United States Patent

Walz, Jr. et al.

[15] **3,683,571**

[45] **Aug. 15, 1972**

[54] **BUILT-IN LIFT ASSEMBLY FOR BUILDING**

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[22] Filed: **Nov. 3, 1969**

[21] Appl. No.: **874,091**

[52] **U.S. Cl.** .....**52/125**, 52/79, 52/745, 294/67 R

[51] **Int. Cl.**.....**E04b 5/58**, E04h 1/12

[58] **Field of Search**.....52/64, 79, 125, 745, 122; 214/38.42; 294/67.4 A, 67.4 B

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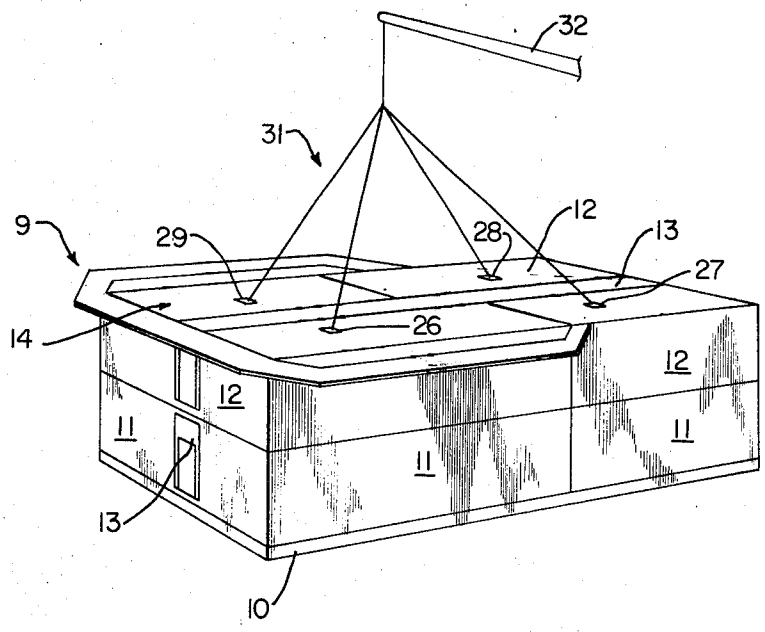
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[57] **ABSTRACT**

A lift assembly for portable buildings is integrated into the building structure to accommodate the lifting and relocation of the building. The lift assembly includes upright lift members secured at selected locations inside the building having upper connector portions defining plural spaced lift stations accessible through the top of the building together with an internal spreader frame arranged between the lift members formed as an integral part of the roof to distribute the lifting forces. Each lift member preferably extends to the base of the building and is rigidly anchored thereto.

