Oct. 28, 1969 J. M. WAH ET AL 3,474,582

BUILDING SYSTEM

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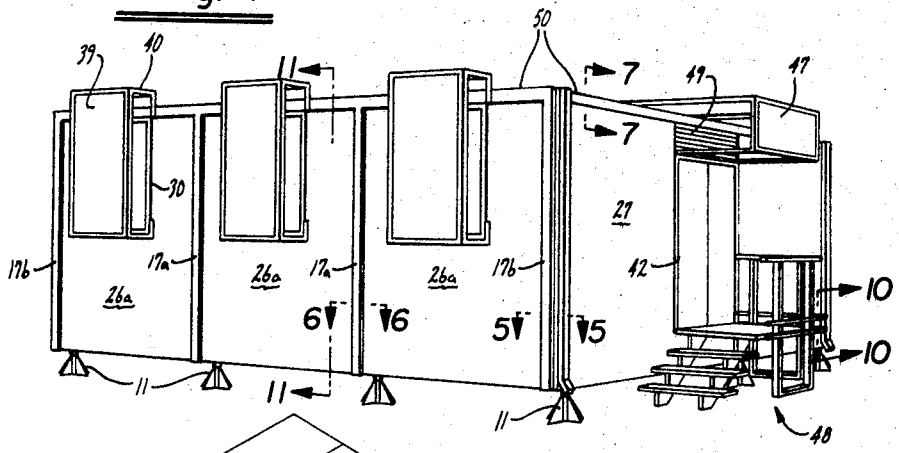
Fig. 1



