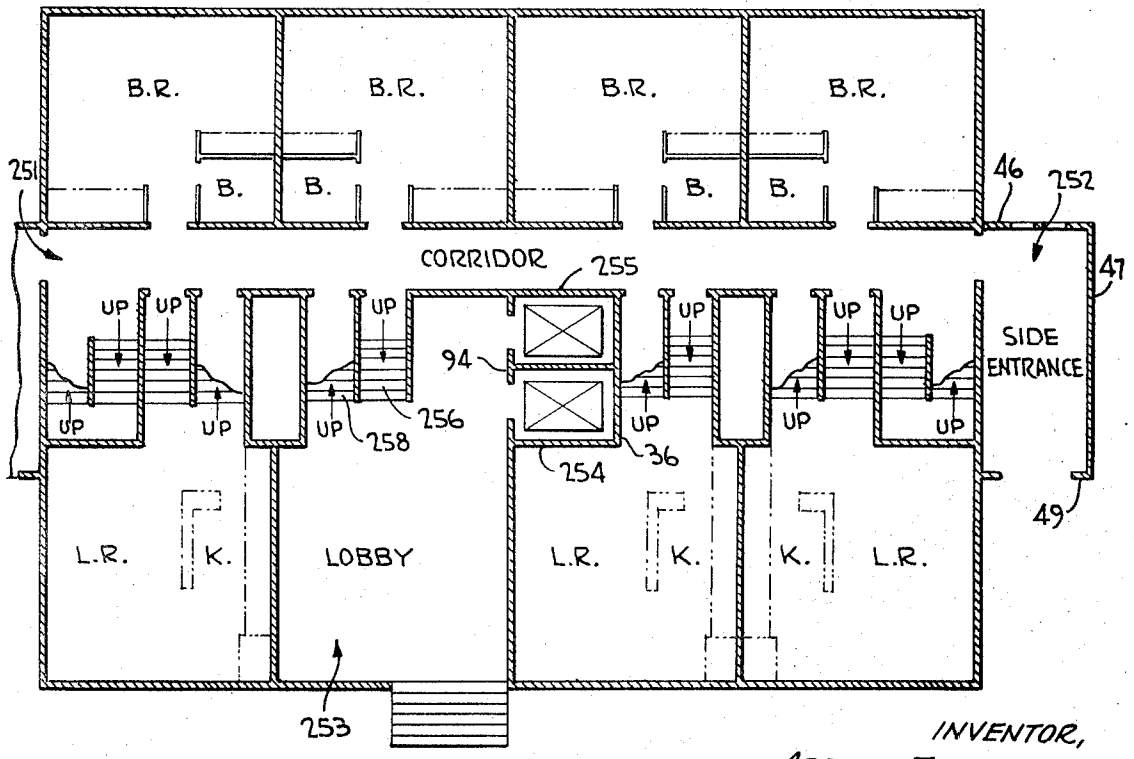


FIG. 30



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BUILDINGS

The present invention relates generally to buildings, and more particularly, to a building formed from a predetermined, relatively small number of precast elements fabricated together to form split-level type units.

Due to expanding population and increasing labor costs, the need for erecting buildings utilizing elements preformed at a location remote from the construction site has been realized by many. While numerous types of buildings have been proposed, none to my knowledge has been widely adapted. Many of the proposed prefabricated type buildings have involved fabricating a complete module of a room, or the like, at a factory and shipping the completed module to a building site. A problem with this proposed type of construction is the expense involved in shipping from the fabrication location to the building site.

In accordance with the present invention, there is provided a building structure utilizing precast elements, comprising mainly slabs easily shipped from a fabricating facility to a building site. The elements are assembled together at the building site to form structures ranging in size from single family, multiple bedroom units to 22-story buildings. The elements are interconnected to form split level units having three sections; two of the sections are inhabitable, while a third section is for stairways and landings. The inhabitable sections are generally formed of rectangular slabs having widths equal approximately to the height of a story and different lengths. Adjacent vertical inhabitable sections are displaced by one-half story relative to each other to form the split level type unit. The vertically displaced sections are connected to each other by precast staircase elements included in the third section. The staircase elements have planar walls forming a wall of the vent shaft carrying heating, electrical and plumbing conduits. To facilitate the running of conduits and minimized space requirements, bathrooms and kitchens are generally located in proximity to the vent shaft. To provide optimum ratio for the number of persons to the number of bathrooms, preferably a pair of bedrooms and a bathroom are provided on inhabitable sections.

In multi-level, high rise buildings utilizing the teachings of the present invention split-level units are assembled with one bedroom units that are wholly on one floor. For every two and one-half stories, or five inhabitable levels, a maximum of one party corridor is provided to establish a large portion of available floor space. One bedroom units are included generally only on floors having a corrider, whereby a high ratio of multi-bedroom to single bedroom units is established, enabling large families to live in the high rise buildings.

A further feature of the invention is that cross ventilation is provided for multi-bedroom units, whether they be of the high-rise single family, townhouse, or garden type variety. Further, each building is topped by a penthouse unit and living rooms of all multi-bedroom units are sunken, features generally associated only with luxury type apartment buildings.

By utilizing precast concrete elements, load bearing walls in each apartment unit are formed. Also, acoustic coupling between adjacent units is at a relatively low level by employing concrete as the wall structure. Internal noise within an apartment unit can be minimized, despite the use of concrete as the walls, utilizing modern acoustic absorption techniques.

It is, accordingly, an object of the present invention to provide a new and improved building structure.

Another object of the invention is to provide a building structure employing precast concrete elements easily shipped from a fabrication site to a building site, thereby to minimize transportation and building costs.

Another object of the present invention is to provide a new and improved building which can be fabricated in a relatively short time since it features precast elements easily connected to each other at a building site.

Another object of the invention is to provide buildings which can be fabricated from a relatively small number of elements that can be employed for constructing units ranging in size from a one family dwelling to a multi-story, high rise building.

Another object of the invention is to provide a high rise building having a floor plan maximizing the amount of usable space.

Still another object of the present invention is to provide a new and improved building employing precast concrete elements as load bearing walls and for substantially eliminating acoustical coupling between adjacent, individual units.

Another object of the invention is to provide a building fabricated from precast elements fabricated with each other to form vent spaces for heating, electrical and plumbing conduits.