11 Claims, 9 Drawing Figures



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SHEET 1 OF 3

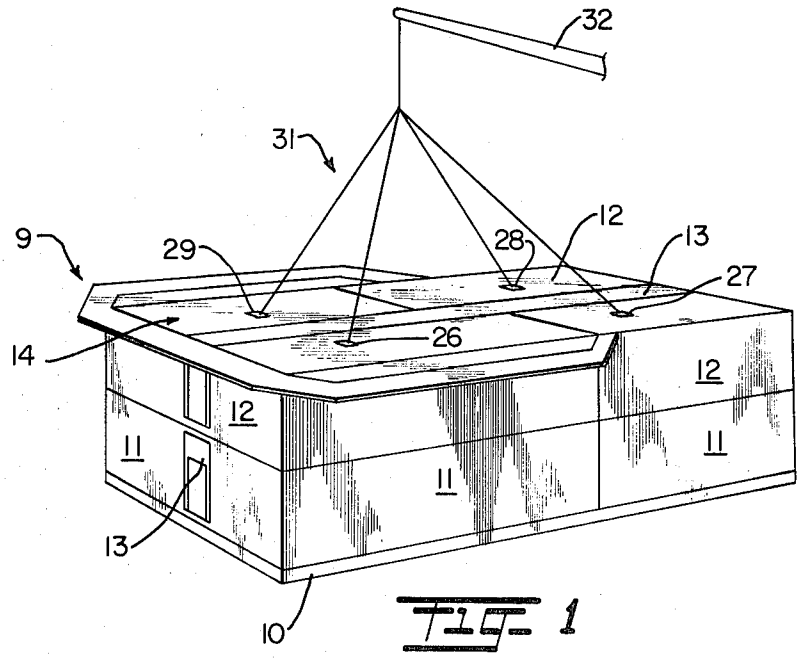


FIG. 1

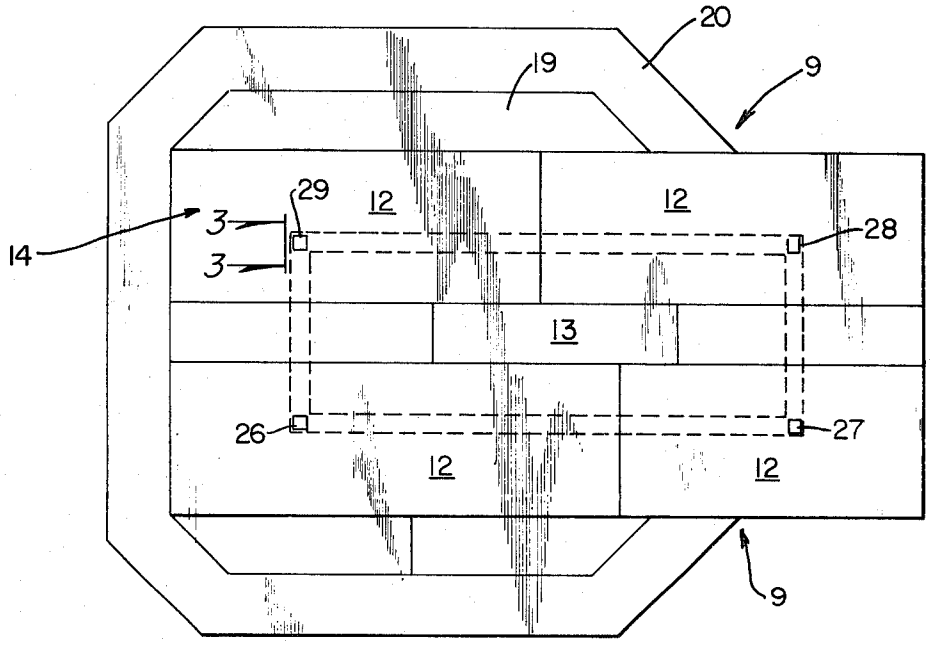


FIG. 2

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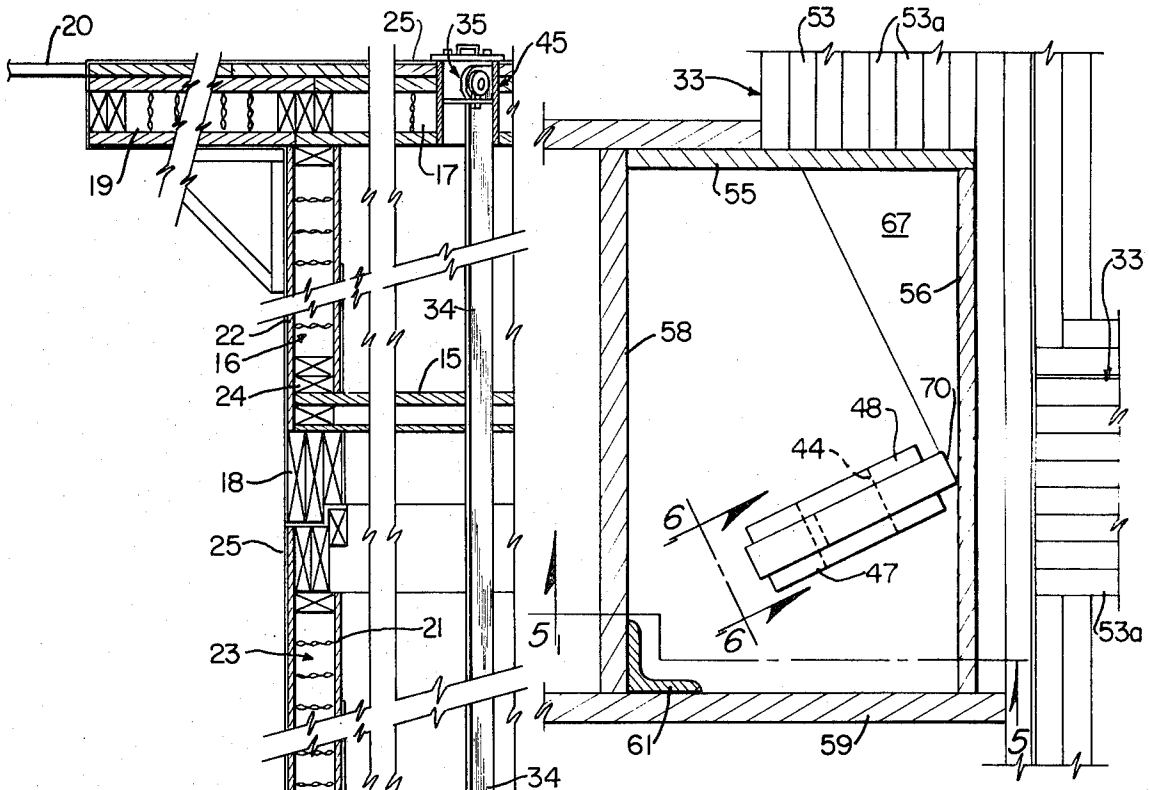


