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Yang

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[54] DEMOUNTABLE GARAGE BUILDING

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[21] Appl. No.: **163,280**

[52] **U.S. Cl.** **52/236,** 52/263, 52/283

[51] **Int. Cl.**.....**E04h 1/04,** E04h 6/00

[58] **Field of Search**.....52/236, 283, 263, 322, 320, 52/321, 332

[56] **References Cited**

UNITED STATES PATENTS

2,294,554	9/1942	Henderson	52/236
3,604,177	9/1971	Faherty	52/283

FOREIGN PATENTS OR APPLICATIONS

301,354	9/1965	Netherlands	52/236
1,409,923	5/1969	Germany	52/236

OTHER PUBLICATIONS

Civil Engineering Sept. 1970 page 75

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[57] **ABSTRACT**

A demountable building usable as a garage with a large number of parking stalls. Precast reinforced concrete vertical frame units each have a width equal to that of a parking stall, and a height equal to the full height of the building at its location. Each frame unit comprises a pair of parallel columns and a series of horizontal beams interconnecting them, and each floor level has a projecting supporting ledge on each column. Each line of frame units has the columns all co-planar, and the frame units are spaced from each other by approximately their own width. Each end of a series of prestressed concrete channels rests side by side on the ledges. The slabs are each the width of a stall and have a pair of depending flanges along each side, these flanges resting on the ledge, and the channel spanning between two series of frame units. The slabs are bolted together and to the frame units to provide the necessary rigidity and to enable demounting.