Still a further object of the invention is to provide a new and improved building formed from a relatively small number of precast elements, fabricated together to form aesthetically pleasing buildings having cross ventilation and sunken living rooms for multi-bedroom individual units.

The above and still further objects, features and advantages of the present invention will become apparent upon consideration of the following detailed description of one specific embodiment thereof, especially when taken in conjunction with the accompanying drawings, wherein:

FIGS. **1** and **2** are exploded views illustrating the manner by which a multiplicity of slabs and elements in accordance with the present invention are assembled together to form a single family townhouse dwelling, with FIGS. **1** and **2** showing reverse end views;

FIG. **3** is a side selectional view of either a single family or multiple family townhouse;

FIG. **4** is a top view taken through the lines **4—4**, FIG. **3**, showing the floor plan of the lowest levels of a multiple family unit, as well as the transitional section connecting the lowest two levels together;

FIG. **5** is a top sectional view taken through the lines **5—5**, FIG. **5**, to illustrate the floor plan of intermediate levels, as well as the transitional section connecting these levels together;

FIG. **6** is a perspective view of the exterior of a plurality of townhouses of the type illustrated by FIGS. **4** and **5**;

FIGS. **7–25** are perspective views of the elements required to erect buildings in accordance with the present invention;

FIG. **26** is a side sectional view illustrating a multi-story high rise building constructed in accordance with the present invention;

FIG. **27** is a section taken through the lines **27—27**, FIG. **26**, to illustrate the floor plan of the high rise for levels having a corridor therein;

FIG. **28** is a sectional view taken through the lines **28—28**, FIG. **26**, to illustrate the floor plan of a level not having a corridor;

FIG. **29** is a front view of a portion of the high rise building illustrated in FIGS. **26–28**; and

FIG. **30** is a floor plan of the lowest levels of the high rise building.

Reference is now made to FIGS. **7–25** wherein there are illustrated the 16 basic precast concrete elements utilized to form buildings in accordance with the present invention. Elements **31–35** and **39–49**, respectively illustrated in FIGS. **7–11** and **15–25**, are planar with each having substantially the same thickness of approximately 8 inches so that they can be manufactured in molds having substantially the same depth and interconnected with each other to form buildings in a facile manner. Each of slabs **31–35** and **39–49** is substantially rectangular or forms a significant portion of a rectangular area, enabling a number of them to be shipped from a fabricating facility to a building site at low cost. In finished buildings, slabs **31**, **32**, **34**, **35**, **41**, **42** and **44–49** usually form vertically extending walls, while slabs **33**, **39**, **40** and **43** generally form horizontal floors or ceilings. Typically, the longest slab **31** and shorter length slab **32**, respectively having lengths of approximately 24 and 12 feet in a preferred embodiment, form seg-

ments of outer load bearing walls having no windows, or interior load bearing walls between units or sections of a finished building. Exterior end walls of a building are formed by slab **34**, having a pair of rectangular apertures therein to form windows. Slabs **33** and **34** have the same length, approximately twenty feet, equal to the distance between vertical walls forming the exterior portions of a section or unit between a pair of parallel opposed walls formed, for example, by slabs **31** or **32**.

As illustrated in FIGS. **1** and **2**, parallel load bearing walls of an inhabitable section are formed from a pair of parallel slabs **31**. The ceiling and floor of the section comprise three abutting, load bearing slabs **33**, across which the wall slabs **31** extend. Exterior walls of each section are formed by load bearing slabs **34**, having window apertures therein. Interior load bearing walls of each section formed by slabs **31**, **33** and **34** are formed by slabs **35**, having a rectangular cut-out therein enabling a door to be fit therein. Slabs **34** and **35** have approximately the same length, equal to the length of slab **33**.

To facilitate shipping, each of slabs **31–35** has substantially the same height, i.e., dimension transverse to its length, equal to the height of a typical story of a modern building, plus space required for electrical, heating and plumbing conduits to fit between a false ceiling and a slab forming the floor for the story immediately above the story having the false ceiling therein. The slabs are interconnected at the building site after having been transported thereto from a fabricating plant. Certain of the inhabitable sections are vertically stacked on each other and horizontally displaced from other sections having floors vertically displaced from the first named sections by half a story to form split-level type buildings.

Several different types of stair sections **36–38**, respectively illustrated in FIGS. **12–14**, interconnect adjacent sections displaced from each other by half a story. Each of staircase sections **36–38** respectively includes a planar slab **51**, **57** and **58**, having a sloping edge (not shown) with a vertical extent equal to approximately one-half a story. The sloping edges run between floors of adjacent sections displaced from each other by one-half a story. Running along the sloping edge of each of staircase sections **36–38** are respectively stairways **141–143**, each having seven risers to provide pedestrian access between adjacent inhabitable sections displaced from each other by one-half a story. The edges of the stairways **141**, **142** and **143** opposite from the edge connected to slabs **51**, **57** and **58** are free and are not rigidly connected with any other structure after the building is erected. Stairways **141**, **142** and **143** can be rigidly connected to slabs **51**, **57** and **58** at the site if facilitating transportation of the elements to the site is an optimum requirement; in the alternative, slabs **51**, **57** and **58** and staircases **141–143** can be assembled at the fabricating facility and nested together during transportation if any problems are envisioned in maneuvering the slabs and staircases at the building site.

The planar slab **51** of staircase section **36** has a vertical extent commensurate with one and a half stories of the building to be fabricated. Slab **51** includes a pair of parallel, vertically extending edges **52** and **53**, each having a vertical extent equal to one story of the building, and vertically displaced from each other by one-half a story. The staircase lower edge terminates in the same plane as the lower surface of edge **52**, while the uppermost riser of the staircase is substantially coplanar with the bottom surface of edge **53**. The portions of slab **51** extending horizontally beyond staircase **41**, i.e., the portions between edge **52** and the riser of the lowest step and edge **53** and the highest tread, are connected to landings at the top and bottom of staircase **141**.

Running parallel with the sloping surface of slab **51** carrying the stair section is sloping edge **54**. Sloping edge **54** forms a support for stairs on a staircase immediately above staircase section **36**. The lower portion of edge **54** is terminated prior to reaching horizontally extending edge **55** of slab **51** with a vertically extending notch having approximately an 8-inch vertical edge **56**. Vertical edge **56** enables flooring of a story immediately above edge **55** to be in abutment with staircase section **36** to form a substantial seal between the floor and staircase. In certain instances, slab **51** includes a rectangular, door receiving opening **144** between edge **53** and the highest riser in staircase **141**. In other instances, the rectangular opening may be omitted, as slab **51** forms a wall for a portion of a vent shaft carrying electric, heating and plumbing conduits.

