United States Patent [19]

Brodie

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[54] **PREFABRICATED BUILDING**

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[52] **U.S. Cl.** **52/646,** 52/122, 165/168, 52/169, 52/93, 52/220, 52/302

[51] **Int. Cl.** **E04h 1/02**

[58] **Field of Search** ..... 52/299, 474, 476, 52/645, 646, 79, 122, 126, 235, 637; 248/357; 135/3 R, 3 BE

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[57] **ABSTRACT**

A prefabricated building which can be assembled, erected and later on dismantled and moved, wherein the entire structure is supported by four or more vertical posts and two or more horizontal structurally integral frames which are supported from the vertical posts and serve the triple purpose of stiffening the structure to resist the forces of wind, providing a beam system which supports full span roof trusses and full span floor joists, and providing the main ducts for distribution of conditioned air throughout the building. The horizontal frames are secured to the posts by means of adjustable post clamps which allow for erection and stabilization of the building on unleveled ground and without a prepared foundation. The side walls of the building are formed of a plurality of panel assemblies through which conditioned air is circulated. Some of these panel assemblies are window assemblies and the circulation of conditioned air therethrough maintains the inner pane at substantially room temperature.

8 Claims, 12 Drawing Figures

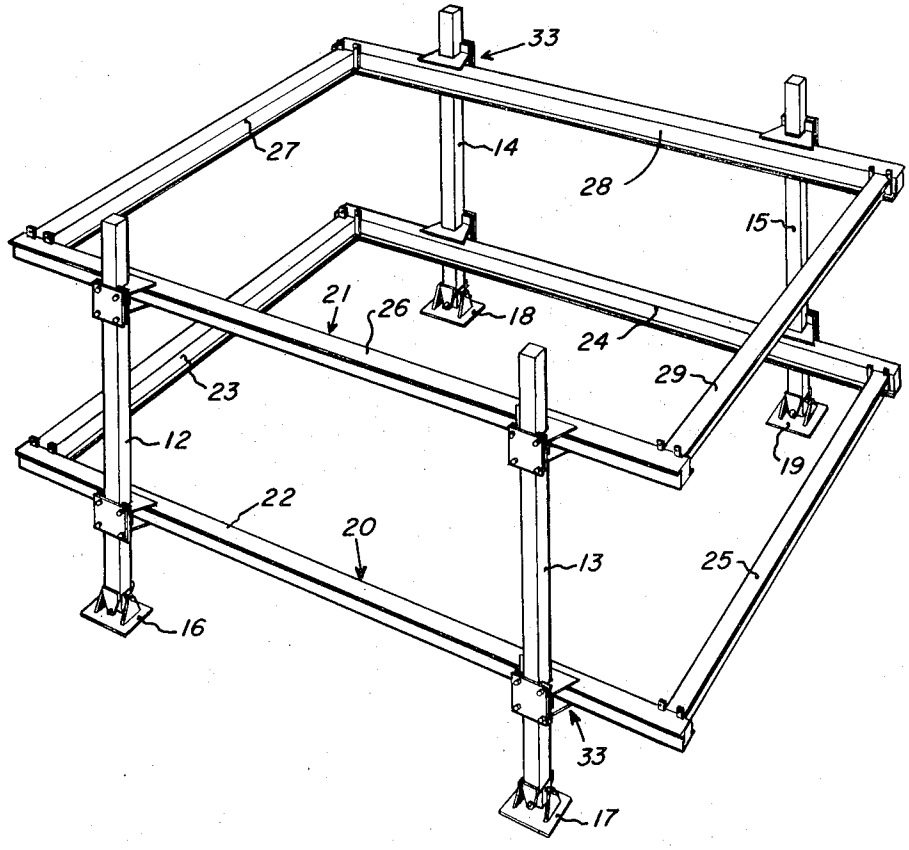
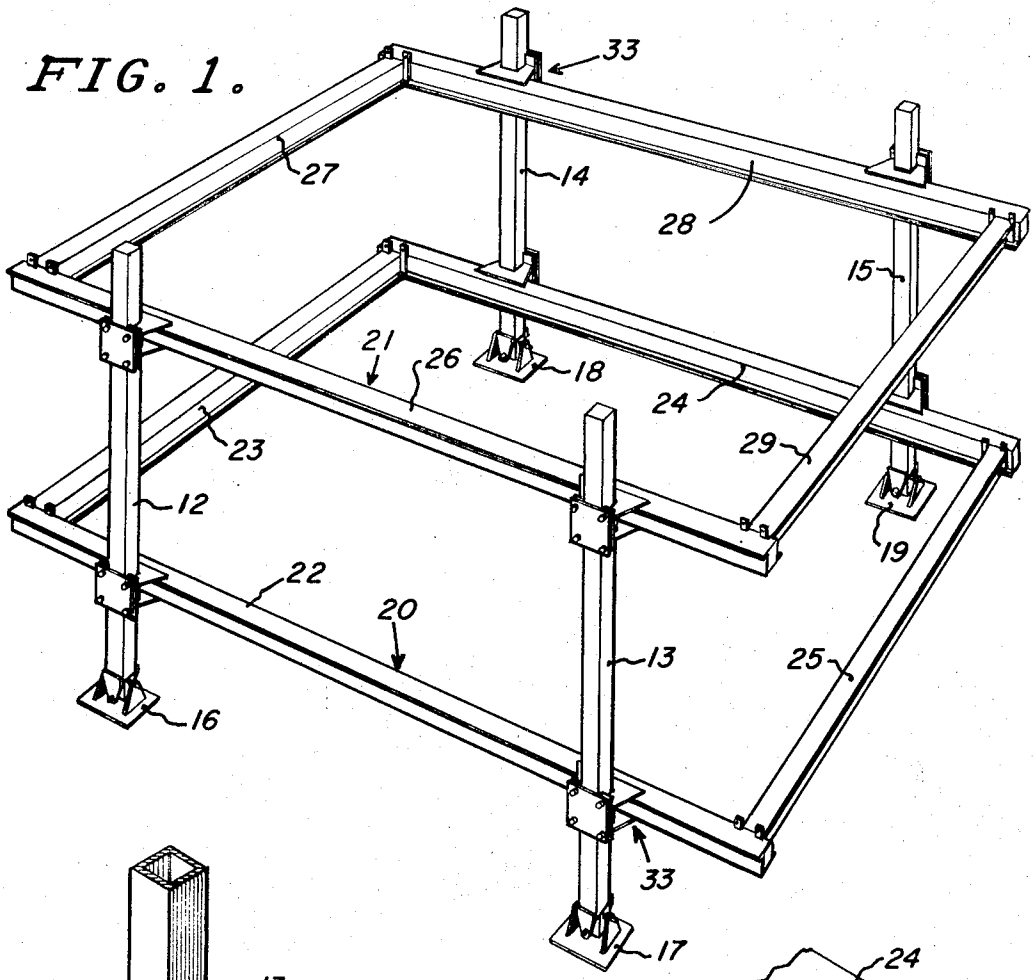


FIG. 1.



