United States Patent [19]

Abrams, deceased

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[54] **PORTABLE BUILDINGS**

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[51] **Int. Cl.** **E04b 1/02,** E04b 7/02

[58] **Field of Search** ..... 52/93, 92, 90, 79, 293, 52/233, 639, 645, 641, 643, 753 C, 753 G, 754, 755, 756

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[57] **ABSTRACT**

The invention relates to a portable building that may have its individual building elements prefabricated at a suitable facility. The completed building elements are capable of being transported to a desired location for erection there. The building elements are suitable manufactured to meet the required building codes and accepted building practices.

3 Claims, 8 Drawing Figures

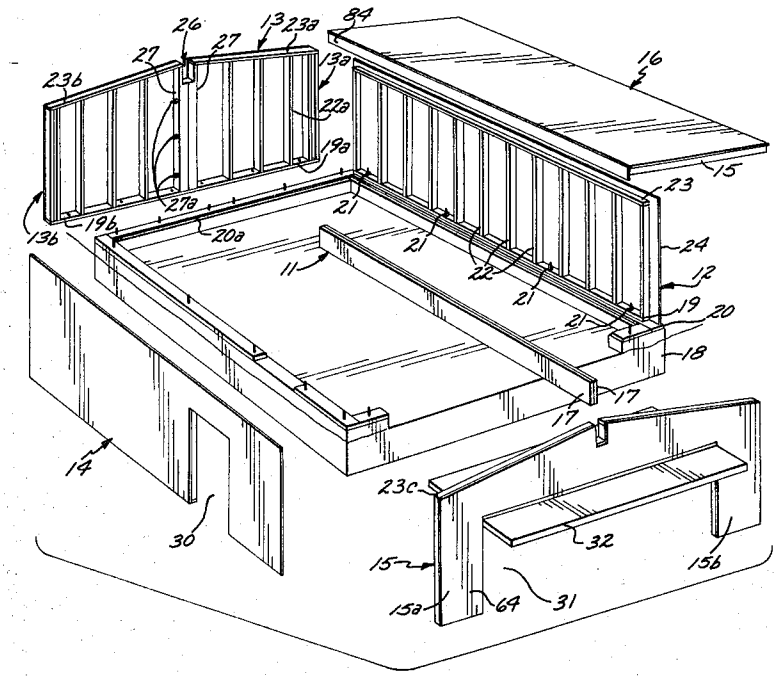


FIG. 1

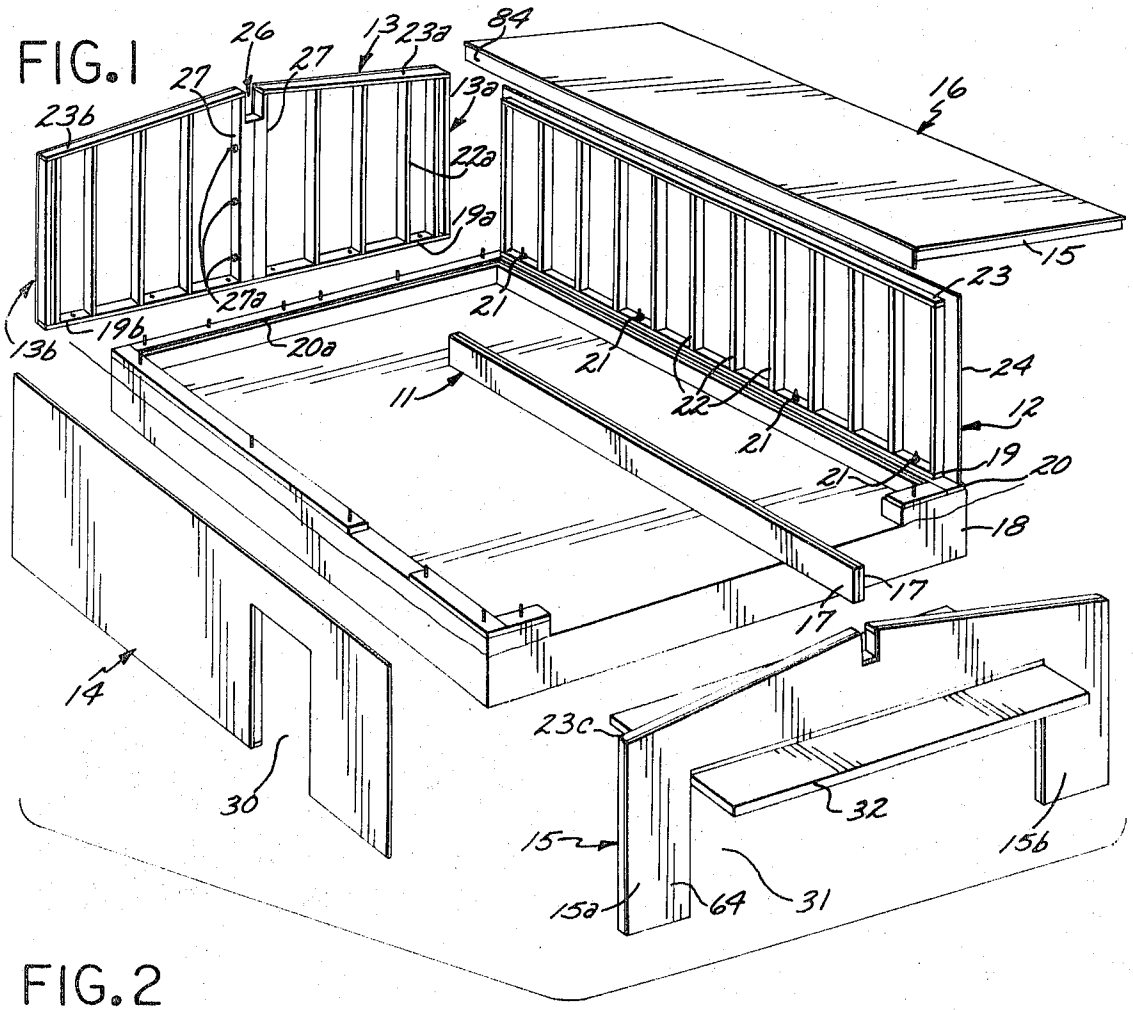
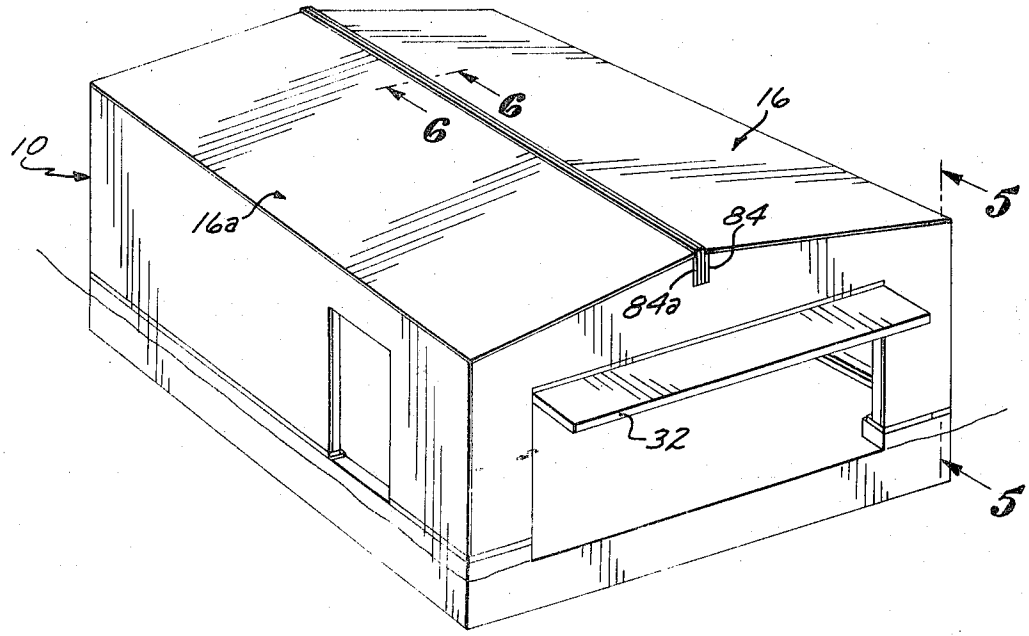