9 Claims, 11 Drawing Figures

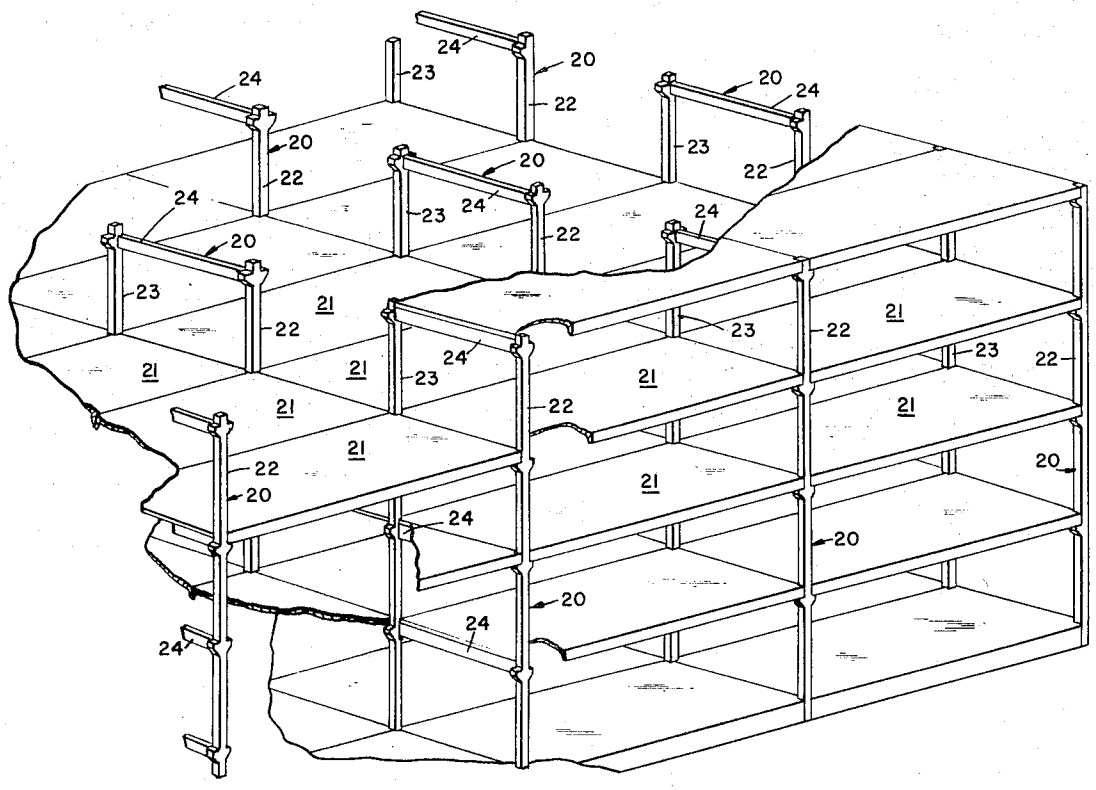
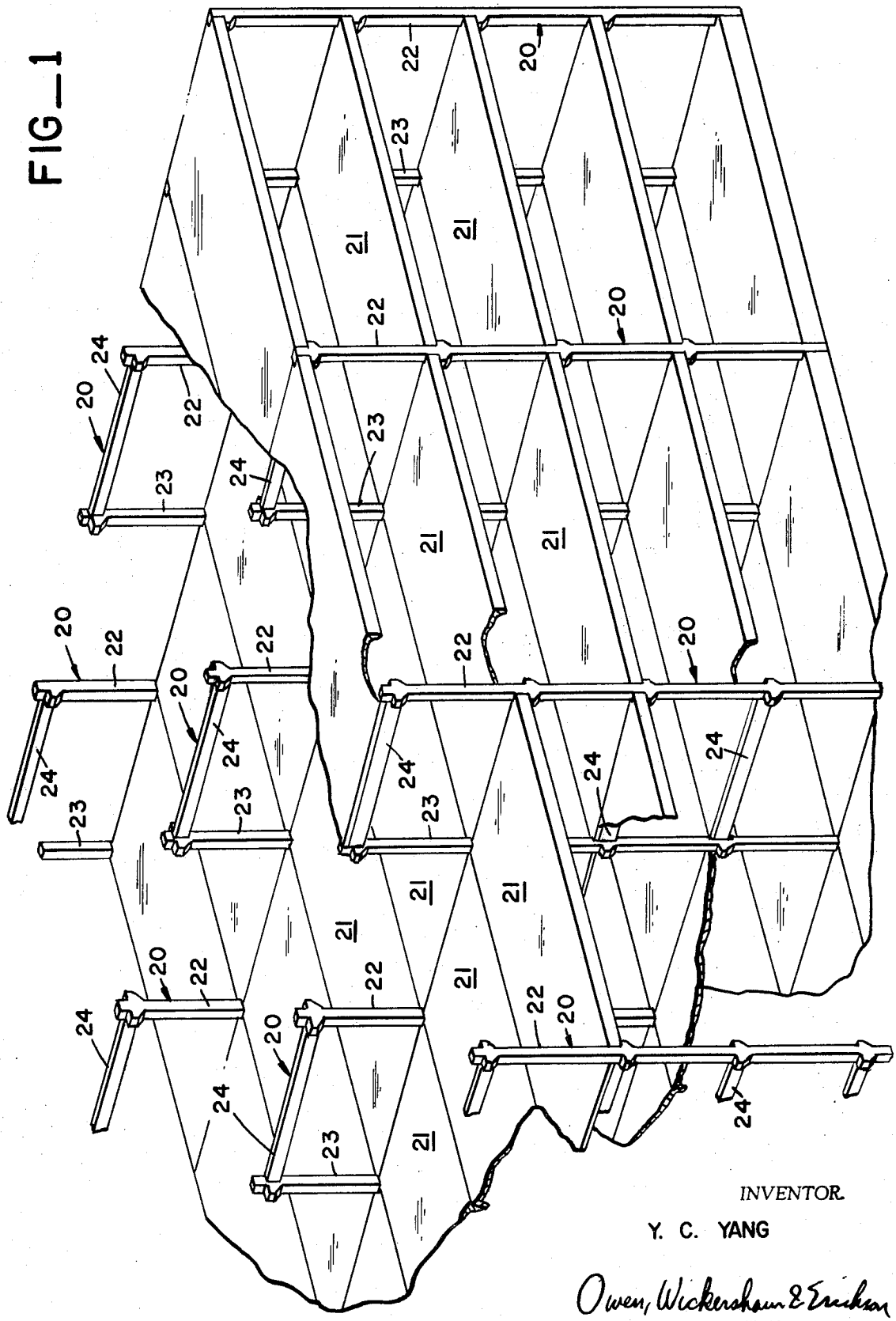