FIG. 3

FIG. 4

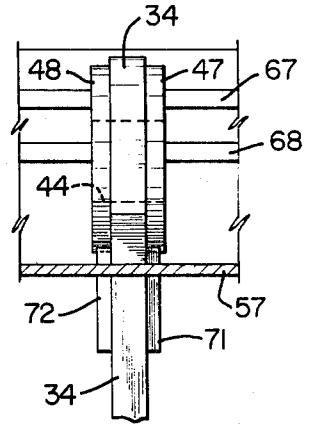


FIG. 6

FIG. 5

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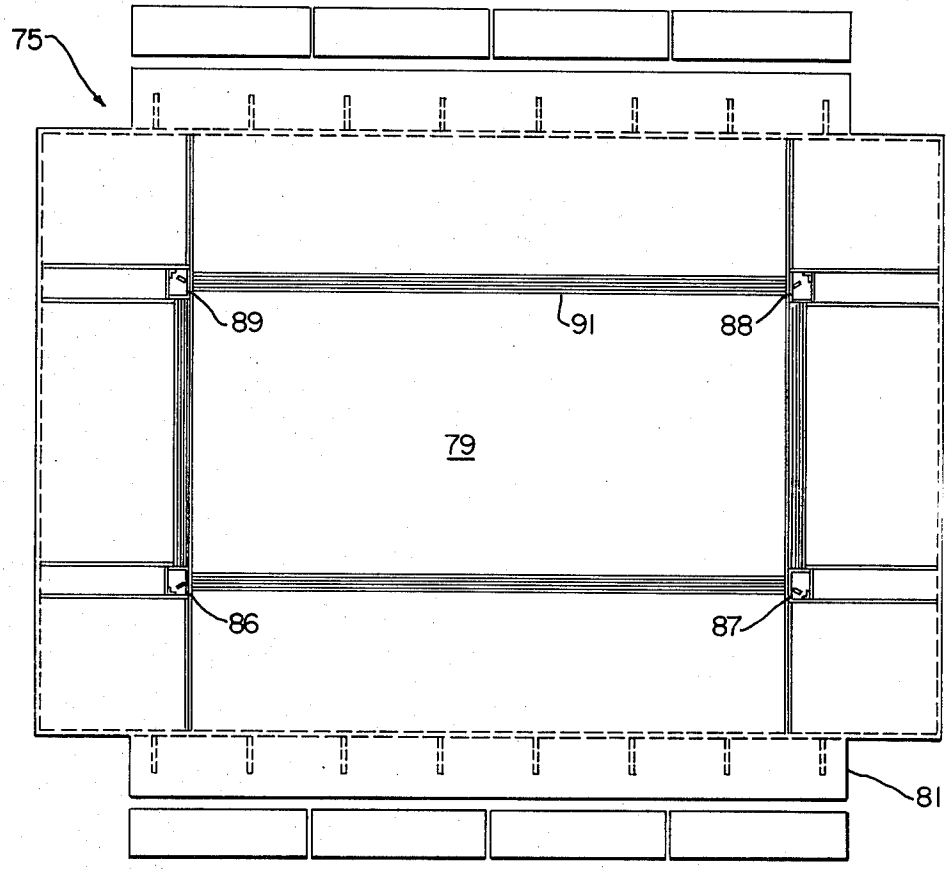