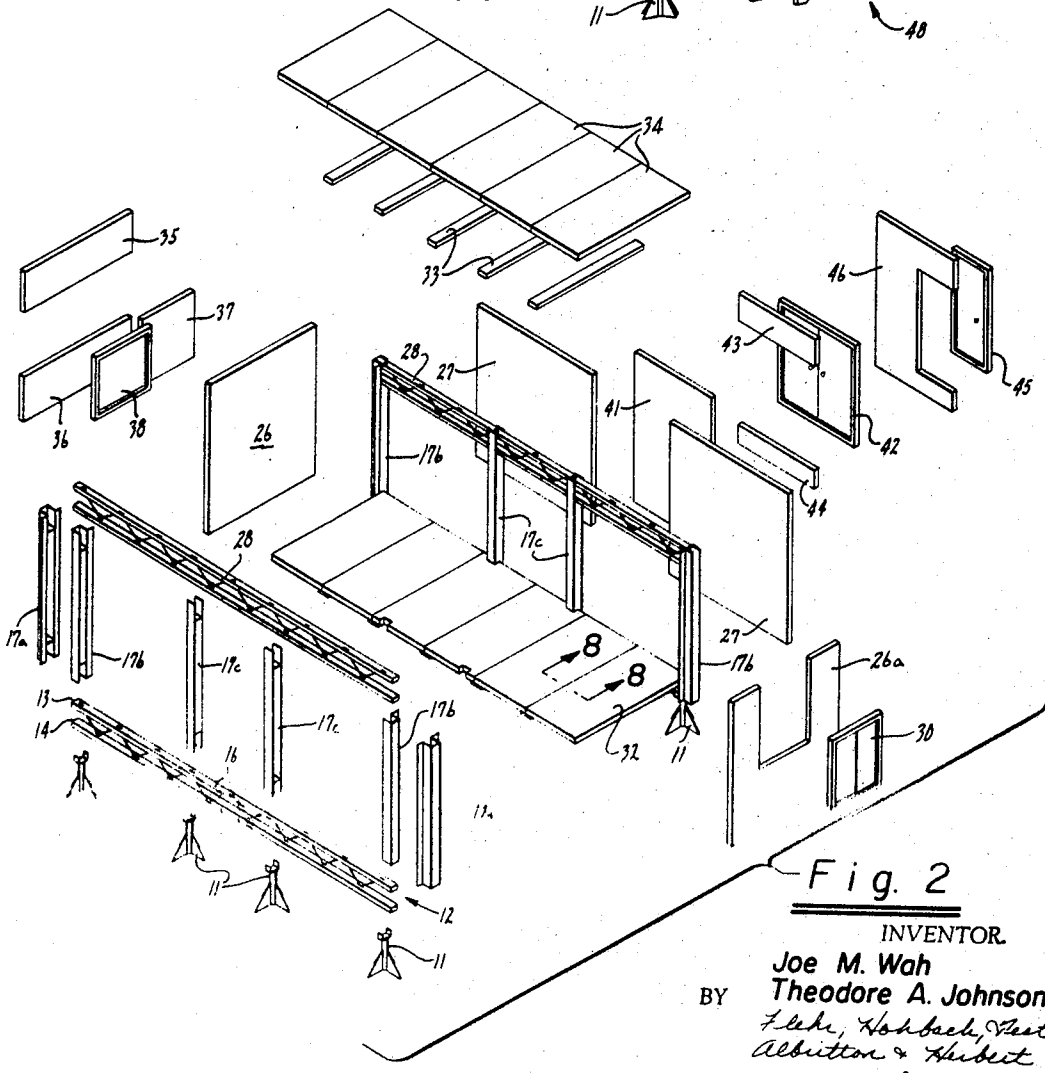


Fig. 2

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BUILDING SYSTEM

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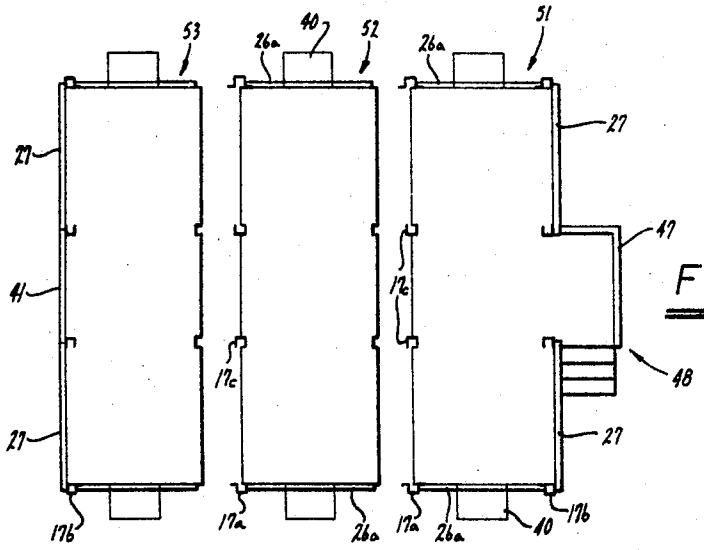