Staircase section **37** includes a planar section **57** having a vertical extent equal to one-half a story, minus the thickness of a floor slab **33**, 8 inches. Planar section **57** has a sloping edge, (not shown), between the top and bottom parallel, horizontally extending edges thereof, along which staircase **141** is secured. The highest riser and tread of staircase **142** extend above the upper edge of slab **57** by the thickness of a floor slab **33** to enable a floor slab to be placed in abutment with staircase **142**. Extending horizontally beyond staircase **142** is a portion of slab **57**, enabling a landing to be provided at the bottom of the staircase. Staircase section **37** is utilized almost exclusively on the top and bottom staircase sections of a building wherein the need for interconnections to additional staircases does not exist.

Staircase section **38** includes a sloping edge (not shown) along which the staircase **143** is mounted. The total vertical extent of slab **58** is one story, as staircase **38** is typically employed as the penultimate staircase of a multi-story building, wherein the requirement for a staircase wall extending one and a half stories does not exist. Slab **58** includes sections extending horizontally from the upper and lower stairs of the staircase **143** to provide for landings at the top and bottom of staircase section **38**. In the upper edge of slab **58**, a rectangular notch having vertical edge **59** is formed. The rectangular notch has a depth of approximately 8 inches, enabling a snug fit to be provided between the ceiling above staircase section **38**. The notch has a horizontally extending edge **60** along the top of slab **58** equal to the distance between edge **144** and the lowest riser on staircase **143** to enable floor and ceiling sections to be maintained in horizontal alignment.

To provide landings at the top and bottom of each of staircases **141–143** of staircase sections **36–38**, slabs **39** and **40** are provided. Slab **39** has a length slightly less than the length of slab **33**, being shorter than slab **33** by half the breadth of a vent shaft included in multi-family dwellings. Slab **40** has a length substantially equal to twice the breadth of a stair section. The stair sections **36–38** and landings **39** and **40**, together with square slab **43**, form a third section of the building which can be considered as a stairwell connecting the two inhabitable sections together. Slab **43** is connected with wall slab **32** to form the floor and ceiling for a closet or similar storage area. Access to the storage area is through a door formed in the rectangular opening **144** of slab **51** of staircase section **36**.

Topping off the stairwell section of each building is a penthouse having side walls formed by a pair of parallel slabs **44**. Slabs **44** are basically rectangular in shape but include a rectangular abutment **261** extending from the upper corner thereof in the horizontal direction. The height of abutment **61** is approximately four feet, slightly less than one-half the height of a story so that an abutting relation is provided between the two displaced lower edges of slab **44** and the surfaces of slabs immediately below slab **44**. In the span between abutments **261** of a pair of parallel slabs **44**, there is provided a slab **41**, having a height equal to the height of the abutment and a length equal to the length of slab **33**. Slab **41** includes rectangular cuts **262** along one edge thereof to provide windows in the penthouse. The span between the vertical edges **151** of a pair of parallel slabs **44** is bridged by rectangular slab **42**, having a height equal to the height of one story and a rectangular opening **152** to form a door opening. Slab **42** has a length equal to that of slab **43**, to form with slabs **41** and **44** virtually a completely enclosed penthouse. If the number of possible parts is minimized, slab **42** can be replaced with slab **35**. Slab **35** has the same exterior dimensions as slab **42**, but the door cut-out has an off center location, rather than the center location of opening **152** in slab **42**.

In some instances, the building is terminated with a floor plan precluding the use of slabs 44 for walls of the penthouse; in these instances, a pair of parallel penthouse walls are formed by using a pair of essentially L-shaped slabs 45. Each of slabs 45 includes an arm 153 having a length equal to the height of a story and a leg 154 having a total extent between vertically extending edges 155 and 156 equal to the length of slab 44. The lengths of slabs 44 and 45 are determined by the horizontal extent of the stairwell section, being slightly in excess of the length of slab 51 between edges 52 and 53 thereof. The length of arm 154 of slab 45 in a direction transverse to the longitudinal axis is equal to the height of overhang or abutment 261 of slab 44.

Each of elements 31–45 is employed in the construction of single or multi-family townhouse type dwellings, as well as apartments of the high rise types. These elements can be employed exclusively in constructing any of these types of buildings, but in some instances it is desirable to provide additional features to the various types of buildings, features provided through the use of slabs 46–49. Each of slabs 46 has a pair of rectangular apertures and the same exterior dimensions as slabs 32, being optionally employed in high rise and garden apartments as walls having windows or stairwells at opposite ends of the building. Rectangular slabs 47 and 48 have exterior dimensions equal to those of slab 34. Slab 47, forming one wall of an anteroom for high rise buildings, is disposed in a plane parallel to the exterior side walls of the high rise and garden type apartments. Slab 47 is provided with a pair of rectangular or suitable apertures to form windows for the anteroom. When anterooms comprising slab 47 are formed, side walls for the anteroom are provided by a pair of parallel slabs 32, extending at right angles to the side walls of the building and into abutting relationship with opposed edges of slab 47. Slabs 48 are utilized as end walls for the two lowest levels of a townhouse or single family unit; they have a length sufficient to span the distance between a pair of parallel wall slabs 31. In slab 48, rectangular cut-outs 156 and 157 are provided through the lowest edges to provide openings in the wall of the lowest level for garage and pedestrian doors, respectively, and window aperture 158 is provided to enable even the basement level to have cross-ventilation. When slab 48 is utilized as an end wall for a level one level above the lowest level, cut-out 156 is provided for a large window or french doors.

Reference is now made to FIGS. 1–6 of the drawings, wherein there are illustrated views showing the manner by which elements 31–44 and 48 are assembled to form single and multi-family townhouses. The townhouses illustrated in FIGS. 1–6 have five separate inhabitable levels, including a basement level, as well as penthouse opening onto a porch. In the remaining figures to be described, non-load bearing partitions or walls, usually fabricated of wallboard, for partitions forming living rooms, kitchens, bedrooms, bathrooms, utility rooms and garages, are indicated generally by dotted lines, while load bearing, precast concrete walls defining section boundaries, ceilings and floors are generally shown by solid lines.