FIG_1



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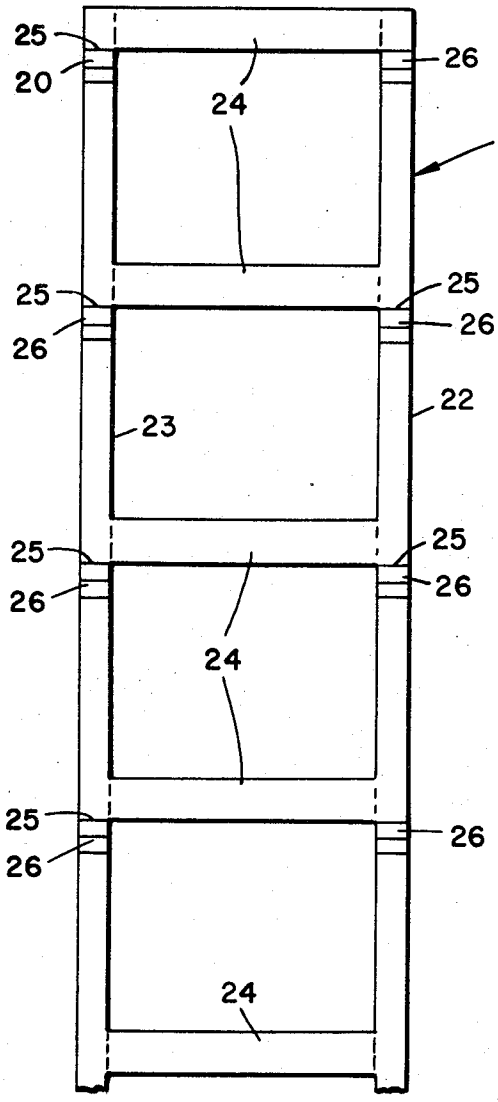