Fig. 3

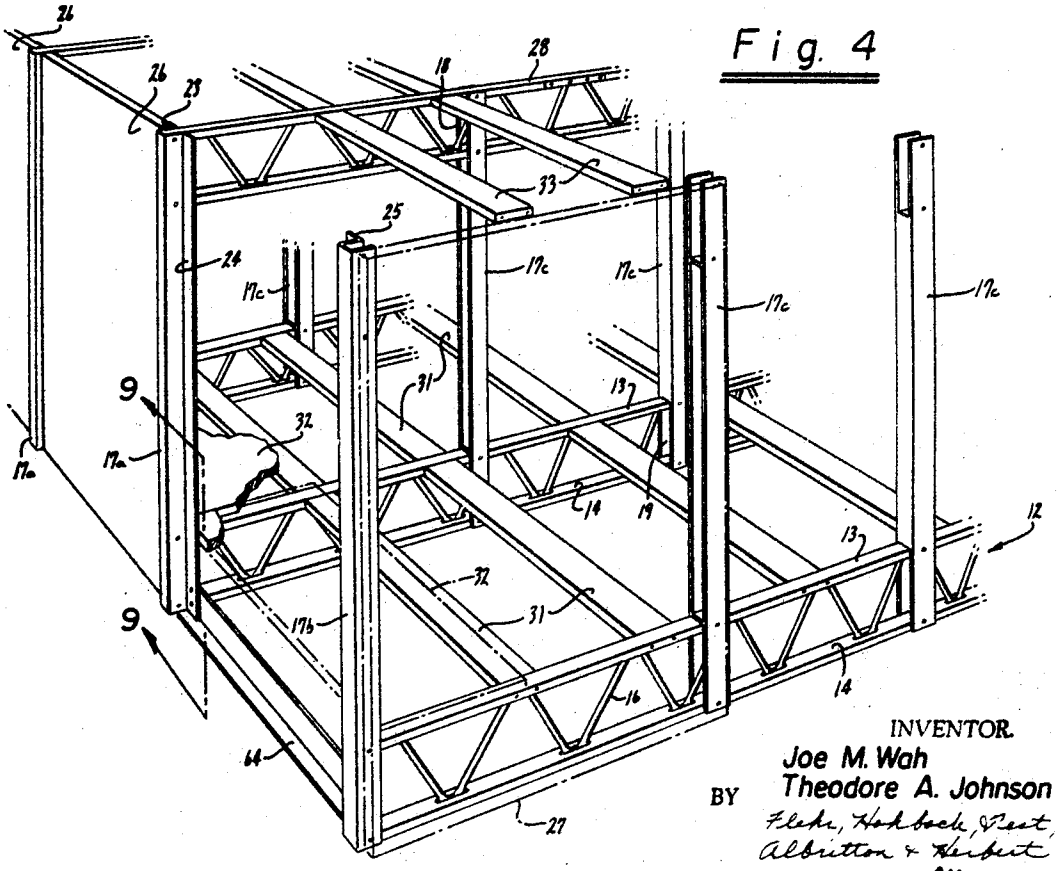

Fig. 4

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BUILDING SYSTEM

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Fig. 7

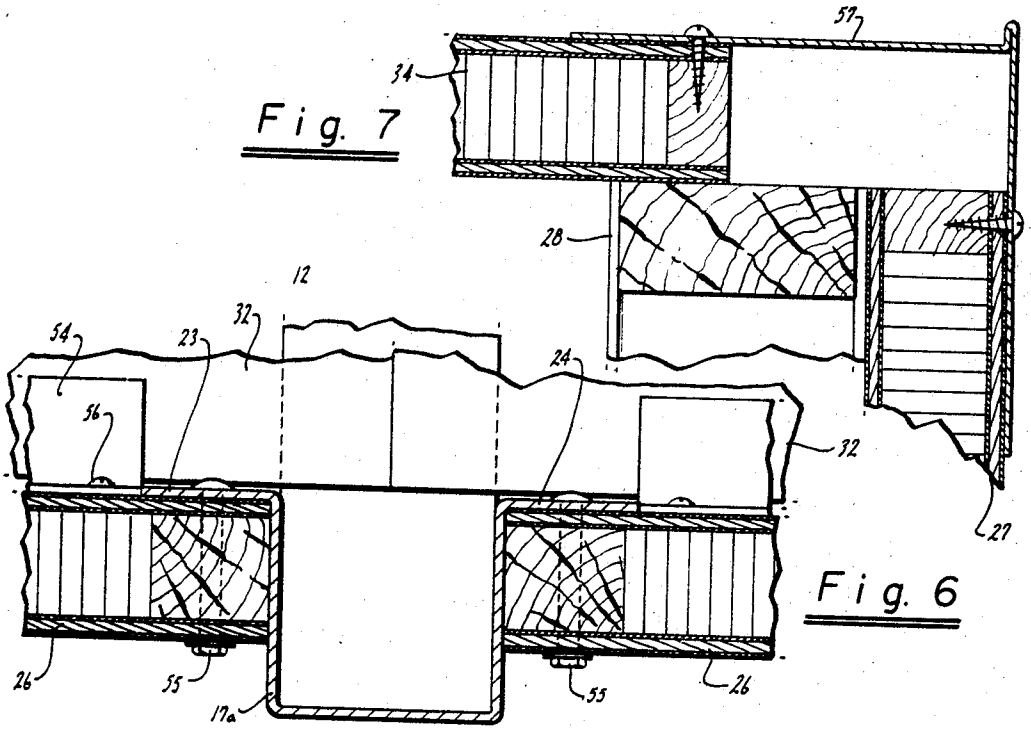
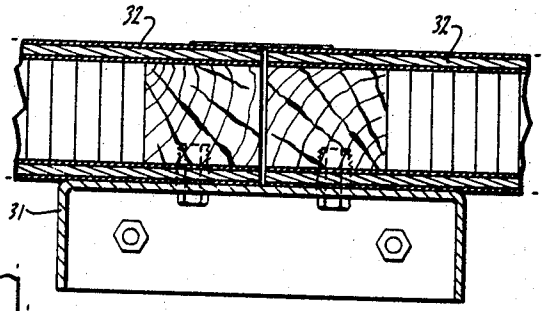