26
13
23a
84
27
27
13a
16
23b
22a
15
19a
23
27a
21
19b
20a
21
24
13b
11
22
12
21
19
20
21
18
17
17
14
23c
32
15
15b
64
31
30
15b

FIG. 2


6
6
16
10
5
16a
84
84a
32
5

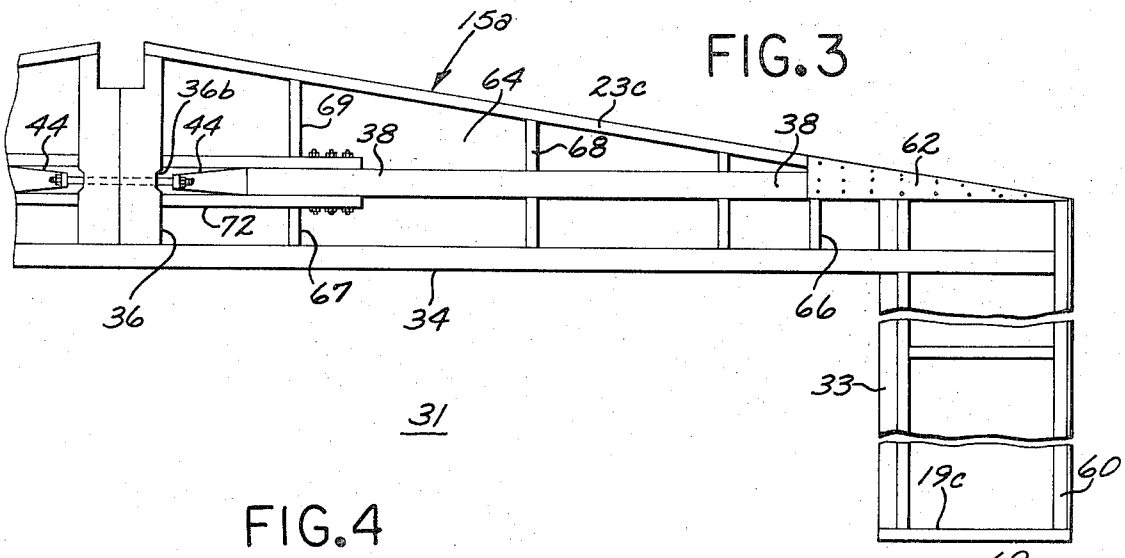
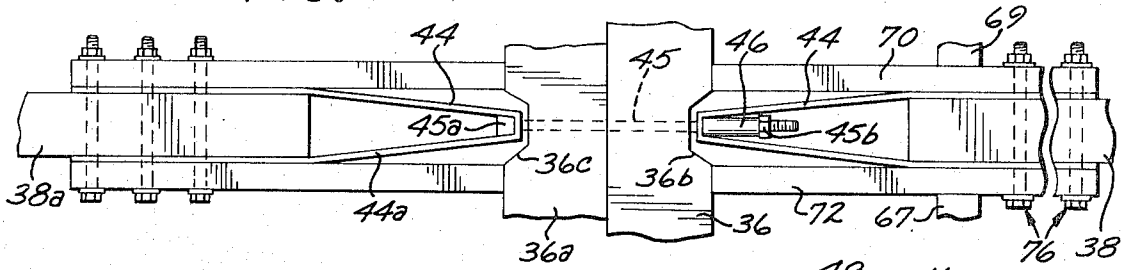


FIG. 3

FIG. 4



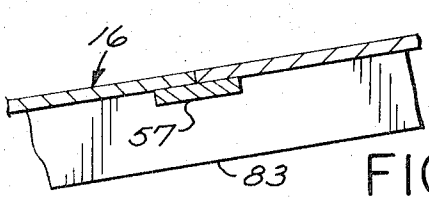
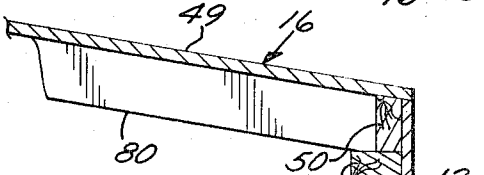