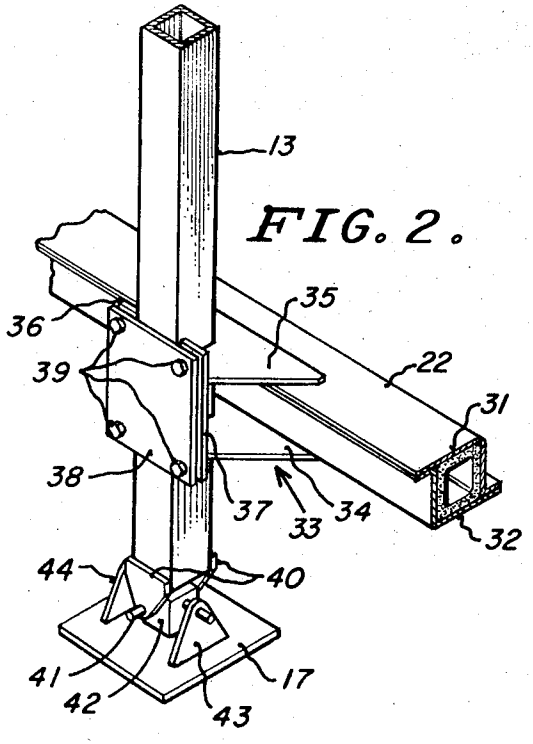


FIG. 2.

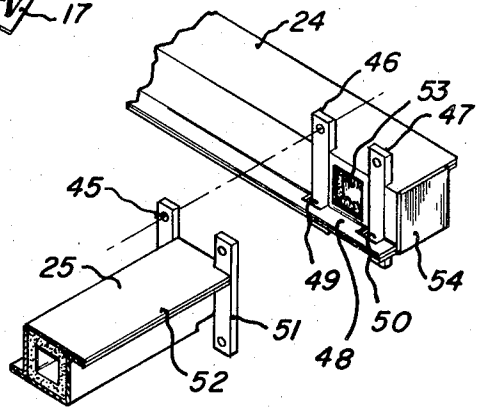


FIG. 3.

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FIG. 4.

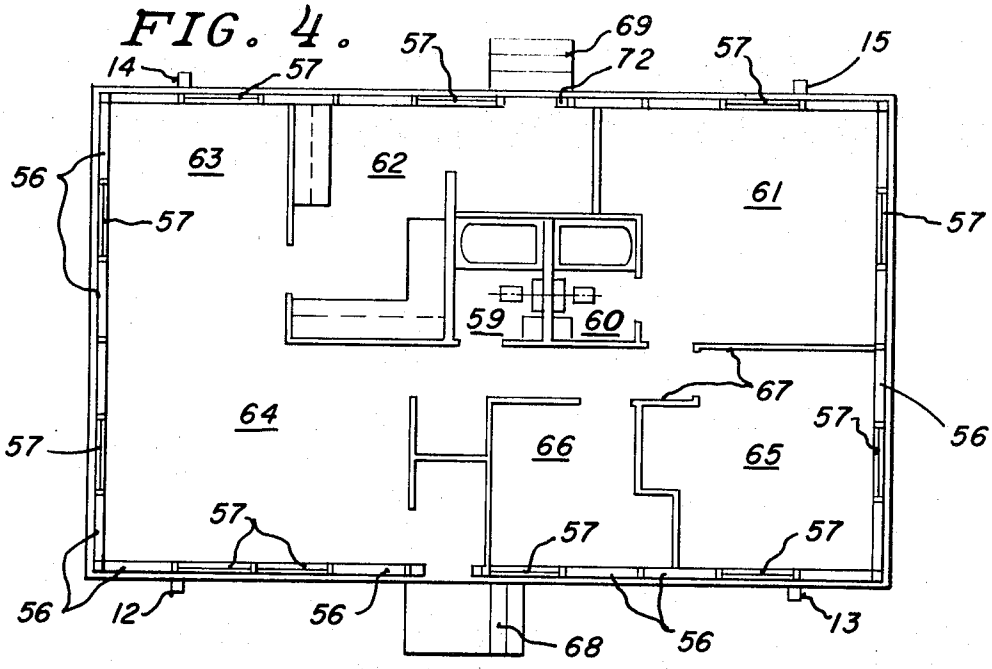


FIG. 5.

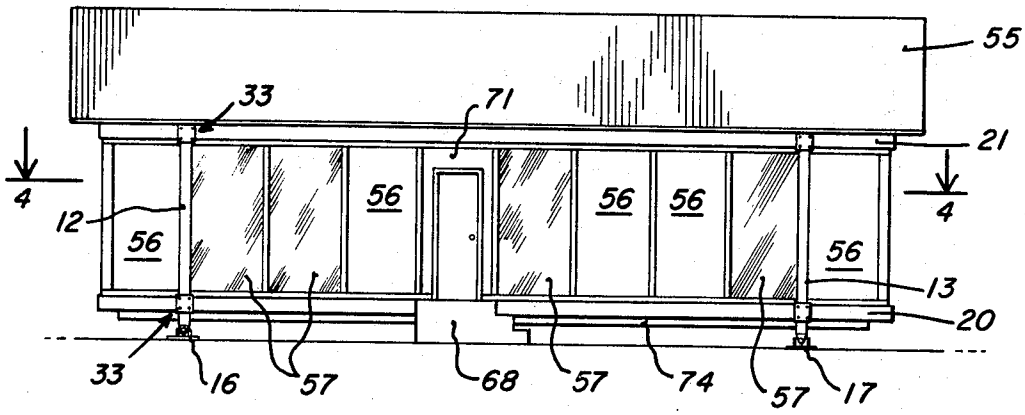
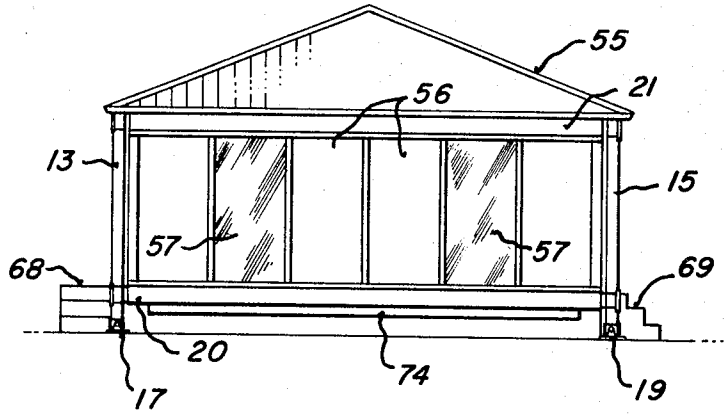


FIG. 6.