FIG_2

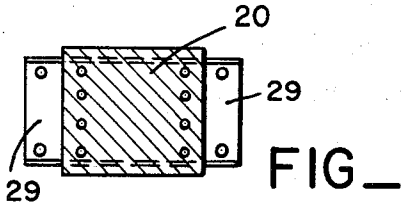


FIG_4

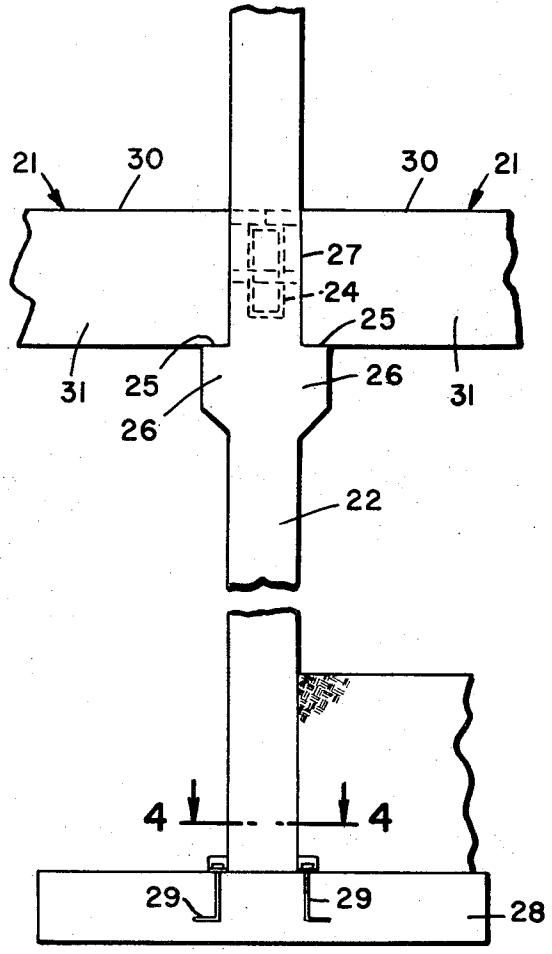


FIG_3

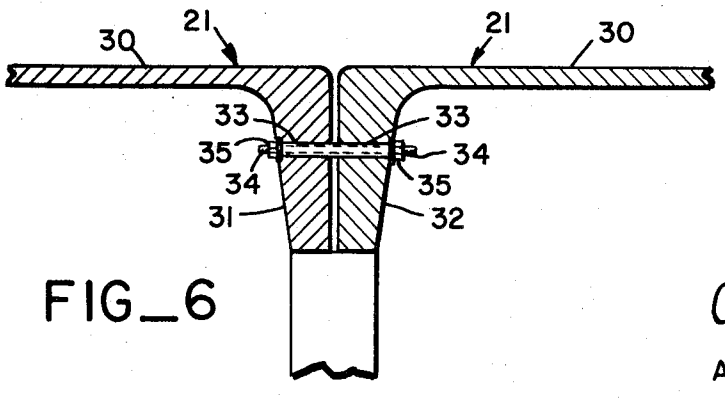
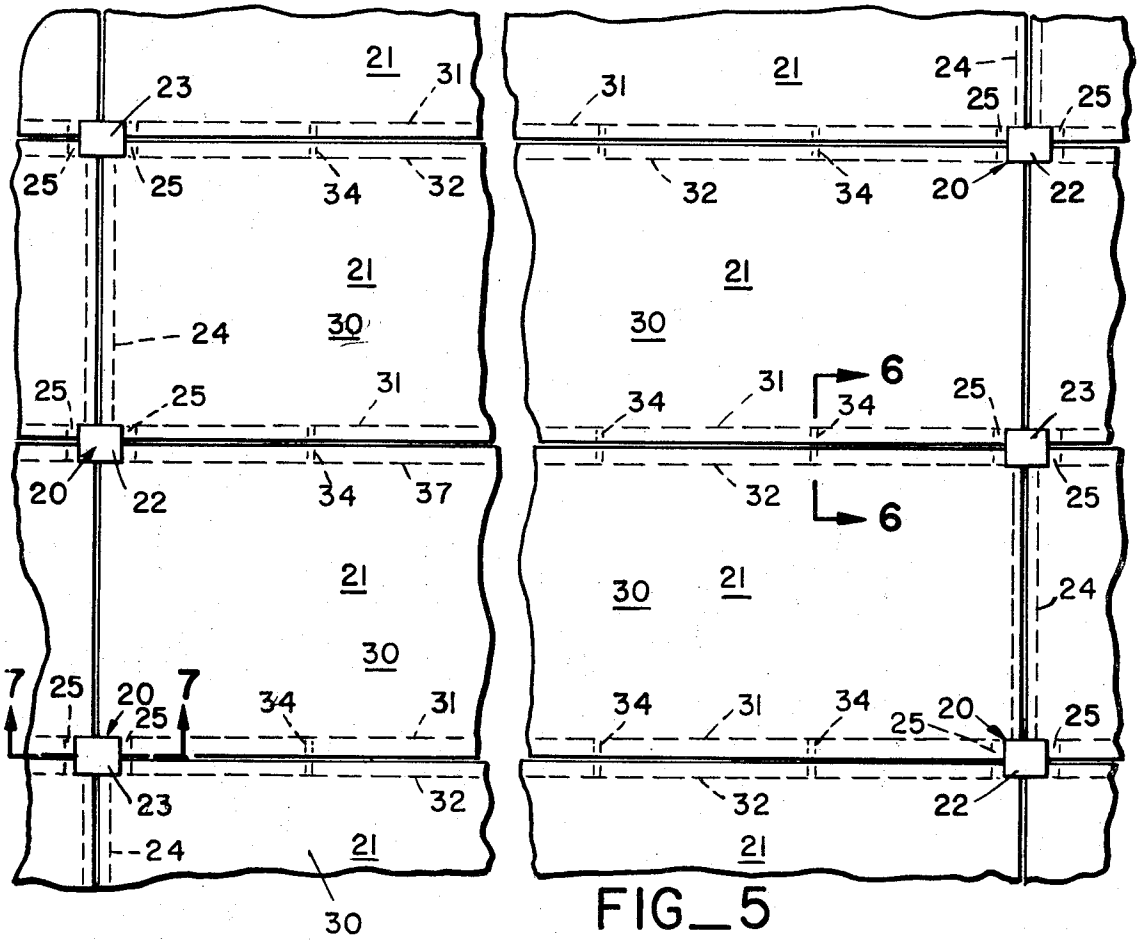