FIG. 7



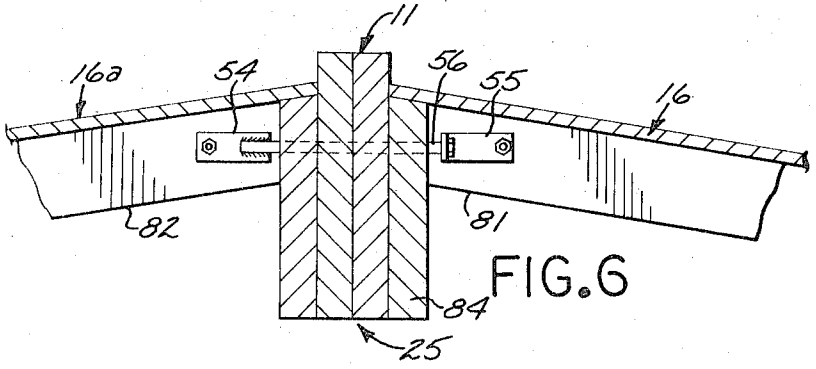


FIG. 6

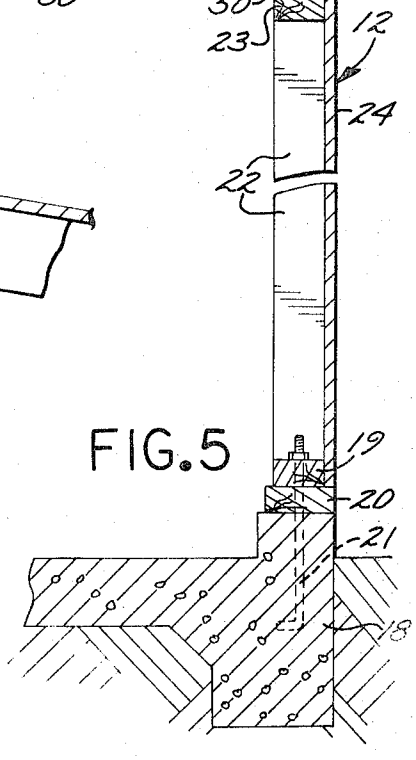


FIG. 5

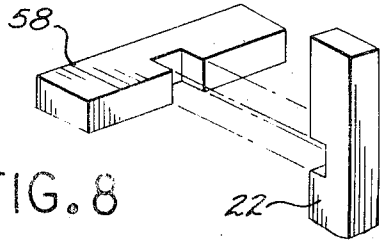


FIG. 8

PORTABLE BUILDINGS

BACKGROUND

It is well recognized that there is a great need for buildings whose elements may be economically prefabricated at a mass production type of facility and then transported at minimum cost to an erection site where the prefabricated building elements may be combined to form a building. Moreover, there are also times when the building should be "demountable" in the sense that it is adapted for disassembly without its parts being seriously altered whereby it can be transported to and reassembled at, still another location.

It is, of course, essential that all such building elements, and the completed building, be constructed in accordance with the building codes in effect at the erection location and that it be constructed to withstand the wind loads, snow loads, sand loads and the like to which the building may be subjected.

There have been other attempts to prefabricate building elements for erection kit-like elsewhere and those efforts have had some success. This invention extends that work to produce a large building that can be taken apart after erection with relative ease and without destroying its parts so that it can be reassembled elsewhere practically and economically. That result is obtained by the use of several special constructional features including: a special ridge beam which combines with side members fixed to the roof sections to form a composite beam; a special clamping system for clamping end wall halves to one another and to the ridge beam; a special roof construction at the eave; and other features.

OBJECT AND DRAWINGS

It is one of the principal objectives of the present invention to provide an improved portable building.

It is another objective of the present invention to provide an improved building that may have its elements economically prefabricated at a suitable mass production facility.