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FIG. 7.

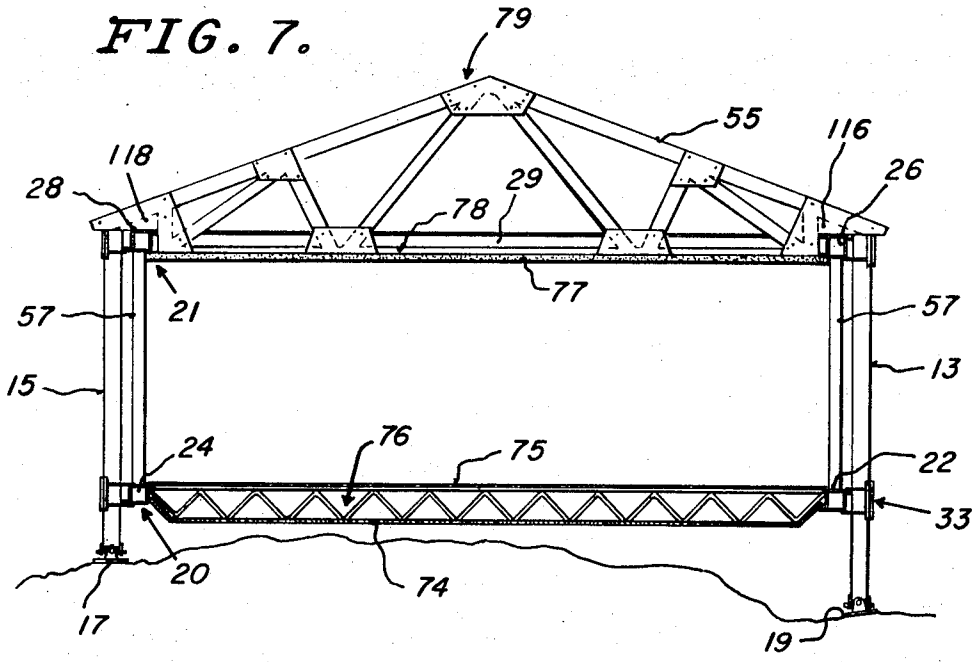


FIG. 8.

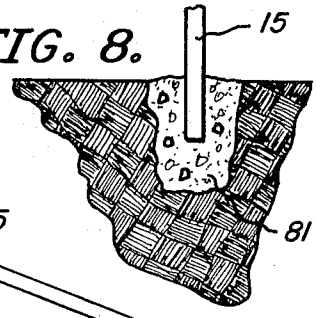
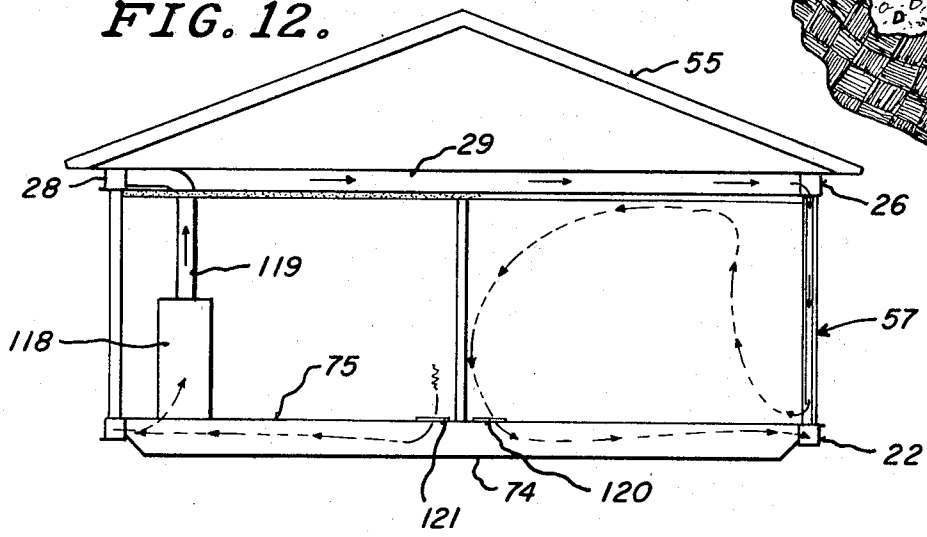


FIG. 12.



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FIG. 9.