The single and multi-family townhouses can be thought of as being divided into three vertically aligned or stacked sections 61, 62 and 63. In section 61 there are three horizontally aligned or stacked levels 161, 162 and 163 to form three separate townhouses stories, at least two of which are inhabitable. Section 63 includes a pair of stacked inhabitable levels 164 and 165, each forming a separate story. Adjacent vertical levels of sections 61 and 63 are displaced vertically from each other by one-half a story by staircase means included in stairwell section 62. Stairwell section 62 is disposed between sections 61 and 63 to interconnect the latter two sections. Stairwell section 62 includes six one-half story staircase sections, of the type illustrated in FIGS. 12-14, to provide complete interconnection between all of the inhabitable areas of sections 61 and 63, as well as penthouse 166. The lowest level 166 of the building is generally employed as a basement and garage, while the next highest level 164 generally includes a living room and kitchen. On each of levels 162, 163 and 165 a pair of bedrooms and bath are provided. The number of bedroom levels can be increased, as indicated by dotted lines 167, FIG. 3. If the highest level of the building is on the left side, as illustrated by dotted lines 167, the penthouse side walls are formed by slabs 45; if the highest building level is on the right side, the penthouse side walls are formed by slabs 44.

The lowermost levels 161 and 164 of sections 61 and 63 are formed on concrete slabs poured into the earth at the building site. The concrete slabs forming levels 161 and 164 are displaced from each other by one-half a story, whereby the floor for level 161 is displaced downwardly from the floor for level 164. Each of inhabitable levels 161–165 of sections 61 and 63 includes load bearing, vertical side walls formed by slabs 31. The distance between parallel extending side walls 31 in the interior of the town house is spanned by a slab 35 having an opening for a door. End walls on levels 162, 163 and 165 between side walls 31 are provided by apertured slabs 34, while the lowermost levels 161 and 164 of sections 61 and 63 have side walls formed by slabs 48. End wall slab 48 for level 164 is recessed from the edges of slabs 31 to provide anteroom 167 and porch 168. Anteroom 167 is closed off by slab 32 and includes non-load bearing wall 169 having a door cut-out therein. The large rectangular opening to one side of slab 48 is of sufficient area to enable an automobile to be driven through it into a garage area formed in the lowest level 161 of section 61. Three walls of the garage are formed by load bearing precast concrete slabs 31, and portions of slabs 35 and 48, while the interior wall 171 is non-load bearing and includes a door opening (not-shown) for access between the garage and basement.

Forming the ceiling and floor for each of levels 162, 163 and 165 of sections 61 and 63 and the floor for each level of these sections are three slabs 33, having abutting longitudinal edges. Slabs 33 have a length sufficient to span the distance from the outer edge of a pair of load bearing side walls for each section. The width of breadth of slabs 33, equal to the height of one story, is thereby one-third the length of one of slabs 31.

Stair section 62, connecting adjacent levels of sections 61 and 63 together, is formed in slightly differing ways for different levels, as best illustrated in FIGS. 1 and 2. Each of staircases 81 and 82, respectively disposed between the lowermost levels 161 and 164 of sections 61 and 63, and the uppermost level 163 of section 61 and penthouse 161, is formed from element 37, FIG. 12. The uppermost tread of staircase 81 is in a plane coincident with the plane forming the wall or level 164, while the lowest riser of staircase 81 extends from the floor of level 61. Similarly, the uppermost tread and first riser of stairway 82 are respectively coincident with the floors of penthouse 166 and level 165.

Extending one-half story between each of levels 164 and 162, as well as between levels 162 and 165, are respectively staircase sections 171 and 172, both formed of elements 36, FIG. 12. Slab 51 on staircase section 171 is solid, i.e., does not include a door aperture, to form one wall of a venting shaft 173, FIGS. 4 and 5. Venting shaft 173 provides air circulation between the various levels of the building, as well as space for plumbing, heating and electrical conduits that extend between the different floors. Slab 51 on staircase section 172, however, is provided with a rectangular cut-out to enable a door to be fit therein. The door in slab 51 of staircase section 172 leads to a closet 174 on level 165. Closet 174 has parallel floor and ceiling members formed by a pair of slabs 43, side walls formed by slabs 35, and an exterior wall formed by slab 32. The top and bottom edges of slab 32, as well as the floor and ceiling of closet 174, are coplanar with the floor and ceiling, respectively, of level 165. Also coplanar with the floor of level 165, at the top of staircase 175, is landing 181, formed from slab 40. At the bottom of staircase 175, coplanar with the floor of level 162, there is provided landing 176, formed by slab 39.

In single family dwellings, as illustrated by FIGS. 1 and 2, first and second pairs of vertically aligned slabs 32 are provided on opposite sides of stairwell section 62 to form exterior

walls in horizontal alignment with side walls **31** of levels **164** and **165**. The space between slabs **32** and the vertical slabs comprising the staircase section on the left side of the building, as illustrated in FIG. **1**, forms a vent shaft. In building configurations wherein a pair of units of the type illustrated in FIG. **1** are abutted together, as illustrated in FIGS. **4–6**, staircase **32** are not provided along the exterior of the vent shaft, but a vent shaft of twice the volume of that of a single family unit is provided by including a pair of elements **36** having parallel, spaced walls.

Connecting the uppermost level **165** of section **163** with the uppermost level **63** of section **61** is staircase **181** formed by element **38**. Element **38** is slightly different from element **36**, in that the former has a total height equal approximately only to one story, while the latter has a total height equal approximately to 1½ stories. Element **38** extends vertically by approximately only one story to enable it to be nested with the floor of penthouse **66**, that fits into engagement with the notch formed by edge **59**, FIG. **14**.

To provide landings from the uppermost riser of each staircase leading to above ground levels **162** and **163** of section **61**, slabs **40** are connected between slabs **33** forming floors of levels **162** and **163**. Slabs **40** have a length equal to the distance from the right edge of the wall formed by elements **36–38**, and the vertical projection from the left edge of slab **43** which forms the closet on each level of stairwell section **63**, a distance equal to twice the width of a staircase. Thereby, each of slabs **42** is in abutment with parallel walls forming the outer edges of each staircase.