It is a further objective of the present invention to provide an improved portable demountable building that conforms to the building codes.

A still further objective is to provide a building whose features make it physically and economically feasible to assemble and dissassemble a building several times notwithstanding the passage long periods of use and weathering between assembly and disassembly.

That attainment of these objectives and others has been realized in the invention will be apparent from a study of the following specification, taken in conjunction with the drawings of which:

FIG. 1 shows an exploded view of the building;

FIG. 2 shows a pictorial view of the assembled building;

FIG. 3 shows an internal partial view of a portion of the front section;

FIG. 4 shows a bolting arrangement for tensioning the front section;

FIG. 5 shows a view of a portion of the side section as assembled to the roof section and to the foundation;

FIG. 6 shows an internal view of the tensioning of the roof sections;

FIG. 7 shows a view of the blocking of a roof seam;

FIG. 8 shows a view of the blocking of a stud. FIG. 1 shows an "exploded" view of a building comprised of a plurality prefabricated building elements that have been transported to a desired location, which has been suitably prepared for the building as by construction of a foundation, piping, electrical wiring and drains. While the invention is applicable to other building styles and sizes the embodiment selected for illustration has the form of a two-car garage having a gable-type roof.

In the preferred arrangement the building is prefabricated into four main assemblies which are transported complete to the site. These assemblies are the ridge beam and the right and left halves of the building and, when there is one, the large door. A major advantage of the construction is that assemblies of half buildings complete with roof and siding can be transported. The tributary weight of each half-roof is temporarily supported by a beam which, after assembly, is combined with beam elements excessively heavy to be carried by either roof half alone. The temporary beam elements are joined on assembly with the separately transported beam to form a composite ridge beam.

Providing a construction that will permit such prefabrication and construction in halves is an important object of the invention. However, any degree of fabrication is possible prior to transportation to the building's resting site. The drawings show one arrangement of partially prefabricated sections not to imply that the arrangement shown is better than others but only because that arrangement would facilitate understanding of what parts are involved and how they are related after assembly.

In FIG. 1 the building elements are shown to include a ridge beam core **11**, a right side section **12**, a rear wall **13**, a left side wall **14**, a front wall **15**, and a right roof section **16**. The left roof section **16***a* has beem omitted from FIG. 1 in the interest of simplification of the drawing and to provide greater visibility of the remaining parts.

THE RIDGE BEAM

The basic construction is the same whether the roof is flat or is of the gable type. The gable type is used more often because it sheds water, snow and ice. and because it tends to be stronger. In general, the flat roof is used only where it is necessary to mount something that requires a flat surface.

The use of a wooden main beam is not mandatory but is more advantageous and the preferred embodiment employs wood. The ridge beam is special. It consists of a central core **11** to which side members are added in the finished assembly to form a composite in which the core beam is flanked on either side by stringers that form a part of the roof sections. A cross-section of the composite central beam and the means by which its parts are held together is shown in FIG. **6** where the composite beam is designated **25.** The core in this case is made of two 2 inch × 12 inch planks **17** joined side-to-side by an adhesive.

THE RIGHT SIDE SECTION

Wall **12** is the wall at the right side of the building in FIG. **1.** In this building it is 22 feet long and it is made in one piece with outside sheathing attached. It is

formed, according to conventional frame construction practice, with a bottom plate **19** that rests atop a mud sill **20** which in turn rests upon the outer edge of the foundation **18.** The lower plate is formed with through holes at spaced points along its length to receive anchor bolts that are imbedded in the foundation and protrude upwardly through the mud sill. Those anchor bolts are placed at the time that the foundation is poured and they are positioned so that they will fit into the plate holes when the building is erected.