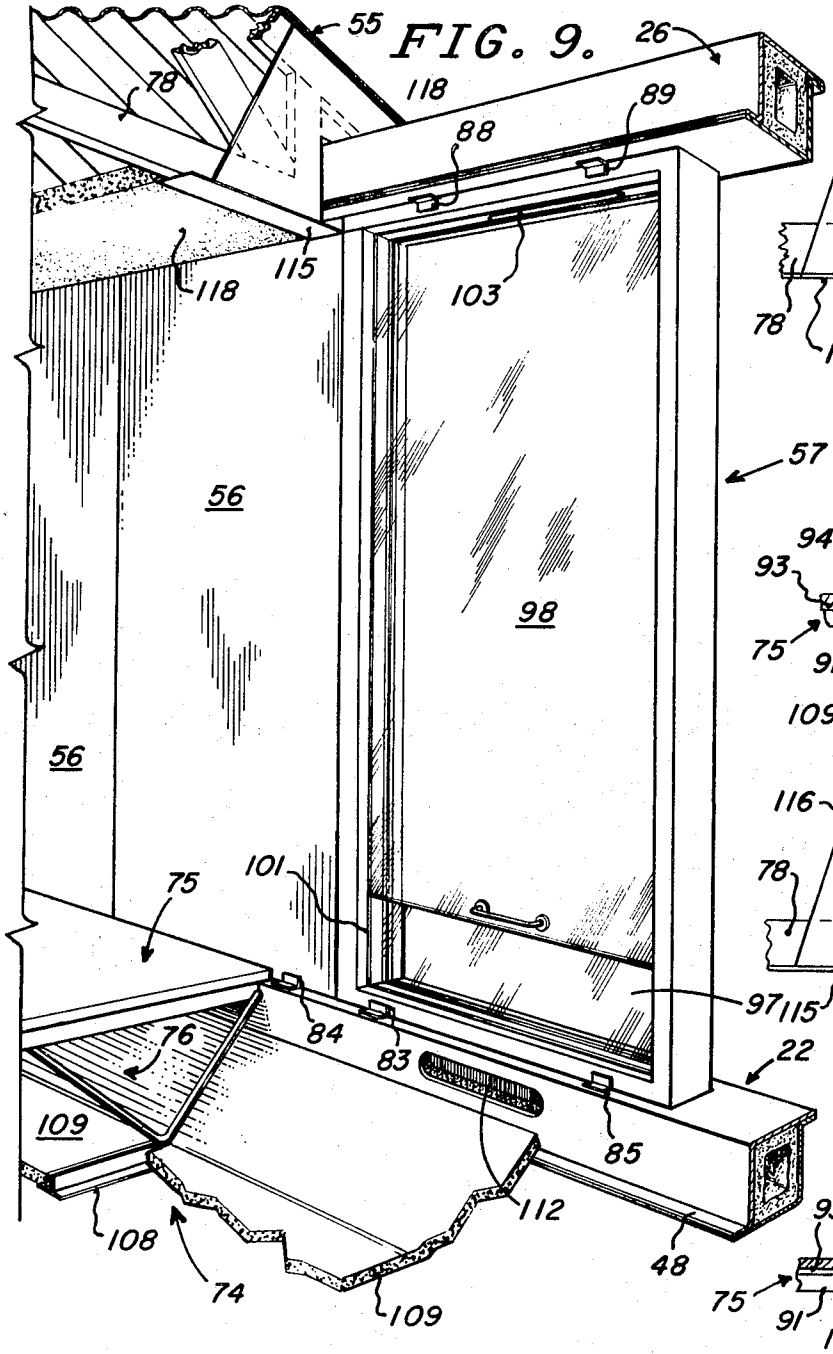


FIG. 10.

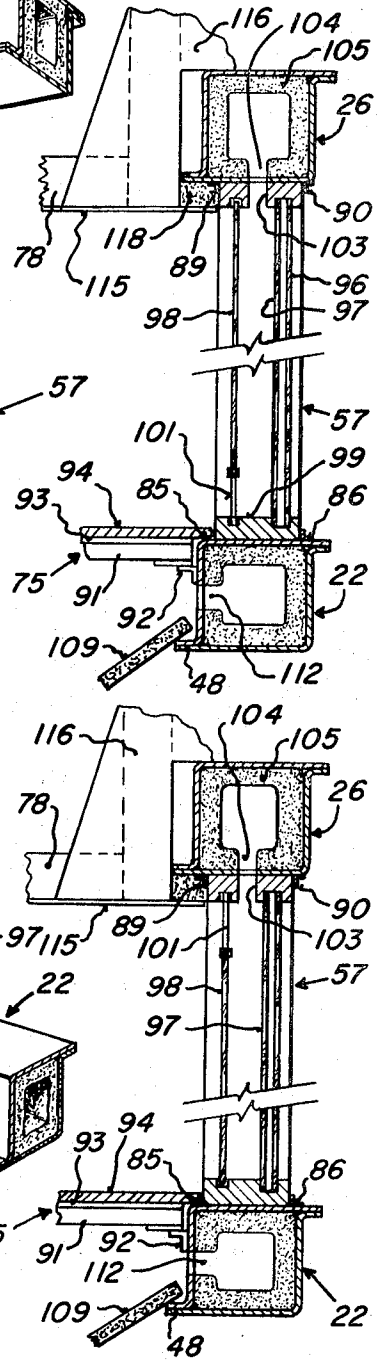


FIG. 11.

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PREFABRICATED BUILDING

BACKGROUND OF THE INVENTION

Due to large movements and shifting of population and the increasing need for converting residential areas to other uses, there is a need for a new type of housing construction in which houses can economically and practically be dismantled and moved away from an original building site and the houses can again be reassembled and erected at another site, when future area planning dictates such a demand. Such new type housing should be comfortable and of a durable type of construction which is comparable in size, shape and quality to conventional permanent homes. This need is strongly evidenced by the rapid growth of mobile type homes and mobile home parks in the environs of modern cities, which parks and mobile homes lend themselves to temporary establishment and which can economically be cleared away.

While considerable effort has been expended in developing housing constructions which can be partially or wholly prefabricated, many of the proposed types of housing constructions suffer from various drawbacks. In some cases, they are quite limited as to size since their construction requires that they be assembled prior to shipment and there is a practical limitation to the size of building that can be transported to a desired building site. In others, there is a limitation as to the terrain upon which they can be mounted. Furthermore, in the case of many of these housing constructions, there is inadequate provision for properly heating and cooling the units.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a type of housing which compares in quality and size to many conventional types of houses and which is made of components which can be completely factory manufactured and finished and easily handled and delivered to a building site where they can be readily and easily erected and assembled by a minimum number of unskilled and inexperienced workmen using simple equipment and hand tools. The housing construction of the present invention thus is designed to permit its erection by the prospective home owner with a minimum of assistance.

It is further an object of the present invention to provide a housing structure which can be readily disassembled and removed from the building site without destroying the building components so that the same components can be used elsewhere.

It is also an object of the invention to provide a building construction which can be readily constructed on uneven terrain without the necessity of expensive fottings or excavation.

It is also an object of the invention to provide a building construction in which a heat transfer medium is not only circulated beneath the floor to radiantly warm the same but also between spaced panels of the outer walls so that the temperatures of the floor and the interior surfaces of the outer walls tend to approximate the desired interior room temperatures.

It is a further object of the invention to provide a construction in which some of such outer panels are windows so that the inner window panes tend to be maintained at a temperature approximating the inside temperature of the room to avoid condensation on the inside of the window panes.

It is also an object of the invention to provide an arrangement in which the heat exchange medium, where it is air, can pass into the room at either the bottom or the top of the inner panel.

To accomplish the above objects, I provide a construction in which there are lower and upper horizontal frame members supported by a plurality of vertical parallel posts supported at their lower ends on the ground and disposed so that they engage the outer peripheries of the upper and lower frame members at a plurality of points. Adjustable clamping means is provided for adjustably securing the frame members at any desired vertical position to the posts so that the frame members may be maintained in a horizontal position regardless of whether the lower ends of the posts lie in a horizontal plane. The means for adjustably clamping the lower and upper horizontal frame members to the vertical posts preferably is in the form of a frictional clamp so as to permit small degrees of adjustment.

The vertical posts may either be supported in the ground by the usual footings or may be pivotally connected to bearing plates which rest on the ground and carry the weight of the post and the structures supported thereby. The pivotal connection preferably takes the form of a universal joint so that the post can assume a vertical position regardless of the slope of the ground on which it is supported.

The lower and upper horizontal frame members have peripheral frame elements which are structurally integral so that stresses applied at the support point are transmitted and distributed throughout the periphery of each of the horizontal frames. While it is important that the peripheral frame elements be held together firmly, I provide detachable connections between these peripheral frame elements which permits the peripheral elements to be disassembled and yet permits them to be held together in such a manner as to be able to withstand twisting forces.

In order to provide a path for the circulation of a heat exchange medium with a minimum of additional structural element, at least some of the peripheral frame elements are hollow to provide longitudinal passages therethrough. In the specific form of my invention, all of these elements are hollow to permit passage completely around the periphery of each frame member. These peripheral frame elements may be formed by providing two members, generally L-shaped in cross-section, and rigidly securing them together to provide the hollow space therein.