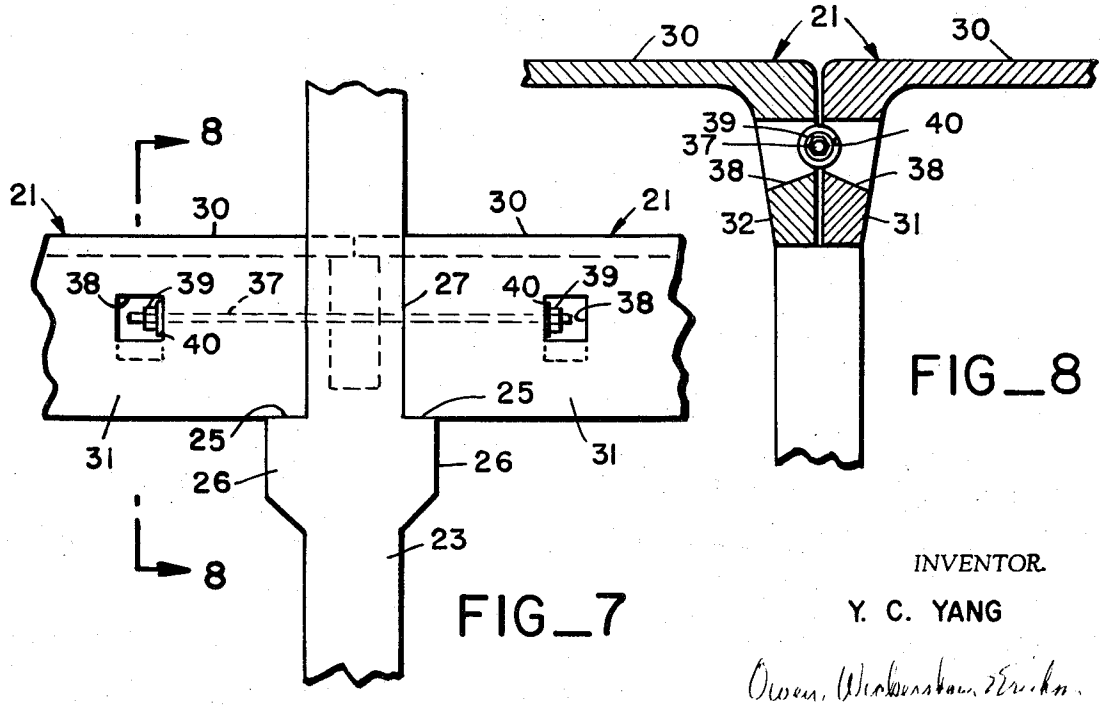
FIG_6

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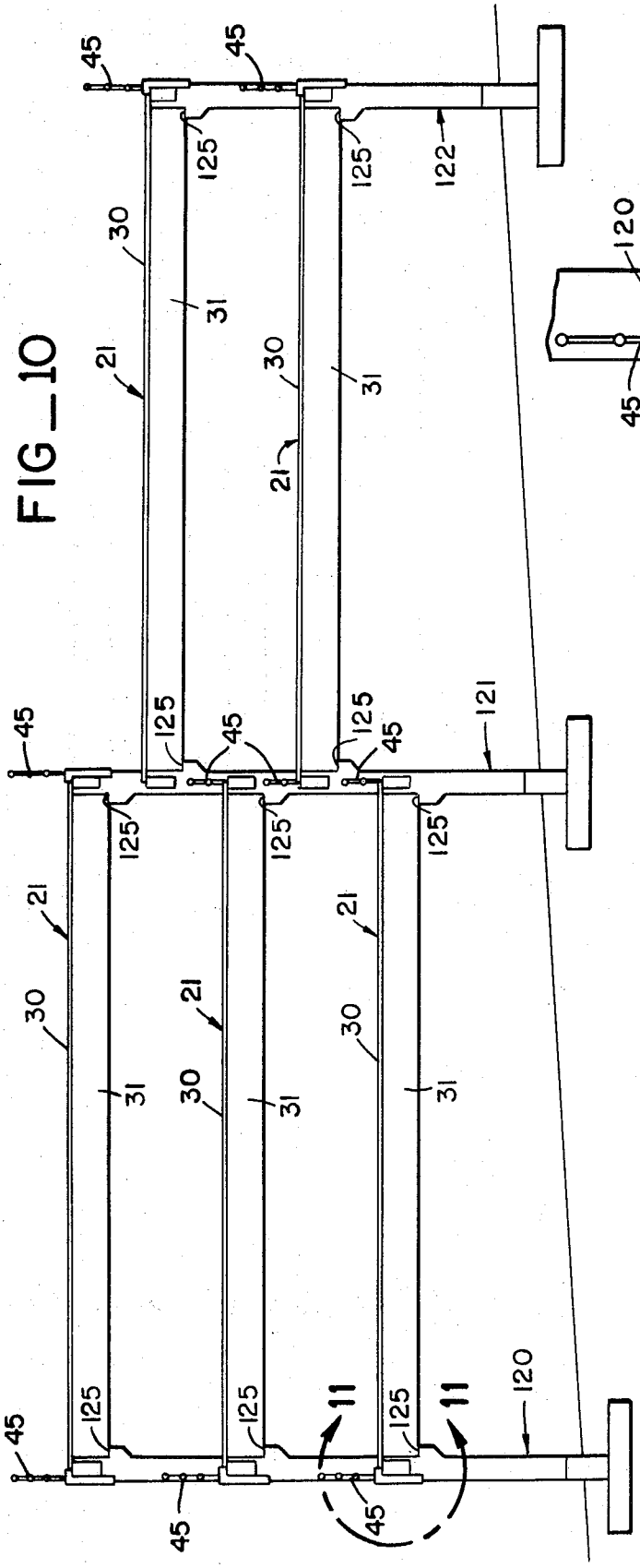