Topping section **61** is penthouse **166**, having walls formed by a pair of parallel extending slabs **44** in planes coincident with the side walls **31** of sections **61** and **63**. Each of slabs **44** includes an abutment like section **261** having a lower edge resting on the upper faces of a slab **33** forming the ceiling of level **163**. Forming the front and back walls of the penthouse are slabs **42** and **41**, respectively, having heights equal approximately to one story and a half a story. The half story height slab **41** is provided with cut-outs to form penthouse windows, while the full story slab **42** is provided with a door-like cut-out for enabling access to be gained to a roof formed by three slabs **33** having abutting edges. These slabs also comprise the ceiling for the uppermost level **165** of section **63**. A roof for penthouse **166** is formed by a pair of slabs, positioned to extend in the same direction as the slabs **33** that comprise the roof of the uppermost levels **163** and **165** of sections **61** and **63**.

The concrete slabs forming the unit of FIGS. **1** and **2**, as well as all other units, are preferably connected to each other with a connector of the type disclosed in my copending application entitled SYSTEM FOR CONNECTING PRECAST CONCRETE SLABS TOGETHER, filed concurrently herewith. It is to be understood, however, that other types of connectors can be employed for interconnecting the various slabs with each other. In essence, the technique for interconnecting the slabs involves running post-tension type cables between connectors embedded in the various precast concrete slab elements. For those elements or slabs forming load bearing walls the cables extend vertically and are connected to each other only in the vertical direction. For floor and ceiling type elements or slabs, the cables run in a direction at right angles to the walls. The wall sections are connected to each other through connectors provided in the floors, while the floor elements are interconnected by connectors in abutting relationship between adjacent floor slabs. The staircase elements **36–38** are considered as vertically disposed and are thereby connected with each other through vertically extending cables.

A plurality of single family units of the type illustrated by FIGS. **1** and **2** can be assembled together in a manner illustrated by the floor plans of FIGS. **4** and **5**, or as illustrated by the perspective view of FIG. **6**. In FIGS. **4** and **5**, a pair of single family units are abutted against each other and are provided with a common vent shaft **173**, formed between a pair of parallel, planar wall slabs of staircase sections **36–38**. To form a common wall between the two units illustrated by FIGS. **4** and **5**, faces of a pair of slabs **31** are placed in abutting relationship. As illustrated in FIG. **5**, a single bathroom is provided in proximity to each half of vent shaft **173** for each pair of bedrooms. By placing the bathrooms in proximity to vent shaft **173**, the length of plumbing pipe between the bathrooms and vent shaft is minimized. It is noted from FIG. **4** that the individual units are symmetrical about the abutting faces of walls **31** so that closets formed in stairwell section **62** are on the exterior of the building and vent shafts **173** are centrally located.

In the four family units illustrated by FIG. **6**, there are provided three sets of abutting walls and two vent shafts, both interiorly located. As in the two family dwellings of FIGS. **4** and **5**, the units of FIG. **6** are stacked with the faces of side walls thereof in abutting relationship and the end walls thereof are exposed. The floor plan for each unit of the four unit townhouse illustrated by FIG. **6** is identical to that illustrated for the two unit townhouse, FIGS. **4** and **5**. Each of the units illustrated by FIGS. **4–6** can be considered as a substantial duplicate of the single family unit illustrated in exploded form by FIGS. **1** and **2**.

The slabs of the present invention can also be utilized to form multi-story high rise buildings having heights up to 22 stories, as illustrated in FIGS. **26–30**. The high rise building illustrated in the cross-section and floor plan views of FIGS. **26–28** includes one bedroom single level, and two bedroom split-level units, and is characterized by having a corridor for every two and one-half stories, with successive corridors being located on opposite sides of the building. By spacing the corridors in this manner, it is possible to decrease the unsaleable and wasted space within the building. The number of corridors can be decreased even further over that specifically illustrated by providing split-level units having more than two bedrooms.

The floor plan of each floor having a corridor **200** is illustrated in FIG. **26**. As illustrated in FIG. **26**, to the left of each corridor **200** and on the same level thereof is a one bedroom unit **201** having a wall with a doorway **203** provided through it into the corridor. The wall including doorway **203** is formed by slab **42**, while an exterior end wall for the one bedroom unit is formed by slab **34** having rectangular apertures therein to form windows. Each interior wall of a one bedroom unit is formed by a slab **33** that extends at right angles between slabs **34** and **42**. The exterior wall of one bedroom units at either edge corridor **200** is formed by a slab **31**, extending between wall **34** and beyond wall **42**. Along the wall slab **42** of each one bedroom unit, and on opposite sides of the door cut-out of slab **42** are bathroom and kitchen fixtures. The bathroom fixtures are located directly across the corridor **200** from vent shaft **204**, formed in a manner similar to that described, supra, with regard to the vent shafts for the buildings illustrated by FIGS. **1–6**. The floor for one bedroom unit **201** and corridor **200** is formed by three slabs **33** extending lengthwise in a direction at right angles between wall slabs **31**. The longitudinal edges of slabs **33** forming the floor and ceiling of one bedroom unit **201** and corridor **200** are in abutting relationship and are connected together as indicated, supra.

On the side of each corridor **200** opposite from a one bedroom unit **201**, entrances **205** are provided to living rooms of two bedroom units **208** and **209**. Entrances **205** lead to staircases **206** and **207** respectively going up and down from corridor **200** to the living rooms of two bedroom split-level units **208** and **209**; the living rooms of units **208** and **209** are vertically stacked with each other and displaced by one complete story from each other. For all intermediate floors, i.e., between the second and next highest levels of the building, the staircase from a corridor **200** to each living room, for example staircase sections **206** and **207**, is formed by an element **36**. A plurality of elements **36** are aligned with each other to provide ingress and egress to the living rooms of units **208** and **209** from corridors **200**, as well as to provide stairways interiorly of each unit. All of the staircase units **36** in-

clude a solid planar slab 51, i.e., no door cut-out is provided in slab 51.

A common or party stairwell 211 is formed along opposite outside end walls of the high rise building. The party stairwells 211 are formed by a multiplicity of stacked elements 36. To provide windows in stairwell 211, a slab 46 is provided for each story within the building. Each slab 46 has upper and lower horizontal edges coplanar with the floor and ceiling of levels in the rear of the building, illustrated on the left side of FIG. 26; for example, the level including unit 201. Slab 46 has the same dimensions as slab 32; if the need for windows does not exist, slabs 46 can be replaced by slabs 32 to minimize the number of slabs required to erect any particular building.