To provide the circulation of air through the outer walls, I provide panel members which are detachably held between the upper and lower peripheral frame members and at least some of which contain spaced panels communicating with the peripheral passages in the frame members. Some of these panels may be window panes. The inner panel or pane may be somewhat shorter and may be vertically adjustable to permit exit of the air at the top of the inner panel for cooling and at the bottom of the inner panel for heating.

As part of the means for circulating the heat exchanger medium, I provide plenum channels beneath the floor to form a plenum chamber. These are supported by the peripheral frame members and can be assembled with a minimum of additional structural elements.

Other objects of the present invention will be apparent from a consideration of the accompanying specification, claims and drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view showing the frame construction of my improved building construction including the upper and lower frame members and the vertical posts;

FIG. 2 is a perspective view of a portion of one of the vertical posts and a portion of one of the peripheral frame elements of one of the frame members showing the manner in which the frame element is peripherally clamped to the vertical posts and also showing in greater detail, the pivotal connection between the vertical post and a bearing plate adapted to rest on the ground;

FIG. 3 is an exploded view showing the connection between two of the peripheral elements of one of the frame assemblies;

FIG. 4 is a horizontal sectional schematic view of a completed residential building in accordance with my invention, the section being taken along the line 4—4 of FIG. 5;

FIG. 5 is a front elevational view of the building shown in section in FIG. 4;

FIG. 6 is a side elevational view of the same building;

FIG. 7 is a vertical sectional view of a building structure in accordance with my invention showing the manner in which the building is supported on uneven ground and showing the roof and floor construction;

FIG. 8 is a fragmentary view showing how the vertical posts can be supported in a concrete footing in the ground rather than by the bearing plates;

FIG. 9 is a perspective view of a portion of the ceiling, floor and side wall panel construction including one of the window panel consturctions in which portions are broken away to more clearly show the relationship of the various parts;

FIG. 10 is a sectional view of one of the winding panel assemblies showing the inner window pane in the raised position in which it is placed during the heating season;

FIG. 11 is a view similar to FIG. 10 but with the inner window pane lowered as it is during the cooling season; and

FIG. 12 is a diagrammatical view showing the path of heated air when the heat exchange medium is air and this air is being heated.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, it will be noted that there are four vertical posts 12, 13, 14 and 15. These posts are supported on the ground by bearing plates 16, 17, 18 and 19, respectively. The four posts 12, 13, 14 and 15 support two peripheral frame members designated in their entirety by the numerals 20 and 21, frame member 20 constituting the lower frame member which supports and forms part of the floor structure and frame member 21 the upper frame member which supports and forms a part of the ceiling structure and the roof. It is to be appreciated that where a two-story building is desired, the vertical posts 12–15 can be of such height as to accommodate a third frame member. In such case, the frame member 21 would constitute the supporting structure for the floor of the second story.

Each of the frame members 20 and 21 is formed of four peripheral frame elements. In the case of frame member 20, these are designated by the reference numerals 22, 23, 24 and 25. In the case of frame member 21, the corresponding peripheral frame elements are elements 26, 27, 28 and 29. As best shown in FIGS. 2 and 10, each of the peripheral frame elements is formed of two longitudinal elements 31 and 32 generally L-shaped in cross-section and having terminal flanges which are secured together as by welding. The result is a beam having very substantial strength which is, at the same time hollow. This beam as will be pointed out acts as a conduit for the circulation of a heat exchange medium and preferably has openings (not shown in FIG. 1) for passing said heat exchange medium into various heat exchange passages at selected points. Also, as shown in other figures, such as FIGS. 9, 10, and 11, these passages are provided with insulation to avoid excessive transfer of heat between the inside and outside of the ducts and to avoid condensation on the surface of the ducts. As best shown in FIG. 2, in connection with peripheral frame member and vertical post 13, each of the frame members has associated therewith a clamping means 33 for frictionally clamping the element 22 to the post 13 at any desired elevation. While this frictional clamping means may take various forms, it is shown in FIG. 1 as including two horizontal plates 34, 35 which are rigidly secured to the upper and lower surfaces of element 32 as by welding. These plates have upper and lower notches therein designed to receive the vertical post 13. Secured to their outer ends are a plurality of plates 36 and 37 which cooperate with an outer clamping plate 38 designed to be tightened against the post by means of a plurality of nuts and bolts or other suitable screw-threaded fastening means. The bolts extend through the outer plate 38 and either are threaded into aligned openings in plates 36 and 37 or cooperate with nuts disposed on the inner sides of those plates. As the nuts or screws are tightened, the post 13 is clamped firmly between plate 38 and plates 34 and 35. Preferably, the inner edges of the notches of plates 34 and 35 are aligned with the outer upper flange of element 22 so that the post 13 is also clamped against this flange.

The manner in which the vertical posts are pivotally secured to the bearing plates is also illustrated in FIG. 2 in connection with post 13 and bearing plate 17. It will be noted that there are two triangular plates 40 secured to the opposite side of the lower end of post 13 and a pivot pin 41 extends through these two plates 40 and through a block 42 which, in turn, is pivotally secured to two vertical plates 43 and 44 rigidly secured to the bearing plate 17. It will further be noted that the plates 42 and 43 are disposed pernepdicular to the plates 40 so that the pivotal axis on which block 42 is supported by plates 43 and 44 is at right angles to the pivot pin 41 extending through plates 40 and block 42. The result is that there is a universal connection between the post 13 and the bearing plate 17. As a result, it is possible to have the bearing plates resting on ground inclined in any direction and still have the posts vertical.

Referring to FIG. 3, I have shown the connection between peripheral frame elements 24 and 25 in an exploded view. It is to be understood that where it is readily possible to ship the frame members 20 and 21 in assembled relation, the peripheral frame elements may

be welded together at the factory so that the frame elements are transported as a single unit. In the case of large buildings or in remote areas where it is difficult to transport a large frame member extending over the entire floor area of a building, it is desirable to have the peripheral elements detachably secured together. Since, however, the peripheral frame elements must be very rigid to withstand twisting stresses, it is imperative that this joint be one which resists any twisting forces. It will be noted that frame element **24** has two vertical bars **46** and **47** recessed therein and extending through openings in the lower flange **48** of element **24.** The bars **46** and **47** are rigidly secured to the element **24** as by welding. The openings **49** and **50** in the lower flange **48** are of a size to also accommodate two bars **45** and **51** which are rigidly secured to the element **24.** The outer bar **51** extends through a notch in the upper flange **52** of element **25** so that the face of bar **51** facing element **24** is flush with the end of element **25.** Bar **45** is secured to the side of element **25.** Thus, both bars **45** and **51** are flush with the end of peripheral element **25.** Bars **46, 47, 45** and **51** have a plurality of aligned bolt openings therein. In assembling the units, the lower ends of bars **45** and **51** secured to element **25** are passed through the openings **49** and **50** in flange **48** to bring the bars **45** and **51** into abutting engagement with bars **46** and **47** and with the bolt holes in such bars aligned. Since the outer faces of bars **46** and **47** lie in the same plane as the inner surface of the main portion of element **24,** it will be obvious that the end of element **25** is in engagement with the inner surface of element **24.** Bolts are now inserted through the aligned opening in bars **46, 47, 45** and **51** and by the use of nuts, the bars **46** and **45** and bars **47** and **51** may be clamped together to clamp the structure firmly together. The lower end of beam **25** will rest on the flange **48** further increasing the rigidity of the structure.