Fig. 6

Fig. 8



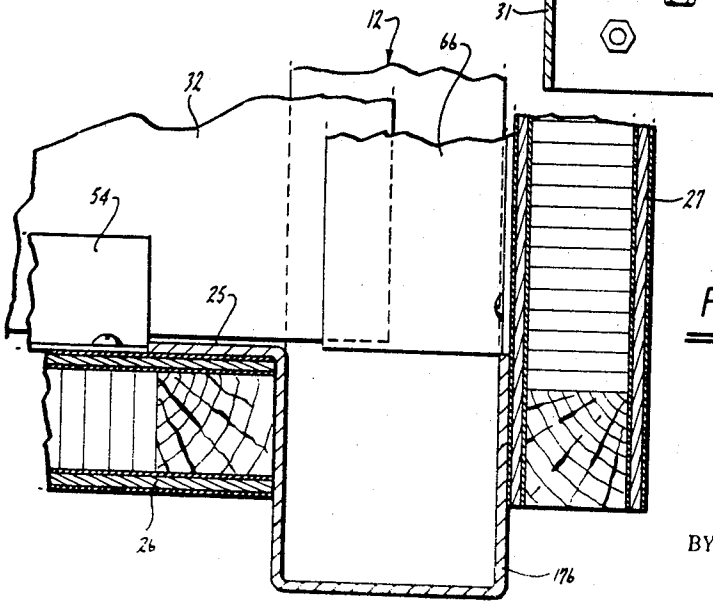


Fig. 5

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BUILDING SYSTEM

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