FIG. 8

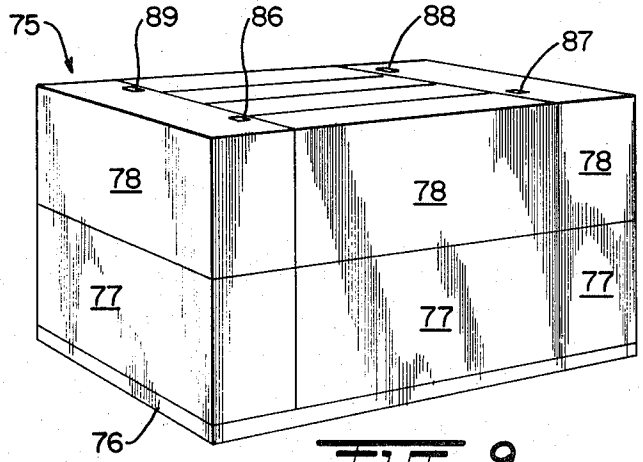


FIG. 9

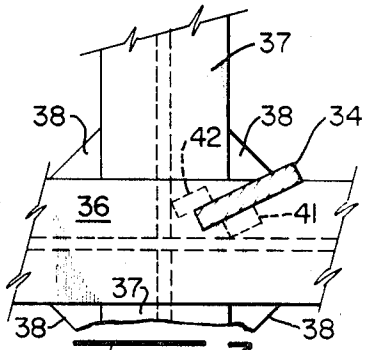


FIG. 7

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BUILT-IN LIFT ASSEMBLY FOR BUILDING

This invention relates to portable building structures and more particularly to a built-in lift assembly for prefabricated buildings in the relatively large, multi-story size range and is particularly applicable to prefabricated buildings with a landing deck suitable for off-shore drilling installations of the type described in a copending application entitled "Prefabricated Building Structure for Off-Shore Quarters and the Like" filed Jan. 21, 1969, Ser. No. 792,475, now U.S. Pat. No. 3,636,667 assigned to the same assignee.

As noted in the above-referred to application, prefabricated portable building structures formed of prefabricated sandwich-type panels comprised of a central honeycomb core and outer skin members covered with a non-porous coating such as fiberglass afford many advantages over the heavier metal structures, particularly for off-shore drilling operations. Typically, at offshore drilling locations there is available a boom for lifting and relocating various equipment including buildings. For smaller-sized, relatively lightweight buildings little difficulty is encountered in providing externally mounted lift devices which attach directly to either the roof or the base of the building thereby permitting them to be readily lifted and relocated by the boom and cable. However, for larger multi-room buildings, such as, those suitable for crew quarters as described in the above-identified application, such previously used lift device are not suitable because of the weights and excessive stresses produced in the building. One approach for such larger buildings has been to provide an external spreader frame at the lower end of the multiline lifting cable sling which will serve to reduce the horizontal compression forces.

Accordingly, it is an object of this invention to provide a novel and improved internal lift structure whereby a building can be picked up or lifted using a boom and multi-line cable assembly without the necessity of a cumbersome external spreader frame or like external, force-distributing mechanisms.

Another object of this invention is to provide a novel, built-in lift assembly for relatively heavy and larger-sized prefabricated portable buildings, such as, those suitable for use as off-shore living quarters with a flight deck which does not interfere with the normal use of the building.

A further object of this invention is to provide a novel and improved lift assembly for relatively large-sized, multi-story buildings wherein the assembly is generally characterized by spaced, upright lift members inside the building having upper ends recessed in the roof of the building to which the depending ends of a multi-line cable sling may be connected together with an internal spreader frame between the lift members and formed as an integral part of the roof of the building.