As is obvious from FIGS. **2** and **3,** there is a hollow space through each of the elements. As previously pointed out, my invention contemplates that the peripheral elements will provide a continuous space around the frame for the circulation of a heat exchange medium. An opening **53** in the end of element **24** is provided, this opening being so disposed as to communicate with the longitudinal passage in element **25** when the latter is secured in abutting relation with element **24.** A suitable closure plug or plate **54** is provided at the end of element **24** to close the end and prevent the escape of heat exchange medium therefrom.

It will be seen from the description so far that when elements **24** and **25** are secured together in the manner just described, the longitudinal passages through these two elements are connected together so that a heat exchange medium can pass from one to the other. Furthermore, it will be seen that by means of the interlocking arrangement, it is possible to have a very rigid joint capable of withstanding very substantial twisting forces. This is due to the fact that the fastening means includes four spaced fastening points and also to the fact that bars **45** and **51** extend through the flange **48.** Furthermore, the engagement of flange **48** with the lower end of the beam further acts to produce an extremely stable and rigid joint.

Referring to FIGS. **4, 5** and **6,** there is shown therein an exterior, somewhat schematic view of a house employing my improved building construction. The view of FIG. **4,** while taken along the section line **4—4** of FIG. **5,** is somewhat schematic and is intended merely to show the general arrangement of a house employing the improved building construction of this invention.

Referring to FIGS. **4** and **5,** it will be noted that the four vertical posts **12, 13, 14** and **15** are visible from the exterior of the house. While these may be provided with ornamental covers, the nature of the house construction is such that they will project outwardly from the walls of the building. Referring specifically to FIG. **5,** it will be noted that the two frame members **20** and **21** are likewise visible as well as the bearing plates supporting the posts **12, 13, 14** and **15.**

The floor of the house is supported by the lower frame member **20** and the ceiling and roof **55** by the upper frame member **21.** There are also a plurality of side panel assemblies **56** which are interposed betwen the upper and lower frame members. The manner in which these are secured in place will be discussed later. Also interposed between the upper and lower frame members **20** and **21** are a plurality of window panel assemblies **57.** Each of these panel assemblies extends the full height from the lower frame member **20** to the upper frame member **21.** While they have been shown schematically as solid or consisting of single panels, these panel assemblies will normally comprise at least two panels providing a space therebetween for the circulation of a heat exchange medium. The structure of these panels will be discussed later in connection with FIGS. **9–12.**

As is evident from FIG. **4,** the floor structure can be laid out to provide any desired number of rooms. In the drawing, there are two bathrooms **59** and **60,** the latter communicating with the bedroom area **61.** There is also a kitchen **62** communicating with a dining alcove **63** which is an arm of a living room area **64.** There is a further bedroom **65** as well as a den **66.** The particular layout of the rooms forms no part of my present invention and the layout shown in FIG. **4** is merely illustrative of any of a variety of layouts which could be employed with the improved building construction of this invention. These rooms are formed by the use of removable wall panels **67** which can be removed either to alter the room arrangement or to disassemble the building. Since the wall panels **67** are not load bearing panels, they can be shifted in position without disturbing other portions of the building. These wall panels can be secured in the desired position by any suitable fastening means such as clips, not shown.

In order to further facilitate the ease with which the building can be assembled from already prepared parts, there is employed precast concrete steps **68** and **69** in front of the front and back doors, respectively. These steps can be selected to conform with the height of the entrances when installed.

It will be noted that there are special panels **71** and **72** in which the front and back doors are installed. These panels can be complete with prehung doors so that upon the panel being placed in position, no further work needs to be done in connection with the installation of the doors.

It will also be noted that there is a wall **74** extending below the lower frame member **20.** The construction of this plenum wall **74** will be discussed in more detail later. This wall is the lower wall of a plenum chamber through which heated air blows when the building is being heated. Thus, even though there is no basement

and the building is supported above the ground, the floor will remain relatively warm, as explained later.

Referring now to FIG. 7, there is shown a layout of the ceiling, roof and floor constructions. In FIG. 7, it is also shown how the bearing plate construction enables the building to be put up even though the ground is not level. It will be noted that bearing plate 17 supporting post 15 is at a somewhat higher level than bearing plate 19 supporting vertical post 13. Furthermore, the ground supporting the plate 19 is somewhat inclined. The post 13 can still, however, be vertical.

The floor 75 of the building construction is supported from the lower peripheral frame members 22 and 24 by truss assembly 76 extending between these elements. The plenum wall 74 is supported from these truss assemblies 76.

The ceiling 77 is supported by beams 78 forming the lower chord members of a roof truss structure 79 extending between and supported by the peripheral elements 26 and 28 of the upper frame member 21. The roof structure will be discussed further in connection with FIGS. 9–11.

While I have shown the use of bearing plates for supporting the lower ends of the posts and this method is normally preferable where building materials are not conveniently accessible, it may be desirable in certain cases, particularly where the building is to be relatively permanent, to embed the vertical posts in concrete in the ground. This method is shown in connection with FIG. 8 in which the post 15 is shown as embedded in concrete 81, the concrete filling the space in an excavation around the post 15. Even here, the advantages of my particular construction are still present in that it is not necessary to insure that the bottoms of the posts 13–15 are all at the same level. It is imperative, however, where the posts are secured in concrete as in FIG. 8, to maintain the posts in a vertical position until the concrete has set.