To provide high speed transportation between corridors 200, an elevator shaft 91 containing two elevators 92 is provided. On each floor having a corridor 200, access is gained to elevators 92 via a vestibule or lobby. On those floors that do not include a corridor, no access is gained to the elevators or the party stairwell 211. One wall of vestibule 93 comprises a planar segment 51 of staircase element 36. Planar segment 51 of staircase element 36 extends in a direction parallel to the exterior side walls formed by slabs 31. A back wall of vestibule 93 and one of the walls of elevator shaft 91 are formed by a slab 31. A slab 43 comprises the front wall of elevator shaft 91 and of a portion of corridor 200, while the side wall of the elevator shaft is formed by the planar slab 51 of one of the staircase elements 36 comprising staircase 207. To gain ingress and egress to elevator shaft 92 and form a side wall for the elevator shaft, a further slab 94, having the same exterior dimensions as slab 36 is provided. Slab 94 extends between slabs 31 and 43 in a direction parallel to slab 36 and is provided with cut-outs for doors into the elevators.

The living room and kitchen levels of a multi-bedroom unit, displaced by one-half a story from corridor 200, have side walls formed by a pair of parallel slabs 31 and an exterior load bearing wall 94 comprised of slab 48 that extends between and at right angles to a pair of parallel slabs 31. Wall 94, fabricated from a slab 48, may be provided with french doors in cut-out 156 to enable access to be had to a porch formed between the wall and the outer edge of the building. In the alternative the side wall of the level forming the living room and kitchen of a multi-bedroom unit can be expanded to the edge of the building and a wall formed by slab 34, having window apertures therein can be utilized. Also, ingress and egress to a porch can be had by forming wall 94 from either of slabs 35 or 42.

The floor for the living room and kitchen of a multi-bedroom unit 208 comprises three slabs 33 connected to each other in the same manner as the slabs 33 are interconnected to form the floor and ceiling of sections 61 or 63 of the garden type or townhouse buildings illustrated by FIGS. 1–6. The kitchen in multi-bedroom unit 208, on the same level as the living room thereof, is positioned in proximity to vent shaft 204 to minimize the run for plumbing conduits between vent shaft 204 and kitchen appliances.

The remainder of the floor for the living room and kitchen level of unit 208 is formed by slab 40, which comprises a landing for stairway 206 leading to corridor 200. Slab 40 also comprises a landing for stairway 221 within the multi-bedroom unit, which stairway leads to bedrooms on level 222, displaced by one-half a story above the level of the living room and kitchen within unit 208. At the bottom of stairway 206 a further landing is formed by a slab 40 to enable access between the stairway 206 and a common corridor to be gained.

Wall segments for one-half of the portion of vent shaft 204 abutting against corridor 200 are formed by slabs 231 and 232, each having the same exterior dimensions as slab 43. Each of slabs 231 and 232 includes a pair of rectangular cut-outs to provide doorways 205 for ingress and egress from corridor 200 to landings 40 at the bottom and top of stairways 206 and 207, respectively. The rear wall 95 of vent shaft 204 is preferably formed by a non-load bearing member.

One-half a story above or below the levels for the living room and kitchen for each of multi-bedroom units 208 and 209 and in vertical alignment with the one bedroom units are bedroom levels for the multi-bedroom units. On each bedroom level of a multi-bedroom unit there are included a pair of bedrooms and a bathroom. The bedroom levels are reached from the living room levels by staircases 221 formed by one of elements 36. Staircases 221 are stacked immediately above staircases 206 and 207, with vertically aligned staircase sections being vertically displaced from each other by one full story. Staircase sections leading to levels displaced by one-half story are horizontally displaced in a manner similar to that disclosed in conjunction with the embodiments of FIGS. 1–6.

The bedroom levels of the multi-bedroom units displaced by one-half a story from the living room and kitchen levels have side walls formed by a pair of parallel slabs 31 and exterior end walls formed by slabs 34 having window apertures therein. The floor and ceiling of the bedroom levels are formed by three slabs 33 having longitudinal axes running between slabs 31 and lying parallel to each other in the same plane. Access to these bedrooms is through landing slab 40 at the bottom or top of each half story staircase element 36. On the bedroom level of each multi-bedroom unit, walls formed by slabs 34 also form walls for the elevator shaft 91 and a closet. Extending at right angles to wall slabs 34 is a pair of abutting wall slabs 32. Running parallel to wall slabs 32 on each level containing bedrooms of a multi-bedroom unit located interiorly of the buildings are closets having walls formed by planar slabs 51 of staircase elements 36. The slabs 51 of elements 36 have rectangular cut-outs to enable doors to be provided therein for ingress and egress to the closet.

To provide entry to the multi-story building illustrated by FIGS. 26–30, side entrances are provided to a corridor 251 on the lowest level of the building, illustrated in FIG. 26 in the rear half of the building. A small anteroom 252 is preferably provided for the side entrances and is formed from slabs 46, 47 and 49. A pair of slabs 49 is provided, each extending at right angles to the building side wall. The edges of slabs 49 remote from the building intersect a face of slab 47 which extends in a direction parallel to the side wall of the building. A roof for the anteroom is provided by slab 33, having the same length as slab 47. On the lowest level, one bedroom units extend from the left of corridor 251, as illustrated in FIG. 26, in a manner similar to the one bedroom units on the same level as corridor 200. On the level one-half a story above corridor 251 is a second level 252 containing the living room and kitchen of three multi-bedroom units. Between a pair of multi-bedroom units on level 252 is formed a lobby 253 that occupies the space taken by the living room and kitchen of one interior multi-bedroom unit on higher floors of the building. Along the left wall of lobby 253, as illustrated in FIG. 30, is a wall having door apertures for elevator shaft 91. One wall of the elevator shaft housing is formed by a wall slab 36, in alignment with the corresponding wall on the level containing corridor 200. At right angles to slab 36 are parallel extending slabs 33 and 43 which form side walls 254 and 255 of the elevator shaft. Ingress and egress to elevators 92 in shaft 91 is provided by doors cut in non-load bearing walls, similar to wall 94, mentioned in conjunction with FIG. 27.