FIG_10

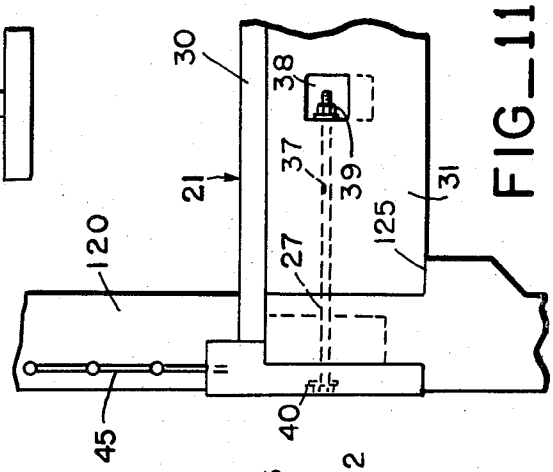


FIG_11

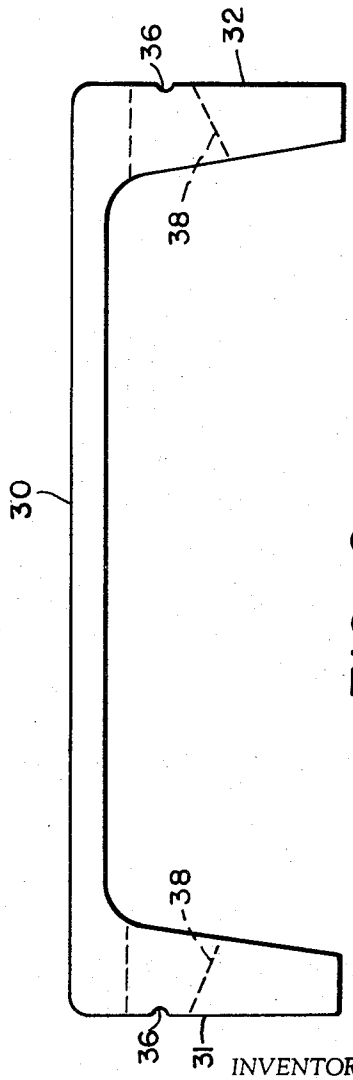


FIG_9

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DEMOUNTABLE GARAGE BUILDING

BACKGROUND OF THE INVENTION

The invention relates to demountable buildings, and especially to demountable garages.

Often it is desirable to have a garage in a location for several years and then to remove it. For example, in many downtown locations old buildings are torn down, awaiting the right time to build, perhaps awaiting the acquisition of some adjacent property. During that waiting time it is desirable to have the property in use, and one of the common uses for such property has been for parking. It having been inconvenient to build a permanent structure during that time, the parking has generally been simply an open lot. However, such a lot enables the use of only one level, and in many locations much more profit could be made if it were economically feasible to have a multi-level garage. Where these have had to be built out of steel, their cost has been excessive, and concrete units have heretofore been only used for more permanent structures because they cannot readily be taken down, they, too, having been expensive under such circumstances.

The present invention provides a structure in which pre-cast reinforced concrete units can be used and reused. They can be erected, used for a desirable time, then taken down and re-erected in another location. The invention is thus useful in converting temporarily open spaces to parking lots and is also useful in other places where parking is considered a temporary use and where there will be use for perhaps two or 3 years for parking with ultimate replacement by something else. Of course, the invention provides structures that can be considered "permanent," whatever that means these days.

SUMMARY OF THE INVENTION

A plurality of series of pre-cast reinforced concrete vertical frame units is employed. Each frame unit has the width of a parking stall, and a height equal to the full height of the demountable garage building at the location of that particular frame unit. Each frame unit comprises a pair of parallel columns interconnected by a series of horizontal beams, and each column has at each floor level a projecting supporting ledge. Each of the series of frame units is placed in a vertical plane with the columns all co-planar, and the frame units of each series are spaced from each other by approximately the width of one such unit.

The floors and the structures which interconnects the frame units comprises a series of pre-stressed concrete channels located side-by-side, each having a long top flat slab which is the width of a stall, and a pair of depending flanges along each side. Each of these flanges rests at each end on one of the ledges of the frame units. Each channel spans between two series of frame units, and adjacent channels have their flanges closely spaced from each other.

A series of bolts extends through the closely adjacent flanges of adjacent channels to prevent relative motion between the channels when the car wheels move from one slab to the next, and another series of bolts rigidly secures each channel member at each end to the columns. Typically, openings are provided for the bolts, both in the channel members and in the frame units to enable attachment and bolting.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. **1** is a fragmentary isometric view illustrating the basic construction of a demountable garage embodying the principles of the invention, showing the disposition of the two-column frame units and of the concrete channel members providing the slab surfaces. The drawing is broken away in various places to expose parts that would otherwise be concealed.

FIG. **2** is a view in end elevation of one of the two-column frame units broken off at the bottom.

FIG. **3** is a view in side elevation of one of the channels broken in the middle in order to save space, and broken at the top again, and showing the bottom footing and an example of the ledge structure which is present at each story.

FIG. **4** is a view in section taken along the line **4—4** in FIG. **3** showing the footing assembly.

FIG. **5** is a fragmentary plan view of a top floor, broken in the middle in order to conserve space, also at each edge of the view showing some of the channels connecting adjacent frame units, and extending between two series of frame units.

FIG. **6** is an enlarged view in section taken along the line **6—6** in FIG. **5**.

FIG. **7** is an enlarged view in section taken along the line **7—7** in FIG. **5**.

FIG. **8** is a view in section taken along the line **8—8** in FIG. **7**.

FIG. **9** is an end view of one of the channels.

FIG. **10** is a view in side elevation of a modified form of garage structure employing modified frame units of the invention.

FIG. **11** is a view in section taken along the line **11—11** in FIG. **10**.