Consistent with conventional frame construction, the wall is formed by a series of studs **22** that extend vertically from connection to the lower plate **19.** In this embodiment, the side wall studs are spaced 24 inches on center. They are connected at their upper ends by a plate **23** whose ends are flush with the outside surface of the two end studs. While the building shown does not employ them, the side wall frame will include braces and fire stops and blocking according to the requirements of local codes. In this embodiment a sheathing **24** has been included. That may be omitted but if it is included the sheathing should extend above the upper plate **23** to cover the eave end stringer of the roof section so the sheathing extends up to and abuts, or almost abuts, the roof covering **49** as shown in FIG. **5.** In this embodiment the sheathing **24** extends forwardly and rearwardly of the stud frame sufficiently far to overlap the ends of the rear wall **13** and the front wall **15.** This feature can be understood by examination of the right end of the rear wall **13** in FIG. **1** in relation to the rear end of the side wall **12** of FIG. **1.**

THE REAR SECTION

Although the width of the building is only twenty feet, the front and rear sections are each divided into two halves on a plane midway across their width. There are two reasons for that. The total height of the center sections in this embodiment is ten feet and in larger buildings may be higher. Because of that height it may not be possible, in view of highway regulations, to transport the front and rear sections lying flat upon a truck bed in the fashion that the side walls can be carried. It may be necessary instead to transport them uprightly whereby division in half will greatly facilitate handling.

Like the side wall, the rear wall **13** employs a frame construction. The two half sections **13***a* and **13***b* are mirror images of one another. Both employ a base plate **19***a* which is provided with holes to match anchor bolts that project up from the rear foundation through the rear mud sill **20***a*. A series of studs **22***a* extend from the lower plate upwardly to an upper plate **23***a* in the case of member **13***a* and **23***b* in the case of member **13***b*. The studs **22***a* and **22***b* of the set gets longer closer to the center of the rear wall to form the end gable. Otherwise the construction so far described is like that of the side wall. The end studs at the outer edges of the rear wall, are heavier and serve as columns. The two inner studs or uprights **27** are also heavier and together they serve as a column to support the composite ridge beam and its load. These uprights **27** are cut away at their inner upper ends. The upper plates **23***a* and **23***b* terminate at the cut out. Together uprights **27** and plates **23***a* form a notch **26** into which the composite ridge beam **25** will fit. The cutout is formed so that the ridge beam will be tightly grasped between the uprights when the two uprights **27** are clamped together by bolts **27***a*.

THE LEFT SIDE SECTION

The left side section **14** is just like the right side section **12** with the exception that a portion of it has been cut away to form a door opening. That door opening is framed out according to conventional building construction and building code practice. Otherwise it is like the side section **12.** It has a lower plate which fits on the mud sill and is held there by being bolted to anchor bolts that are imbedded in the foundation slab. It is formed with studs that correspond to studs **22** of the right wall **12** and it is fitted with an upper plate corresponding to plate **23** of wall **12.** In this case, the mud plate is cut away at the door opening but the foundation is not lowered at that point. That is a matter of choice.

THE FRONT SECTION

The front section is also prefabricated. It is formed with a large double doorway opening to accommodate a truck which is closed by a garage door **32.** The door and the manner in which it is hung are conventional. The remainder of the front section is not conventional. Like the rear section **13,** the front section **15** is divided into two portions, a left front half section **15***a* and a right front half section **15***b*. As in the case of the rear wall division is made to facilitate transportation and handling. In addition, division into two sections facilitates clamping the front section against the sides of the ridge beam **11.**

The construction of the front section is shown in FIG. **3.** Again, the two halves of the front section are mirror images of one another. At the outer portion of each half section the lower member is a plate corresponding to the plates of the other sections. In this case the plate is designated **19***c*. The studs rise from that. In this case the first two studs or uprights serve as columns and are made of heavier material. The outer column **60** extends the full height of the side and abuts the under side of the tie beam **38.** The other upright the one that forms the side of the door opening **31** in FIG. **3,** is designated **33.** It is a heavy member constructed, in this case, of two uprights which may be secured together by any convenient means. At its lower end upright **33** rests on the plate **19***c* and its upper end underlies and supports a header **34.** The header extends from the inside edge of upright **60** at the right to the center line of the front section **15** which marks the center edge of the half section shown in FIG. **3.** The eave end of the upper plate **23***c* rests atop the tie beam **38** but the connection is hidden from view by a gusset plate **62** which is used to tie them together. At its other end the upper plate **23***c* rests atop the upper end of a column **36** whose lower end abuts the upper side of the header **34.** These elements are fastened together and the whole assembly is strengthened by a sheathing **64** which is applied to the exterior of the end by short stud sections **66** which separate the header **34** and tie beam **38** and by stud sections **68** which rest at their bottom ends against the tie plate **38** and at their upper ends on the bottom side of the upper plate **23***c*. Stud **67** differs from the stud **66** and stud **69** differs from the stud sections **68** in that they abut against clamping members that are bolted to the upper and lower sides of the cross beam **38.** In the case of the front half section **15***a*, those upper and lower clamping members are designated **70** and **72,** respectively. As best shown in FIGS. **3** and **4,** these two