In accordance with the present invention, a plurality of spaced lift members define an integral part of a building structure with upper connector portions recessed in the top of the building to which the ends of a multi-line cable sling may be readily attached and released when top covers are removed as required; the lift members preferably extend throughout the vertical extent of the building and are preferably disposed inboard of the sides and ends and rigidly anchored at the base of the building, and cooperate with a spreader

frame formed as an integral part of the roof to distribute the lift forces applied to the upper connector portions.

Other objects, advantages and capabilities of the present invention will become more apparent as the description proceeds taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of a combined built-in lift assembly and two-story prefabricated eight-module building with a landing deck to which is connected a typical multi-line cable sling rigging which in turn depends from an overhead boom;

FIG. 2 is a top plan view of the lift assembly and building shown in FIG. 1 without the boom and cable rigging;

FIG. 3 is a fragmentary vertical sectional view taken along lines 3—3 of FIG. 2;

FIG. 4 is a fragmentary sectional view through the lift compartment illustrating an arrangement of the ends spreader frame beams relative to the lift compartment walls;

FIG. 5 is a sectional view taken along lines 5—5 of FIG. 4; and

FIG. 6 is an end elevational view of the connector portion taken along lines 6—6 of FIG. 4.

FIG. 7 is a fragmentary top plan view taken as a section through the lower end of the lift member showing the manner of anchoring it to the I-beam substructure of the building.

FIG. 8 is a top plan view of another embodiment of a combined lift assembly and building, the latter being comprised of twelve modular units in a two-story arrangement with a flight deck on top with the top coating of compartment covers removed to show the outline of the spreader frame;

FIG. 9 is a perspective view of the embodiment of FIG. 3 shown somewhat schematically to indicate the division between the modular units with the flight deck side outriggers removed for clarity.

Referring now to FIGS. 1–3 of the drawings, there is shown a typical prefabricated building 9 which is intended for use as off-shore living quarters the details of which are fully described in the above-referred-to copending application. For reference purposes the building structure associated with the lift assembly herein includes a lower, skid substructure or base 10 with four, lower-level modular room units each designated 11 and four, upper-level modular room units each designated 12 and a hallway 13 separating the units. A flight deck 14 is provided on top of the building. As best shown in FIG. 3, each modular unit comprises a floor panel 15, upright side wall panels 16 and the upper level units have a ceiling panel 17 which ceiling panels are secured together at joints at adjacent ends. A box-like skid 18 is provided under each lower level floor panel and the lower level skids rest on the base 10 in which is shown the form of a substructural skid framework of fabricated structural metal I-beams which are welded together.

Prefabricated wing panels 19 extend along the sides outwardly of the ceiling panels to form a part of the flight deck and a safety fence outrigger 20 extends around the wing panels and one end of the building. Each prefabricated panel comprises an at least inner and outer skin members 21 and 22 with a honeycomb

core 23 and joints 24 are sandwiched between the skin members being disposed both around its periphery and at spaced intervals in the interior thereof. An outer non-porous protective coating 25 preferably of fiberglass covers the exposed exterior surfaces of the assembled building.

The lift assembly, in general, comprises four spaced lift stations in the roof of the building designated 26, 27, 28 and 29 which are arranged about the center or midpoint of the building and are preferably disposed inboard of the sides and ends of the building, the lift stations being located in a generally rectangular array. In the form shown in FIGS. 1 and 2 the lift stations are located approximately midway between a center line longitudinally of the building and each of the sides. The inboard location of the lift stations provides a counterbalancing effect whereby the weight of the building on the substructure inwardly of the lift stations is counterbalanced by the weight of the building on the substructure outwardly of the lift stations. This feature facilitates a reduction in the size and weight of the substructure 10. These lift stations are adapted to provide pick-up points in the top of the building for the lower ends of a cable assembly 31 shown as a four-line cable sling attached to a common boom cable depending from a boom 32 located at the site whereby the boom cable and cable sling transmit the lifting forces to each of the four lift stations. An internal spreader frame generally designated by numeral 33 is formed of four beams arranged in an open, box-like configuration as an integral part of the roof below the outer non-porous covering with the lift stations located at each corner of the frame as described more fully hereafter.