DESCRIPTION OF A PREFERRED EMBODIMENT

The demountable garage of this invention is made up of a plurality of series of frame units **20**, a plurality of series of channel members **21**, and a series of bolts. Additional refining structure may be used, such as end walls or railings, and ramps to afford movement from one floor to the next, but these are used in a conventional manner, except for being bolted into place in a normal way.

Each of the frame units **20** (see FIGS. **1** and **2**) comprises two parallel vertical columns **22** and **23** interconnected by a plurality of horizontal members **24**, the number of these depending on the height of the frame unit **20**. The frame unit **20** is made to be the height of the building, or in places where the building is higher in one location than another, each frame unit **20** is the height of the building at the location where that frame unit **20** is to be installed. Each column **22**, **23** has at each floor level at least one ledge **25** provided by a projecting portion **26** of the precast concrete column **22** or **23**. Some bolt openings **27** (FIGS. **3** and **7**) are also provided.

In units like those of FIG. **1** where the building is to be of uniform height, and where the ground is substantially level, all the frame units **20** are the same height. In a building like that shown in FIG. **10** where the ground is sloping and where the building may vary in height, or where it is desirable to provide for half story differences in ramping from one level to another

somewhat different frame units 120, 121, 122 are employed. At each end, the frame units 120 and 122 have only one ledge 125 per column per story; in the middle portions of the frame units 121 each have one ledge 125 per column for each half story. In the building of FIG. 1 there will be end frame units (not shown here but see FIG. 10) with only one ledge 25 per column per story, as well as the frame units 20 with two ledges 25 per column per story.

An important part of the invention is that the frame units 20 (or 120, 121, 122) are not installed side by side in any series, but are spaced from each other by approximately their own width. The width is substantially that of a parking stall. It may be greater or smaller, but this is the most convenient way to divide the building, for it enables the basic modulus to be the width of the parking stall. Thus, the units 20 may be placed in a series, with first a unit 20 of two columns 22 and 23 and then a vacant space between that unit 20 and the next unit 20, the vacant space being substantially equal to the distance between the two columns 22 and 23 of the unit 20. Two series are spaced apart from each other the length of the channels 21, and the channels 21 may be quite long, for example, they may easily be 60 feet or even more in length.

The frame units 20 are supported on suitable footings 28 (FIGS. 3 and 4) using either a poured footing which is the one part that will later be destroyed, or an otherwise securable temporary footing, with flange members 29 enabling attachment.

The channels 21 are, as shown in FIG. 9, provided with a top slab surface 30 and two parallel depending flanges 31 and 32. The top slab surface 30 provides the driving and parking surface, and the depending flanges 31 and 32 provide strength and also have functions in joining the channels 21 together and to the columns 20. At each end, each flange 31 and 32 rests on a ledge 25 on a column 20.

A series of bolt openings 33 is provided in each channel 21 to enable the channel units to be secured together side-by-side by suitable detachable securing means such as bolts 34 and nuts 35 as shown in FIG. 6. This means that not only are the channels 21 demountable, but that when they are mounted the slab surfaces 30 are held as substantially a single floor with deflection prevented. In other words, if there were no bolts 34, when a car was on one slab 30 rather than another, there would be a substantial deflection in the slab 30, providing a bump when it came to the next slab. With the bolting at convenient distances the intervals are chosen such as to prevent any substantial sagging from this cause. The bolts 34 may have a head, or they may have nuts 35 at each end and may be simply threaded rods, as shown in FIG. 6.

As shown in FIGS. 7, 9, and 11, the flanges 31 and 32 of the channel members 21 are also provided adjacent their ends with rounded notches 36 to enable use of end bolts 37, and they are provided at a desired distance from each end with a window-like opening 38 to enable access to the nuts 39 on these bolts 37. Thus, as shown in FIGS. 7 and 8, the bolts 37 are inserted in the openings provided by the notches 36, with the aid of a bearing plate 40 to bear on each of the two adjacent flanges 31 and 32. The bolts 37 pass through the openings 27 in the center of the columns 22 or 23 of the frame units. Thus the frame units 20 and channels 21 may be tightened together, with access afforded by the windows 38.

The end members are tightened together in substantially the same manner as shown in FIG. 11, but instead of going through to the channels opposite, they bear against a bearing plate which itself bears on the frame unit. The end channel member usually need have no additional bolting than what is provided by where it joins the next unit.

Railings 45 are provided along the ends of the floors, as shown in FIGS. 10 and 11, embedded in or secured detachably to the channel members 30.