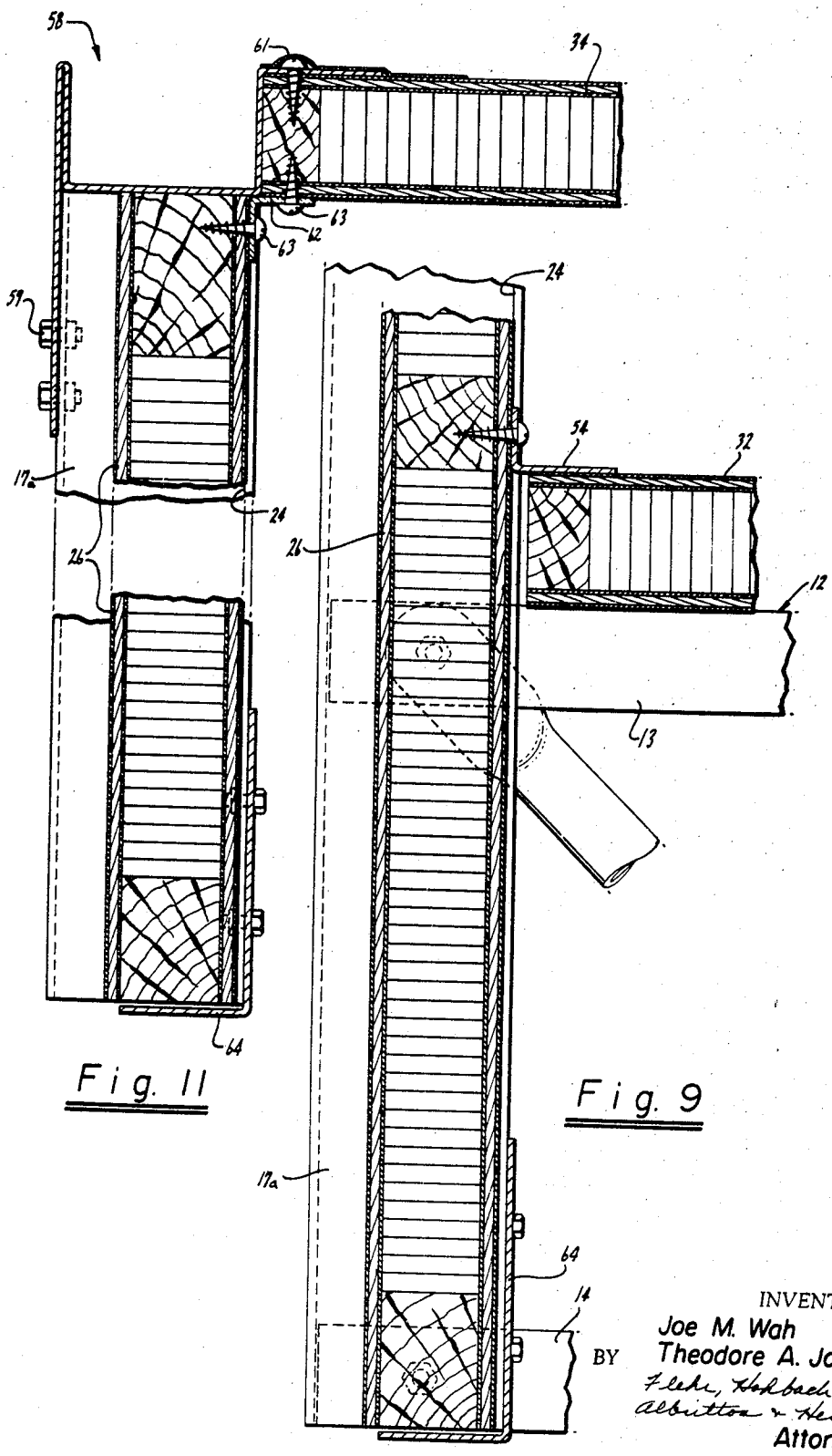

Fig. 11

Fig. 9

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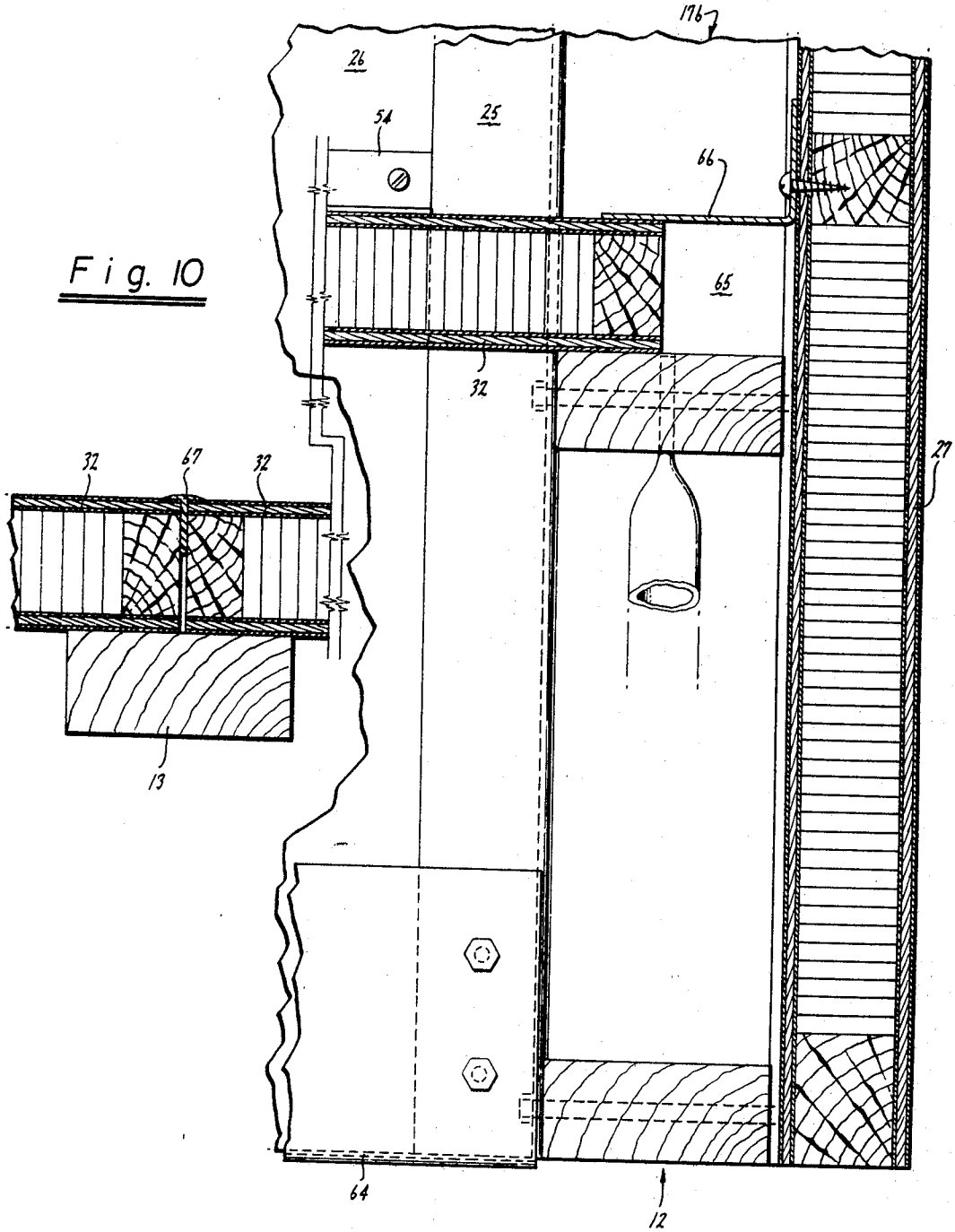
Fig. 10