Referring now to FIGS. 9, 10 and 11, there are shown certain details of construction particularly pertaining to the way in which the plenum chamber is made, the panel assemblies are mounted and the ceiling is supported. Referring specifically to FIG. 10, I have shown a portion of the front wall of the housing including peripheral elements 22 and 26 and a plurality of solid panels 56 and one window panel 57. All of these panels are held in position by a series of angular brackets 83, 84, 85 and 86 at the bottom and a similar series of clips 88, 89 and 90 at the top. While only three brackets are shown inside of the panels, it is to be understood that there are a number of these brackets along the length of each peripheral member. As shown in FIGS. 10 and 11, there are also inner and outer brackets on both the upper and lower beams. The majority of the brackets 83, 84, 85, 86, 88, 89 and 90 are rigidly attached to the associated peripheral beam and the panels are secured in position by simply sliding the panel sidewise in between these beams. Thus, considering the portion of the wall shown in FIG. 9, the two panels 56 are slid into position and then the window panel 57 is similarly slid into position. It will be obvious, however, that certain of the bradkets will have to be removable in order to permit a final panel section to be placed in position. This may be accomplished by providing screw openings in the legs of the bracket mounting on the beam 22 so that these brackets may be removed and reinserted after the panel is in position. Preferably, this should be done in connection with all of the brackets on one side for any one panel section.

As is evident from FIGS. 10 and 11, there are a plurality of trusses 76 which extend across the lower frame member 20, being supported by the frame member at opposite ends of the trusses. Each of these two spaced T-beams 91 and 108 which respectively constitute the top and bottom chord members of the truss and are interconnected by the usual diagonal strut members secured to the beams 91 and 108 as by welding. These trusses are supported by the beams 91 which may be supported on the peripheral beams in any suitable manner as by means of brackets 92. Each of the T-beams 91 and 108 while shown as a unitary T-beam, is actually, as is used with such trusses, two angle members secured back to back with the strut members extending between them, and welded to both angle members so that the angle members collectively act as a T-beam. The floor 75, which rests on the beams 91 is preferably provided with a sublayer 93 and a final layer 94, which collectively constitute the floor 75. Layer 93 may constitute the floor proper whereas layer 94 forms the floor covering and may, for example, take the form of carpeting.

It will be noted from FIG. 9 that the floor covers the brackets that retain the panel sections in place. Only bracket 84 is visible in connection with the right-hand panel 56 in FIG. 9. As is best shown in FIG. 10, the panels are so disposed that they are obscured from sight by the floor covering 94 which abuts against the upstanding legs of the brackets. Thus, when the house is completely assembled, the brackets 83, 84 and 85 are not visible. As will be pointed out later, the same is true of the upper brackets since they are covered by the ceiling panel board.

As best shown in FIGS. 10 and 11, the window panel assembly 57 consists of three window panes 96, 97 and 98 mounted in a window frame 99. The window panes 96 and 97 are preferably sealed into the frame so as to provide an air space therebetween and thus to hinder the transmission of heat through the panes. The inner pane 98 is mounted in the frame so as to be slidable in a groove 101. While only the groove on the left-hand side of pane 98 is shown, it is to be understood that there is a similar groove on the right-hand side. In FIGS. 9 and 10, the pane 98 is shown in raised position with the upper end thereof abutting a horizontal groove in the upper portion of the window casing 99. This is the position assumed during the heating period. In FIG. 11, the inner pane 98 is shown as lowered so that the lower edge abuts the bottom of the window casing, which is the position assumed when the building is being cooled. It will further be noted from FIGS. 10 and 11 that there is a passage 103 through the upper portion of the window frame 99 which passage communicates with an opening 104 in the beam 26. As noted, the interior of the beam has a layer of insulation 105 thereon to guard against heat loss through the beam and condensation of moisture thereon. Each of the peripheral beams is similarly insulated. The opening 104 in beam 26 communicates with an opening in the insulation 105 so that heated or cooled air passing through the interior of beam 26 can pass downwardly through the openings 104 and 103 into the space between the panes 97 and 98. During the heating period, the heat passes down the entire distance between panes 97 and 98 issuing into the room at the bottom of pane 98. The

complete path of circulation will be discussed in more detail later. During the cooling period, the cooled air passes into the room at the top of pane **98** so that it can move downwardly in the room.

As previously pointed out, the trusses **76** each include a T-beam **108** which constitutes the lower chord member of the truss. Disposed on the flanges of the T-beams **108** are a plurality of plenum wall panels **109.** Each plenum panel **109** has a turned-up portion **110** at its outer end extending diagonally upwardly and having its outer end resting on the flange **48** of the peripheral beam **22.** It will be understood that there is a plurality of such plenum panel members, each extending between and supported by the flanges of the T-beams **108.** The collective effect of the plenum panel members **109** is to form a planum wall **74** referred to previously and appearing in FIGS. **5, 6** and **7.** This plenum wall forms a chamber extending beneath the floor **75.** The chamber formed by the floor **75** and the plenum wall **74** communicates with various openings in the peripheral beams such as opening **112** in the peripheral beam **22.** These openings, as best shown in FIGS. **10** and **11,** communicate with the interior passage in the lower beam **22.** As will be pointed out later, the space beneath the floor is used as a return passage for heated or cooled air. The floor **75** is thus maintained at a temperature approximating the temperature which it is desired to maintain in the space.

The way in which the ceiling is supported is also best shown in FIGS. **9** and **10.** As has been previously discussed in connection with FIG. **7,** there are a plurality of truss structures **79** supported by the upper peripheral beams. The outer triangular portions **116** and **118** of the truss structures may rest upon and be supported by the tops of the peripheral beams to support the roof truss members. Secured to the underside of each beam **78** is a strip **115** which acts to provide flanges on each side of the beam. These flanges act to support a number of ceiling panel boards **118,** only one of which is shown in FIG. **9.** These ceiling panel boards may be of a common type used to form insulating ceilings. It will be noted from the position of ceiling panel **118** in FIG. **9** and the brackets **88** and **89** that when these ceiling panels are placed in position, the brackets **88** and **89** are covered by the ends of the panels so that the upper brackets **88** and **89** likewise are not visible from the interior of the room.

Referring now to FIG. **12,** there is shown the general path of circulation of the heat exchange medium when the heat exchange medium is air that is heated for heating the building. A suitable furnace **118** is provided for heating the air. It is to be understood that this furnace includes means such as a blower for circulating the air. The heated air passes through a main delivery duct **119** which is connected with the interior of one of the peripheral beam members, for example, beam **28.** As previously explained, the peripheral beam members all have longitudinal passages therethrough which are interconnected so that the heated air is able to pass around the periphery of the upper frame structure. Due to the fact that all of the beam members are thoroughly insulated, the heat loss is relatively minimal. Spaced around the periphery of these peripheral beams, as previously explained, are a plurality of hollow panel assemblies **56** and **57, 56** being the ones with opaque panels and **57** being the one in which the panels are window panes. While the air may be circulated through panel assemblies having opaque panels, provided that a suitable opening is provided at the bottom or top of the panel, it is particularly desirable to circulate the air through the window panel assemblies so as to minimize fogging of the window such as occurs when the window is at a substantially different temperature than the interior of the house. The air thus may pass through beams **28, 29** and **26** down through the space between the panes of window panel assembly **57.** As previously explained, the inner window **98** is in its uppermost position when heating is desired. Consequently, the warm air passing down between the window panes issue into the room out of the space at the bottom of window **98.** Since the air is relatively warm, it immediately rises and moves across the room, descending at the opposite wall and passing through a cold air register **120.** This air is then conveyed through the plenum chamber formed by the wall **74** and floor **75** back to an adjacent peripheral beam **22** from which it can travel through the whole peripheral frame member and back to the furnace **118.** I have illustrated the path of flow of the heated air by a dotted line with arrows in connection with one particular room of the house. It will be obvious that similar paths of air flow can be produced in connection with other rooms. Thus, in connection with the room to the left of that shown, there is a cold air register **121.** Similarly, air can pass down through a panel assembly along the outside wall of this room and follow the path traced above in connection with the room on the right-hand side of FIG. **12.**