In erection, the frame units 20 are set in place on suitable footings 28, each series being set so that the frame units 20 are spaced apart by substantially their own width between columns 22, 23 and each series is set apart from the adjacent series by a desired amount, which will be the length of the channels 21. The erection may be either as shown in FIG. 1 or as shown in FIG. 10. Thus the entire height of the building is determined by the erection of the frame units 20, and it may be several stories high. The next step is to locate at least some of the channels 21, and this, of course, may be going on while some of the frame units 20 are still being erected. With the aid of derricks the channels 21 are lifted into place on the ledges 25, and the bolts 37 that secure them to the columns 20 are put in place, use being made of the windows 38. The adjacent channels 21 are bolted together at intervals by the bolts 34, and the entire building is thus erected. As stated before, there are railings 45 at the floor ends (shown in FIG. 10) and there are ramps at suitable locations.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. A demountable building including in combination:

a plurality of series of precast reinforced concrete vertical frame units, each said frame unit comprising a pair of parallel columns and a series of horizontal beams interconnecting said columns, each said column having at each floor level a projecting supporting ledge,

all the columns of each said series of vertical frame units being co-planar, the frame units of one said series being parallel to the frame units of other said series, the frame units of each said series being spaced from each other by approximately the width of a said frame unit,

a series of prestressed concrete channels side by side each having a long top flat slab and a pair of depending flanges along each side, each said flange resting at each end on a said ledge, each said channel spanning between two series of said frame units, adjacent channels having their flanges closely adjacent each other,

a first series of demountable fasteners, each extending through two closely adjacent flanges of adjacent channels and securing them together, and

a second series of demountable fasteners rigidly securing said channels at each end to said columns.

2. The demountable building of claim 1 wherein each of said second series of demountable fasteners secures two said channels to each said column.

3. The demountable building of claim 2 wherein said flanges of said slabs have through transverse openings adjacent to and spaced from their ends to enable installation of and tightening of said second series of demountable fasteners.

4. The demountable building of claim 3 wherein each said flange has a slot along an outer face thereof from said transverse opening and each said demountable fastener for that location has bearing means for bearing against the wall provided by said transverse opening.

5. A demountable garage building having a large number of parking stalls, including in combination:

a plurality of series of precast reinforced concrete vertical frame units, each said frame unit having a width equal to that of a said parking stall and a height equal to the full height of the building at the location of that frame unit, each said frame unit comprising a pair of parallel columns and a series of horizontal beams interconnecting said columns, each said column having at each floor level a projecting supporting ledge,

each said series of frame units being placed in a vertical plane with its columns all co-planar, the frame units of each said series being spaced from each other by approximately the width of a said stall,

a series of prestressed concrete channels side by side each having a long top flat slab the width of a said stall and a pair of depending flanges along each side, each said flange resting at each end on a said ledge, each said channel spanning between two series of said frame units, adjacent channels having their flanges closely adjacent each other,

a first series of bolts extending through the closely adjacent flanges of two adjacent channels, and the next, to them by nuts to prevent relative motion between channels when car wheels move from one said slab to the next and

a second series of bolts, nuts and bearing plates rigidly securing said channels at each end to said columns.

6. The demountable garage building of claim 5 wherein each of said second series of bolts, nuts and bearing plates secures two said channels to each said column.

7. The demountable building of claim 6 wherein said flanges of said slabs have through transverse openings adjacent to and spaced from their ends to enable installation of the bolts, nuts and bearing plates there and to provide transverse wall surfaces for said bearing plates to bear against.

8. A demountable garage building having a large number of parking stalls on a plurality of floors, including in combination:

a plurality of series of precast reinforced concrete vertical frame units, each said frame unit having a width equal to that of a said parking stall and a height equal to the full height of the building at the location of that frame unit, each said frame unit comprising a pair of parallel columns and a series of horizontal beams interconnecting said columns, each said column having at each floor level a projecting supporting ledge and, therefore, a through opening,

each said series of frame units being placed in a vertical plane with its columns all co-planar, the frame units of each said series being spaced from each other by approximately the width of a said stall,

a series of prestressed concrete channels side by side, each having a long top flat slab the width of a said stall and a pair of depending flanges along each side, each said flange resting at each end on a said ledge, each said channel spanning between two series of said frame units, adjacent channels having their flanges closely adjacent each other, each said flange having a plurality of bolt openings matching such openings in other flanges, and each said flange having adjacent each end an access opening and having a slot along an edge wall extending from said access opening to the end of said channel,

a first series of bolts extending through the matching bolt openings of the closely adjacent flanges of two such adjacent channels, and secured to them by nuts, to prevent relative motion between channels when car wheels move from one said slab to the next, and

a second series of bolts, bearing plates, and nuts rigidly securing two said channels at each end to each said column, some of said bearing plates bearing against a wall of said access openings of two adjacent said flanges, said bolts extending through said slots.

9. The demountable garage building of claim 8 wherein some of said frame units lie between two sets of said channels, said bolts of said second series there extending not only through said columns but also from the access openings of one pair of said channels on one side of said columns to the access openings of a second pair of said channels on the opposite side of said columns.

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