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BUILDING SYSTEM

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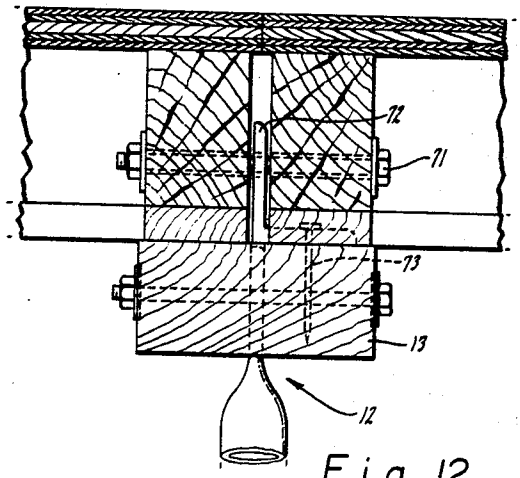


Fig. 12

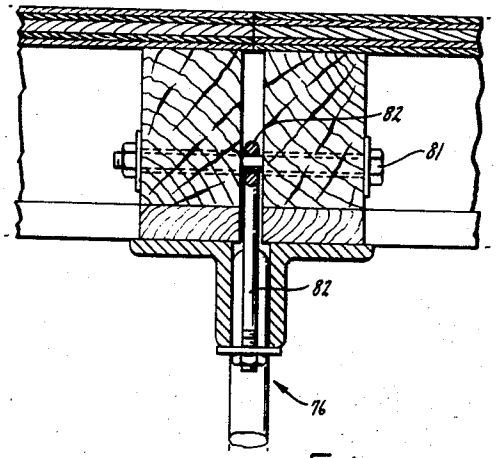
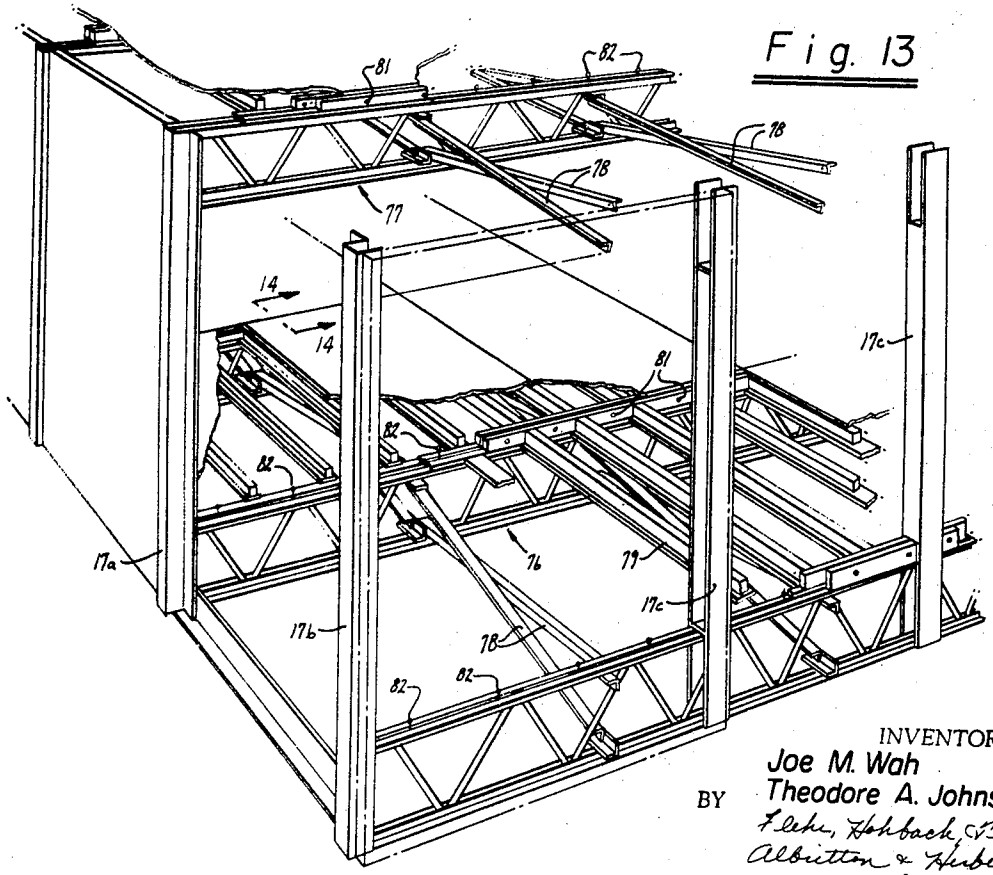


Fig. 14

Fig. 13



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3,474,582

BUILDING SYSTEM

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Int. Cl. E04b 1/00, 5/00, 7/00
U.S. Cl. 52—263 1 Claim

ABSTRACT OF THE DISCLOSURE

A building system using prefabricated components is provided. The basic prefabricated components include side and end panels; foundation jacks; roof and floor truss joists; structural steel framing including support posts and channel joists; interior panels; windows and screens; porch deck canopy, steps, and porch; doors; and flashing, gutters, and downspouts. These components are assembled into two end modules and a number of center modules depending on the desired size of the building. The support posts of the system are fastened to the truss joists at two spaced points at each end. The posts themselves are spaced from one another and include side flanges for receiving wall panels.

The present invention is generally directed to a building system and more particularly to a building system using prefabricated components.

In the construction of temporary housing units, it is desirable that the units be durable, easily erected, as for example by two men, be capable of being put up and taken down many times during their life span, employ few components to minimize the manufacturing, warehousing, and replacement considerations, be flexible in both exterior and interior design, and be low in cost without sacrificing building quality or durability.

It is a general object of the present invention to provide a building system which incorporates all of the above desired features.

Accordingly, there is provided a building system in which a plurality of exterior side wall panels are provided which have a predetermined width. A plurality of floor truss joists are supported from a ground plane by spacer means so that the top surfaces of the joists are coplanar and horizontal. A plurality of roof truss joists are provided which are similar to said floor joists. Vertical support members have ends adapted to interlock with the floor and roof joists at two spaced points on each joist. The vertical supports which are on an exterior side wall are spaced from each other substantially the width of a side wall panel and have at least one flange for receiving an edge of a side wall panel.