Access to the rear of lobby 253 is provided from corridor 251 via staircase 256 formed by element 37, while access to the lobby from the front of the building is provided through door 257. The lobby 253, in addition to providing access to corridor 251 and elevators 292, provides access via stairway 258 to a one bedroom unit located in the rear of the building one full story above the level of corridor 251. The one bedroom unit one-half a story above lobby 253 is slightly larger than the other one bedroom units and can therefore be considered as a premium unit. The exterior walls of the one bedroom unit one-half a story above the lobby are formed in exactly the same manner as the exterior walls of a bedroom level of a multi-bedroom unit.

The high rise building illustrated by FIGS. 26–30 is analagous in many respects to the townhouse units illustrated by FIGS. 1–5. In essence, the high rise building can be considered as including three enclosed sections, two of which are inhabitable and connected together by a stairwell section topped with a penthouse. Adjacent inhabitable sections are displaced from each other by one-half a story and vertically aligned sections are displaced from each other by one complete story.

While there has been described an illustrated one specific embodiment of the invention, it will be clear that variations in the details of the embodiment specifically illustrated and described may be made without departing from the true spirit and scope of the invention as defined in the appended claims.

I claim:

1. A multi-story building comprising a multiplicity of individual units of a first and second type, each of said units of the first type being a split level unit and including a plurality of adjacent levels displaced horizontally with respect to each other and vertically by approximately one-half a story from each other, a stairway interior of each of the first units, said stairway having a vertical extent only for approximately one-half a story connecting adjacent vertical levels of the first type of units together, a common corridor connecting entrances to the units of the first and second type together, each of said units of the second type being on the same level as the corridor, each of said units of the first type having a level displaced vertically by approximately one-half a story from the corridor, and a stairway having a vertical extent only for approximately one-half a story connecting the corridor with the story of the unit of the first type displaced from the corridor by a half story, different ones of said corridors being displaced vertically from each other by at least two-and-a-half stories, and alternate vertical corridors being displaced horizontally from each other.

2. The building of claim 1 further including an elevator shaft for carrying an elevator cab, and means wholly on the same level as each of said corridors for enabling access to the same side of the elevator cab from each of said corridors.

3. The building of claim 2 wherein each of the means for enabling access comprises a lobby having a first opening into the corridor, and a wall running at right angles to the corridor, said lobby wall having a second opening for access to the elevator cab.

4. A multi-story building comprising a multiplicity of individual units of a first and second type, each of said units of the first type being a split level unit and including a plurality of adjacent levels displaced horizontally with respect to each other and vertically by approximately one half a story from each other, a stairway interior of each of the first units having a vertical extent only for approximately one half a story connecting adjacent vertical stories of the first type of units together, a common interior corridor connecting entrances to the units of the first and second type together, said corridor having opposed walls, each of said units of the second type being on the same level as the corridor, each of said split level units having a level displaced vertically by approximately one-half a story from the corridor and a stairway having a vertical extent only for approximately one half a story connecting the corridor with the level of the split level unit displaced from the corridor by a half story, different ones of said corridors being displaced vertically from each other by at least two and a half stories, and alternate vertical corridors being displaced horizontally from each other, entrances to the units of the second type and stairways leading to the units of the first type being displaced on opposite walls of the corridor.

5. The building of claim 4 wherein one level of units of the first type is displaced vertically by one full story from said story of the units of the second type, said one level being horizontally aligned with said level of the units of the second type.

6. The building of claim 4 comprised of a plurality of first and second sections each having a height of one story, each of said first sections being vertically aligned, each of said second sections being vertically aligned, said first and second sections being displaced from each other in non-overlapping relationship, adjacent ones of said first and second sections being vertically displaced by approximately one half a story, each of said first and second sections including: a multiplicity of abutting precast substantially rectangular first slabs exclusively forming floors, ceilings and load bearing walls, each of said first slabs having substantially the same thickness and height, the height of each of said first slabs being substantially equal to one story, four of the slabs abutting each other to form four walls of a rectangular area substantially enclosing the section, each of the slabs forming the ceiling and floor extending between a pair of parallel walls; a plurality of vertically aligned third sections forming stairways between adjacent ones of said first and second sections; each of said third sections including: a planar load bearing precast slab having a height substantially equal to at least one story, said third section slab having a pair of parallel, vertically extending edges abutting vertically extending surfaces of walls of adjacent first and second sections, and a stairway extending along the third section slab with a vertical extent only for approximately one-half a story connecting flooring on levels of adjacent first and second sections.

7. The building of claim 6 wherein the stairway comprises a plurality of vertically aligned planar precast second slabs, some of said second slabs having a vertical extent of approximately one-and-a-half stories, said some slabs having a pair of parallel sloping edges extending between floors displaced from each other by one-half a story and a pair of parallel vertical edges each having an extent of approximately one story, one of the vertical edges extending between a floor and ceiling of a first level and another of the vertical edges extending between a floor and ceiling of a level vertically displaced from the first level by one-half a story, a stairway having only one edge rigidly connected to each of said some slabs and having a vertical extent only for approximately one-half a story connecting adjacent floors together, said stairways being connected along one of said sloping edges of each of said some slabs, sloping edges of adjacent aligned slabs being in abutment with each other.

8. The building of claim 7 wherein a plurality of aligned precast slabs of the staircase form one face of a vent shaft running between floors of the building.

9. The building of claim 6 further including a penthouse topping off the third section.

10. A multi-level building fabricated from a relatively limited number of precast members comprising a plurality of first and second sections each having a height of one story, each of said first sections being vertically aligned, each of said second sections being vertically aligned, said first and second sections being displaced from each other in non-overlapping relationship, adjacent ones of said first and second sections being vertically displaced by approximately one-half a story, each of said first and second sections including: a multiplicity of abutting precast substantially rectangular first slabs exclusively forming floors, ceilings and load bearing walls, each of said first slabs having substantially the same thickness and height, the height of each of said first slabs being substantially equal to one story, four of the slabs abutting each other to form four walls of a rectangular area enclosing the section, each of the slabs forming the ceiling and floor spanning the entire distance between a pair of parallel walls; a plurality of vertically aligned third sections forming stairways between adjacent ones of said first and second sections; each of said third sections including: a planar load bearing precast slab having a height substantially equal to at least one story, said third section slab having a pair of parallel, vertically extending edges abutting vertically extending surfaces of walls of adjacent first and second sections, and a stairway extending along the third section slab with a vertical extent only for approximately one-half a story connecting flooring on levels of adjacent first and second sections.