clamping members are bolted by a series of bolts **76** to opposite sides of the tie beam **38** which ends at a point between the stud sections **67** and **69** on one hand and a member **36** at the other side. The ends of members **70** and **72** abut against the side of member **36.** Those members **72** and **70** are held tight against the central member **36** by a bolt set **45.** The bolt extends through member **36** of front half section **15***a* and through section **36***a* of the other front half section. The bolt is connected at each side of the center column formed by members **36** and **36***a* to a metal strap which is generally V-shaped in the region between each of the tie beams **38** and **38***a* and the center members **36** and **36***a*. The lower end of the strap is sandwiched between member **72** on the lower side of tie beam and the upper end of the strap is sandwiched between the tie beam **38** and the upper member **70.** The bolt set **45** includes a head **45***a* which is lodged in the apex of the strap **44***a* at the left in FIG. **4,** and the nut **45***b* at the other end of the bolt set **45** bears against a spacer **46** which in turn bears against the apex of the V-shaped portion of metal strap **44.** Tightening of the bolt **45** to pull the straps **44** and **44***a* toward one another, pulls on the tie beam **38** and the members **70** and **72** forcing the members **70** and **72** against the face of member **36** forcing it toward contact and connection with the member **36***a*. This arrangement provides a very strong construction, no part of which is damaged either in assembling or disassembling the building. And it provides a connection which will not deteriorate with time. If the bolt set is kept from corroding, a simple task, the passage of time will have no effect upon the ability to disassemble and reassemble the connection. In this case member **36** and its counterpart in the other front wall half are notched at **36***b* and **36***c* to provide clearance for the apex of the straps.

ROOF SECTION

Although the under side of the roof section is not shown in plan view in any of the drawings, the construction of the roof section can be understood from an examination of the several figures. The sections employ regular frame construction. A series of spaced rafters are arranged in parallel from one end of the section to the other. One of those rafters **80** is visible in FIG. **5** and two others **81** and **82** are visible in FIG. **6.** Another rafter **83** can be seen in FIG. **7.** The rafters are made of wood and they are conventional. Their size and spacing is dictated by conventional engineering considerations and the codes. A stringer **50** connects all of the rafters of roof half **16** at the eave end. A stringer **84** connects all of the rafters at their roof peak end. The stringer **84** will be assembled so that it lies side by side with the ridge beam **11** as shown in FIGS. **2** and **6** and in assembled condition it forms part of the ridge beam. A similar stringer **84***a* is connected to the ridge end of the roof section **16***a* and it lies against the opposite face of ridge beam **11.** The stringers **84** and **84***a*, and therefore the roof sections, are tied to the ridge beam **11** by a bolt **56.** One end of the bolt is welded to a plate **54** which is bolted to a rafter of roof section **16***a*. The bolt itself extends through a hole in the stringers **84** and **84***a* and the beam **11** and through an opening in an arm of an L-shaped bracket **55** which is bolted to a rafter on the roof side **16.** The roof sections and the ridge beam are connected together at each rafter set.