If cooling is to be provided, the furnace unit **118** will also incorporate cooling means and the blower will be used to circulate cool air through the duct **119** and the passages in the peripheral outer beam. As shown in connection with FIG. **11,** the inner window **98** is lowered so as to leave a space between the top of the window **98** and the ceiling. The cool air issuing out of the passages in the peripheral ducts passes out over the top of the window near the ceiling and descends through the room and out through the register **120.** Otherwise, the path of circulation of the cool air is the same as with the heated air. By having the cold air exit at the top of the window rather than at the bottom, the circulation is improved in that the tendency for cold air to fall is taken advantage of. During the heating period, however, the air issues at the bottom of the window and the natural tendency of heat to rise is taken advantage of.

While I have shown the inner windows as sliding, it will, of course, be appreciated that other means could be employed for selectively providing an opening at the top or bottom of the inner window. For example, there could be small sections of pane at the top or bottom which could be folded back upon the main portion of the window to provide an opening. This method would be particularly desirable in connection with the opaque panels of panel assemblies **56.** With this technique, the air entering the space between the panels could be allowed to leave either at the bottom or the top depending upon whether the upper hinged panel or lower hinged panel was open.

CONCLUSION

It will be seen that I have provided a building construction which permits a building to be quickly erected and which uses prefabricated parts, none of which are too bulky for shipment. It will also be seen that because of the fact that even the peripheral frames

can be disassembled, there is not the limitation on the size of the building that is inherent in buildings in which large sections are prefabricated and shipped in assembled form. Furthermore, the manner in which the floor and ceiling frames are adjustably supported in my housing construction permits it to be assembled on irregular ground with a minimum of excavation.

Unlike some buildings which are quickly assembled on the site, the building construction of my present invention provides for both heating and air conditioning and has provision for the circulation of heating or cooling air with a minimum of additional ductwork, the major portion of the ductwork being formed as an integral part of the building elements.

It will furthermore be seen that with my building construction, the side walls function both as walls and also as means for circulating the heated or cooled air. The window assemblies of my consturction are relatively free from condensation of moisture since the heated air is circulated between panes of the window.

In general, while I have shown certain embodiments of my invention, it is to be understood that this is for purposes of illustration only and my invention is limited solely by the scope of the appended claims.

I claim as my invention:

1. A building comprising:

a rigid frame unit comprising upper and lower horizontal rectangular frame members,

four rigid vertical posts of generally rectangular outline supporting said rectangular frames in vertically spaced relation,

each rectangular frame including a pair of spaced parallel longitudinal members and spaced parallel transverse members connected rigidly at their ends to form the corners of the rectangular frame,

said posts engaging the outer peripheries of the longitudinal members of said frames, two on one side and two on the opposite sides of said horizontal frames, said posts being equally spaced from said transverse members to support the ends of said horizontal longitudinal members and said transverse members in cantilever relation to the portions of said longitudinal members between said posts,

four adjustable clamping means for clamping each of said upper and lower rectangular frame members to said rigid vertical posts,

each clamping means including a pair of vertically spaced bracket plates rigidly secured to the upper and lower surfaces of said longitudinal members and extending outwardly therefrom, the outer portions of said plates being notched to snugly engage on opposite sides of one of said vertical posts, the bases of the notches engaging the sides of said vertical posts most closely adjacent to said rectangular frames,

vertically extending coplanar connecting plates rigidly connecting the outer ends of said vertically spaced plates on opposite sides of said notch to provide a contact coupling between said vertically spaced plates on opposite sides of the corresponding vertical post,

a clamping plate engaging the outer surface of the corresponding post and secured by vertically spaced adjustable fastening means to said connecting plates, holding said post engaged in said notches of said vertically spaced plates,

each said clamping means being rigid and resistant to angular deflection due to side forces on said building between said frame and said post in two principal vertical planes at 90° to each other, said rigidity and resistance to angular deflection due to forces applied to said building on a plane parallel to said longitudinal members being provided by stresses of a resisting force couple generated by a pressure of contact between one edge of the notch in the upper horizontal plate on one side of said post and an equal pressure of contact oppositely directed on the opposite side of the notch in the lower horizontal plate on the opposite side of said post,

said resistance to angular deflecting due to forces applied in a direction transverse to said horizontal frames being provided by stresses of a resisting force couple generated by a spacing of points of application along the vertical dimension of the post and pressure of contact between the said post and the base of the notch in the upper or lower bracket plate and equal pressure on contact with the post oppositely directed between a vertical extremity of the clamping plate which is opposite that of said bracket plate.

2. The structure of claim **1** and in which said longitudinal members are hollow and rectangular in section and torsionally stiff to support said transverse members.

3. The structure of claim **2** and in which said transverse members are hollow in cross-section and torsionally stiff to prevent relative angularity between said longitudinal members.

4. The structure of claim **1** and in which said connecting plates and said clamping plates extend vertically beyond said vertically spaced bracket plates.

5. The structure of claim **23** and in which said vertically spaced adjustable fastening means are above the level of said upper bracket plates and below the lower bracket plate, respectively.

6. The structure of claim **1** and in which said posts are spaced at such points on said longitudinal member that the bending moment in the span of said longitudinal members intermediate said posts, due to vertical uniform live loads on said building is equal to the bending

in the cantilever overhang outward from said posts, due to said vertical uniform live loads on said building.

7. The structure of claim **1** in which said longitudinal members are hollow, square in section, and torsionally rigid, said configuration being to accommodate stresses due to overturning moments applied to said posts due to side loads on the building, said torsional stresses being transmitted from the point of said clamping means outwardly longitudinally to said transverse members, said rigid corner connections and said transverse members resisting said overturning moments.

8. The structure of claim **6** in which said longitudinal members are hollow, square in section, and torsionally rigid, said configuration being to accommodate stresses due to overturning moments applied to said posts due to side loads on the building, said torsional stresses being transmitted from the point of said clamping means outwardly longitudinally to said transverse members, said rigid corner connections and said transverse members resisting said overturning moments.

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