11. The building of claim 10 wherein the stairway comprises a plurality of vertically aligned planar precast second slabs, some of said second slabs having a vertical extent of approximately one and a half stories, said some slabs having a pair of parallel sloping edges extending between floors displaced from each other by one-half a story and a pair of parallel vertical edges each having an extent of approximately one story, one of the vertical edges extending between a floor and ceiling of a first level and another of the vertical edges extending between a floor and ceiling of a level vertically displaced from the first level by one-half a story, a stairway having only one edge rigidly connected to each of said some slabs and having a vertical extent only for approximately one-half a story connecting adjacent floors together, said stairways being connected along one of said sloping edges of each of said some slabs, sloping edges of adjacent aligned slabs being in abutment with each other.

12. The building of claim 11 wherein a plurality of aligned precast slabs of the staircase form one face of a vent shaft running between floors of the building.

13. The building of claim 10 further including a penthouse topping off the third section.

14. A staircase between levels of a building, each of the levels being vertically displaced from an adjacent level by one-half a story, comprising a plurality of vertically aligned planar precast slabs, some of said slabs having a vertical extent of approximately one and a half stories, said some slabs having a pair of parallel sloping edges extending between floors displaced from each other by one-half a level and a pair of parallel vertical edges each having an extent of approximately one story, one of the vertical edges extending between a floor and ceiling of a first level and another of the vertical edges extending between a floor and ceiling of a level vertically displaced from the first level by one-half a story, a stairway having only one edge rigidly connected to each of said slabs and having a vertical extent only for approximately one-half a story connecting adjacent floors together, said stairways being connected along one of said sloping edges of each of said slabs, sloping edges of adjacent aligned slabs being in abutment with each other.

15. The staircase of claim 14 wherein a plurality of aligned precast slabs of the staircase form one face of a vent shaft running between floors of the building.

16. The building of claim 4 further including an elevator shaft for carrying an elevator cab, and means wholly on the same level as each of said corridors for enabling access to the same side of the elevator cab from each of said corridors.

17. The building of claim 16 wherein each of the means for enabling access comprises a lobby having a first opening into the corridor, and a wall running at right angles to the corridor, said lobby wall having a second opening for access to the elevator cab.

18. The building of claim 10 wherein mating slabs form the precast wall of the third section, each of said third section slabs including an edge having a vertical extent of one story extending between the floor and ceiling of one of the first and second sections, and a sloping edge having an extent of one-half a story extending between adjacent floors of adjacent levels of the first and second sections, said sloping edge mating with a sloping edge of another third section slab and being generally aligned with a sloping plane formed by risers and landings of the stairway.

19. A multi-unit, multi-story dwelling building comprising a plurality of levels, adjacent ones of said levels being displaced from each other by one-half a story, each of said levels including a plurality of units, at least some of said units being split level units and having an interior stairway extending one-half a story between adjacent levels of the unit, a common vertically extending vent shaft running between said levels, said vent shaft including a pair of parallel walls forming a portion of boundary walls for the split level units, risers and treads for the stairway of each split level unit extending for one-half story along the vent shaft wall of the respective unit, said building including: a plurality of first and second sections each having a height of one story, each of said first sections being vertically aligned, each of said second sections being vertically aligned, said first and second sections being displaced from each other in non-overlapping relationship, adjacent ones of said first and second sections being vertically displaced by approximately one-half a story, each of said first and second sections including: a multiplicity of abutting precast substantially rectangular first slabs exclusively forming floors, ceilings and load bearing walls, each of said first slabs having substantially the same thickness and height, the height of each of said first slabs being substantially equal to one story, four of the slabs abutting each other to form four walls of a rectangular area substantially enclosing the section, each of the slabs forming the ceiling and floor extending between a pair of parallel walls; a plurality of vertically aligned third sections forming the vent shaft and stairways between adjacent ones of said first and second sections; each of said third sections including: a planar load bearing precast slab forming each of the vent shaft walls, each of the slabs forming the vent shaft walls having a height substantially equal to at least one story, each of the slabs forming the vent shaft walls having a pair of parallel, vertically extending edges abutting vertically extending surfaces of walls of adjacent first and second sections, and a stairway extending along the third section slab with a vertical extent only for approximately one-half a story connecting flooring on levels of adjacent first and second sections.

20. The building of claim 19 wherein slabs forming one of the vent shaft walls include: an edge having a vertical extent of one story extending between the floor and ceiling of one of the first and second sections, and a sloping edge having an extent of one-half a story extending between adjacent floors of adjacent levels of the first and second sections, said sloping edge mating with a sloping edge of another slab forming said one vent shaft wall and being generally aligned with a sloping plane formed by risers and landings of the stairway.

21. A multi-story building comprising a multiplicity of individual split level units, each of said units including a plurality of adjacent levels displaced horizontally with respect to each other and vertically by approximately one-half a story from each other, a stairway interior of each of the units having a vertical extent only for approximately one half a story connecting adjacent vertical levels of the units together, a common corridor connecting entrances to the units together, each of said units having a level displaced vertically by approximately one-half a story from the corridor, a stairway having a vertical extent only for approximately one-half a story connecting the corridor with the level of the unit displaced from the corridor by a half story, different ones of said corridors being displaced vertically from each other by at least two-and-a-half stories and alternate vertical corridors being displaced horizontally from each other, an elevator shaft for carrying an elevator cab, and means wholly on the same level as each of said corridors for enabling access to the same side of the elevator cab from each of said corridors.

22. The building of claim 21 wherein each of the means for enabling access comprises a lobby having a first opening into the corridor, and a wall running at right angles to the corridor, said lobby wall having a second opening for access to the elevator cab.

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Disclaimer

3,656,266.—*Adolfo Tylius*, Washington, D.C. BUILDINGS. Patent dated Apr. 18, 1972. Disclaimer filed Feb. 15, 1974, by the assignee, *Alvic Development Corporation.*

Hereby enters this disclaimer to claims 1, 4 and 5 of said patent.

[*Official Gazette August 27, 1974.*]