As best shown in FIG. 3, at each lift station there is an upright lift member 34 in the form of a structural bar of an oblong cross-section vertically disposed inside the building having cable connector portion 35 at its upper end, and the lift bar preferably extends continuously from the connector portion downwardly along the side walls, through the floor panels and through the top flange of the side I-beam structure 36 forming base 10 and seats on the bottom flange. A transverse I-beam structure 37 abuts side beam 36 adjacent the bottom of the lift bar and is secured by welding and gusset plate 38, as best shown in FIG. 7. Filler bars 41 and 42 are provided between the upper and lower flanges of side beam 36 on each side of the bottom of the lift member for added strength and they are secured to the lift member and to the base beams as by welding.

The connector portion 35 is somewhat enlarged from that of the remainder of the bar and has an aperture 44 to facilitate its connection to the lift cable. Each connector portion 35 is encompassed in a closed compartment 45 which is arranged as corner structure in the spreader frame. Each lift member together with its connector portion is disposed along a diagonal line extending through the center or midpoint of the building to provide for balanced weight distribution. A pair of upper doughnut-shaped check plates 47 and 48 are provided on each side of the upper end of the lift bar as a part of the connector portion for added surface area and strength. Each lift member is rigidly secured at its upper end to the compartment walls to be described and this way the lift members 34 and internal spreader frame 33 cooperate to distribute the lifting forces applied to the upper connector portions by the boom and cables 31 and 32 to avoid undue compression and tension forces in the building during the lifting and relocation thereof by the boom.

The spreader frame 33 is comprised of four elongated fabricated beams 53 with the compartments being disposed at each corner juncture thereof to serve as corner structure between adjacent ends of a beam pair. Each beam is preferably comprised of a plurality of wooden members 53*a* of a conventional lumber size which is made up by stacking them side by side and securing abutting surfaces with an adhesive and/or bolts and then securing an inside wood member to a peripheral wood member on the prefabricated ceiling panel in a like manner, the height dimension of the beam and ceiling panel being approximately the same and in this way the beam is in effect integrated into the ceiling panel and is thereby an integral part of the roof of the building to provide a durable lift structure. The four beams 53 which are shown in dashed lines in FIG. 2 and in detail in FIG. 4 are initially made in sections corresponding in extent with the side edges of the upper level modular room units 12 and hallway units 13. Each beam section is integrated and built into the associated ceiling panel of that unit 12 or 13. In the assembly thereof into a unit, the ends of the beam sections are butted against one another or arranged end-for-end and are preferably secured with an adhesive to form the box-like beam configuration shown in dashed lines in FIG. 2.

Each compartment 45 comprises inner side plates 55 and 56 and a bottom plate 57 preferably made of metal plate and secured together at adjacent ends with the outer side walls 58 and 59 preferably of wood being further supported by an angle iron 61 in the outer corner thereof. A removable cover 62 shown with a lift handle 63 normally closes the top of the compartment and is detachably fastened in place by suitable fasteners such as bolts 64 disposed at suitably spaced positions and extending through the cover into nuts 65 inside the compartment. A gasket 66 is preferably provided between the cover and the top surface of the building to seal the compartment against the external weather elements.

Each lift member 34 is rigidly secured at its upper end to the inner compartment wall plates 55 and 56 and bottom plate 57 in a way to transmit a portion of the lifting forces from the lifting member to the spreader beams 53 adjacent the side plates 55 and 56. This attachment is made by securing spaced upper and lower triangular-shaped gusset plates 67 and 68 to the sides of the side wall plates which are provided alined slots 70 in the inclined edges thereof to receive a side portion of the lift member. The lift member extends through the bottom wall and check plates 71 and 72 are provided on each side of the lift bar which extend both above and below the bottom plate to provide added strength and provide a structure which may be readily welded together for adequate strength.

Referring now to the embodiment of FIG. 8 and 9 this form of portable building 75 has a skid substructure or base 76 with six lower level modular room units each designated 77 and six upper-level modular room units each designated 78 and with the roof forming a flight deck 79 having side outriggers 81 as shown in

FIG. 8. The arrangement of the modular units is to have four inner units disposed lengthwise of the building and one modular unit at each end thereof extending transversely of the building for both upper and lower levels.