OTHER FEATURES

The ridge beam **11** in this embodiment is made of a pair of two-by-fours. The two stringers **84** and **84***a* have their top edges tapered to conform to the pitch of the rafters but essentially are two-by-tens. In assembled condition the bottom edge of all of these members is made flush so that the center ridge extends above the two stringers sufficiently far so that it will also extend above the roof boards or roof sheathing. The roofing is ordinarily applied as part of roof section fabrication. For the sake of clarity, no fire blocking has been shown in the walls spanning the studs. However, some building codes require that such blocking be employed and when it is employed it is innerfitted with the studs in the manner illustrated in FIG. **8** where in an exploded view the stud **22** is shown to have a notch which innerfits with a notch formed in the block **58.** The two notches are arranged so that corresponding sides of the stud and the block are flush with one another.

FIG. **7** illustrates that a batten **57** is used at the juncture of sections of the sheathing material that are used to complete the roof sections.

THE ASSEMBLED BUILDING

The manner in which the building is assembled will be apparent from a comparison of FIGS. **1** and **2** and an examination of FIGS. **5** and **6.** The order of part erection can be altered and would be changed somewhat depending upon what equipment was available for lifting the component parts of the building from the delivering vehicle and for lifting the roof sections **16** and **16***a*. In one procedure the four walls of the building are erected first. They are interconnected at their adjacent corners by means not shown in the drawing and which will vary somewhat as the sheathing material is changed. In any event the use of removable fasteners is envisioned. The two roof sections are then placed in position atop the walls so that the center stringer, **84** in the case of roof section **16,** rests in the notch **26** of the rear wall and the notch **52** of the front wall. Thereafter the core beam **17** is placed between the stringers **84** and **84***a* so that the ends of stringer **11** fit between them in the notches **26** at the rear and **52** at the front of the building. The bolt **45** at the front wall and the bolts **27***a* at the rear wall will have been tightened as part of the wall erection procedure. It remains only to insert the bolts **56** through the ridge beam **25** at each rafter and to complete the assembly with the brackets **54** and **55.** As the bolt **56** is turned up tight the inner ends of the rafters, **81** and **82** in the case of FIG. **6,** abut against the stringers **84** and **84***a* and clamp them to the sides of the ridge core **11.**

What is claimed is:

1. A multi-element portable building comprising:
a ridge beam core;
a prefabricated front wall;
a prefabricated rear wall;
a prefabricated right wall;
a prefabricated left wall;
a right roof section;
a left roof section; and
fastening means for joining adjacent sections, whereby said elements of said building may be transported to, and assembled at, a desired location;

said right roof section and said left roof section each comprising a stringer capable of being assembled flush with a respectively associated side of said ridge beam; and

means for clamping said stringers and ridge beam core together;

said front wall and said end wall being notched at opposed points on their upper edges to receive said ridge beam core and said stringers;

at least one of said front wall and said end wall being divided into separable sections each ending in an upright which abuts against the back of the other when said sections are assembled;

said fastening means comprising a bolt set one end of which is fixed to one of said sections and the other of which is fixed to the other of said sections;

each of said sections comprising a tie beam secured to said section and extending in a direction toward said upright, said fastening means further comprising a metal strap of generally "V" shape having its apex extending toward said upright and its arms bolted to said tie beam, the head of said bolts being secured in the apex of the clamp of one of said sections and the nut of said bolt sets being disposed at the apex of the "V" shaped strap of the other of said sections.

2. In a prefabricated building having a wall which is divided into two sections each of which is formed with an upright along the line of its connection with the upright of the other section:

means for clamping said sections together comprising a pair of tie beams each secured to a respectively associated wall section and extending towards the upright of its wall section and ending at a point spaced from said upright whereby a space between them remains;

two pairs of clamping members each member of a pair being fixed to opposite sides of a respectively associated one of said tie beams and extending from connection to said tie beams into abutment with the upright associated with said one of said tie beams, whereby a cavity is formed bounded by said upright, said clamping members and said tie beam; and

fastening means including a fastening element extending from through uprights from the cavity of one wall section to the cavity of the other and a pair of holding means fixed to said tie beam and said clamping sections for maintaining said fastening element in said cavities.

3. Invention defined in claim **2** in which each holding means comprises a "V" shaped metal strap having its apex disposed in one of said cavities and having each of its arms clamped between the tie beam of said section and a respectively associated one of said clamping members.

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