This building has a lift assembly similar to that above-described with four lift stations **86, 87, 88** and **89** arranged in a rectangular array in the roof section thereof about the midpoint of the building. These stations and the lift members associated therewith are located in the laterally extending end modular units substantially inwardly or inboard of the outer side walls and end walls of the composite building and approximately midway between longitudinal center line of the building and the sides of the building. The compartments at each lift station are disposed at the corners of the spreader frame **91** in the roof of the building.

It is therefore to be understood that various modifications and changes may be resorted to in the preferred and alternate forms described and illustrated herein without departing from the spirit and scope of the present invention as defined by the appended claims.

What is claimed is:

1. In a portable building the combination comprising a roof section, upright wall sections and a base secured together at joints, a lift assembly to facilitate the lifting and relocating of the building including spaced, lift members secured at selected locations inside the building, said lift members extending downwardly through the roof section and anchored at their lower ends to the base, each said lift member having an upper connector portion adapted to connect to a lifting cable and a spreader frame having beams connected in an oblong open configuration extending between the upper connector portions with the lift stations being located at the corners of the frame, said roof section being made up of prefabricated panel sections within the frame and projecting outwardly from the side edges of the frame and integrally connected to the inner and outer side edges of the frame to form a built-in part of the roof section and locate the lift stations inwardly of the ends and sides of the roof section and wall sections of the building whereby the weight of the building on the base inwardly of the lift members is counterbalanced by the weight of the building outwardly of the lift members when lift forces are applied to said connector portions from above, said roof section and upright wall sections including upper and lower skin members having a honeycomb core and peripheral reinforcing beams sandwiched between said skin members together with an outer protective layer of fiberglass covering the exterior surfaces of said panels and said joints to define a non-porous exterior building surface.

2. In a portable building as set forth in claim **1** wherein said connector portions are disposed along diagonal lines extending through the center of the building.

3. In a portable building as set forth in claim **2** wherein said beams are composed of a plurality of wooden members laminated together side by side.

4. In a portable building the combination comprising a roof section, upright wall sections and a base secured together at joints, a lift assembly to facilitate the lifting and relocating of the building by lift forces applied from above the building, said lift assembly including a plurality of upright structural members disposed at selected locations inboard of the sides and ends of the building, each said structural member having an upper connector portion fixedly secured in a closed compartment in the roof section and accessible through a top opening in the compartment and extending vertically through the building along the wall sections thereof and being anchored to said base, a spreader frame having beams connected in an oblong open configuration and having one of said compartments at each corner thereof with the structural members being located at the corners of the frame, said roof section being made up of prefabricated panel sections within the frame and projecting outwardly from the side edges of the frame and integrally connected to the inner and outer side edges of the frame to form a built-in part of the roof section and locate the structural members inwardly of the ends and sides of the roof section and wall sections of the building whereby the weight of the building on the base inwardly of the structural members is counterbalanced by the weight of the building outwardly of the structural members when the lift forces are applied to said connector portions, said roof section and upright wall sections including upper and lower skin members having a honeycomb core and peripheral reinforcing beams sandwiched between said skin members together with an outer protective layer of fiberglass covering the exterior surfaces of said panels and said joints to define a non-porous exterior building surface.

5. The combination of a prefabricated portable building and a built-in lift assembly to facilitate the lifting and relocating of the building, said building including a plurality of interconnected, prefabricated modular units arranged with upper units on lower units and the lower units on a common base, each said modular unit including a prefabricated floor panel and prefabricated upright wall panels secured together at joints, each said upper unit having a prefabricated ceiling panel secured together at joints to the wall panels, said panels including inner and outer skin members and a honeycomb core sandwiched between said skin members and an outer protective layer covering the exterior surfaces of the panels and joints between said modular units to define a non-porous enclosure, said lift assembly including spaced, upright lift members at selected locations inboard of the sides and ends of the building and secured at their lower ends to the base, each said lift member having an upper connector portion recessed in a ceiling panel forming the roof for the building, and a spreader frame formed as an integral part of the roof and extending between the lift members whereby to cooperate with the lift members in distributing the lift forces applied to said connector portions.

6. The combination as set forth in claim **5** wherein said building has prefabricated wing panels extending from each side of the ceiling panels to form a flight deck on the building structure.

7. The combination as set forth in claim **5** wherein said building has the modular units on each level arranged end to end along the building and a lift member extends through each of the modular units adjacent an outer side wall thereof.

8. The combination as set forth in claim **5** wherein said building has modular units on each level arranged side by side along the building and an extending modu-

lar unit at each end thereof with the lift members extending through the laterally extending units adjacent the ends of the lengthwise modular units.

9. In a portable building the combination comprising a roof section, upright wall sections and a base secured together at joints, a lift assembly to facilitate the lifting and relocating of the building including spaced, lift members secured at selected locations inside the building, said lift members extending downwardly through the roof section and anchored at their lower ends to the base, each said lift member having an upper connector portion adapted to connect to a lifting cable and a spreader frame having beams connected in an oblong open configuration extending between the upper connector portions with the lift stations being located at the corners of the frame, said roof section being made up of prefabricated panel sections within the frame and projecting outwardly from the side edges of the frame and integrally connected to the inner and outer side edges of the frame to form a built-in part of the roof section and locate the lift stations inwardly of the ends and sides of the roof section and wall sections of the building whereby the weight of the building on the base inwardly of the lift members is counterbalanced by the weight of the building outwardly of the lift members when lift forces are applied to said connector portions from above, each said roof panel section including inner and outer skin members and a honeycomb core sandwiched between said skin members, each of said upper connector portions being recessed in a closed compartment in the roof section, each said compartment including inner side walls at right angles and engaging the corner of the frame and a bottom wall, each said compartment having a demountable, top cover to provide a normally covered top access opening to the connector portions.

10. In a portable building the combination comprising a roof section, upright wall sections and a base secured together at joints, a lift assembly to facilitate the lifting and relocating of the building including spaced, lift members secured at selected locations inside the building, said lift members extending downwardly through the roof section and anchored at their lower ends to the base, each said lift member having an upper connector portion adapted to connect to a lifting cable and a spreader frame having beams connected in an oblong open configuration extending between the upper connector portions with the lift stations being located at the corners of the frame, said roof section being made up of prefabricated panel sections within the frame and projecting outwardly from the side edges of the frame and integrally connected to the inner and outer side edges of the frame to form a built-in part of the roof section and locate the lift stations inwardly of the ends and sides of the roof section and wall sections of the building whereby the weight of the building on the base inwardly of the lift members is counterbalanced by the weight of the building outwardly of the lift members when lift forces are applied to said connector portions from above, each said roof panel section including inner and outer skin members and a honeycomb core sandwiched between said skin members, each of said upper connector portions being recessed in a closed compartment in the roof section, each said compartment including inner side walls at right angles and engaging the corner of the frame and a bottom wall, each said compartment having a demountable, top cover to provide a normally-covered top access opening to the connector portions, each said connector portion being rigidly secured to said side and bottom walls in its compartment to transmit lift forces along the spreader frame.

11. In a portable building the combination comprising a roof section, upright wall sections and a base secured together at joints, a lift assembly to facilitate the lifting and relocating of the building including a plurality of spaced, lift stations arranged at selected locations in the roof section of the building, each lift station including a lift member extending downwardly through the roof section and anchored at the lower end to said base, and a spreader frame having beams connected in an oblong open configuration extending between said lift stations with the lift stations being located at the corners of the frame, said roof section being made up of prefabricated panel sections within the frame and projecting outwardly from the side edges of the frame and integrally connected to the inner and outer side edges of the frame to form a built-in part of the roof section and locate the lift stations inwardly of the ends and sides of the roof section and wall sections of the building whereby the weight of the building on the base inwardly of the lift members is counterbalanced by the weight of the building outwardly of the lift members when lift forces are applied to said lift stations from above, said roof and upright wall sections including upper and lower skin members having a honeycomb core and peripheral reinforcing beams sandwiched between said skin members together with an outer protective layer of fiberglass covering the exterior surfaces of said panels and said joints to define a non-porous exterior building surface.

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