The invention will become more clearly apparent from the following description when taken in conjunction with the accompanying drawings. Referring to the drawings:

FIGURE 1 is a perspective view of a building system in accordance with the present invention;

FIGURE 2 is an exploded view of the building system of FIGURE 1 showing alternative components also;

FIGURE 3 is a schematic plan view illustrating the modular construction of the present invention;

FIGURE 4 is an enlarged perspective view of a portion of the building of FIGURE 1 broken away in several parts to show interior construction features;

FIGURE 5 is an enlarged cross-sectional view partially broken away taken along the line **5—5** of FIGURE 1;

FIGURE 6 is an enlarged cross-sectional view partially broken away taken substantially along the line **6—6** of FIGURE 1;

FIGURE 7 is an enlarged cross-sectional view taken along the line **7—7** of FIGURE 1;

FIGURE 8 is an enlarged cross-sectional view taken substantially along the line **8—8** of FIGURE 2;

FIGURE 9 is an enlarged cross-sectional view partially broken away taken substantially along the line **9—9** of FIGURE 4;

FIGURE 10 is an enlarged cross-sectional view partially broken away taken substantially along the line **10—10** of FIGURE 1;

FIGURE 11 is an enlarged cross-sectional view partially broken away taken substantially along the line **11—11** of FIGURE 1;

FIGURE 12 is an enlarged cross-sectional view similar to FIGURE 8 showing the tiedown of an alternative type of panel on a truss joist;

FIGURE 13 is a broken away perspective view of a modified building having no interior supports and modified truss joists; and

FIGURE 14 is an enlarged cross-sectional view taken along line **14—14** of FIGURE 13.

A building incorporating the improved building system of the present invention is illustrated in FIGURE 1 and is shown in exploded form in FIGURE 2. Generally it consists of a very limited number of basic components which may form a building as small as two basic sections or modules or one of several modules as to be described in detail below.

More specifically, the building consists of a number of adjustable foundation jacks **11** which support floor truss joists **12**. Jacks **11** are normally placed on concrete footings and adjusted to maintain truss joists **12** level. Each floor truss joist consists of a top chord **13**, a bottom chord **14** and interconnecting bracing **16**. The top and bottom chords **13, 14** provide two spaced points which may interlock with vertical support members **17**. This is best shown in FIGURE 4 where each support **17** has U-shaped ends **18** at the top and **19** at the bottom. End **19** is fastened to the top and bottom chords **13, 14** by spaced pins. Actually the vertical support members are of several different types. The type designated **17***c* may be termed an interior support post. The other types of support posts include an exterior middle side post **17***a* which has flanges **23** and **24** on each side which are for the reception of side wall panels **26**. These posts, **17***a*, also have one side of their U-shaped ends covered to present a smooth and continuous exterior surface at both extreme ends of the support post. Another type of the post is an exterior corner post **17***b* (FIGURE 4) which has a single flange **25** instead of a double since end panels **27** are directly fastened to the flat surface of the support post. The opposite corner post would naturally have its corresponding flange **26** on the opposite side. Lastly, exterior middle end posts **17***c* serve as support members for both the end panels **27** and the door structure and are similar in configuration to interior post **17***c*.

The roof of the building is supported by roof truss joists **28** which are constructed similarly to the floor truss joists **12**. Again they interlock with the U-shaped ends of the vertical support posts and are fastened at two spaced points for providing a rigid structure.

Between each pair of floor truss joists **12** there extends several floor channel joists **31** (FIGURE 4) which are attached to top chords **13** of the floor joist to form a flush surface. The channel joists provide rigidity for the structure in a direction perpendicular to that of the truss joists **12** and in addition support floor panels **32**.

Similarly, roof truss joists **28** are interconnected by roof channel joists **33**, the channel joists also providing support for roof panels **34** which are similar to floor panels **32**.

Windows are provided in the side panels **26** by use of

a side panel **26***a* (FIGURE 2) with a U-shaped cut-out for receiving a window unit **30**. Alternatively, an off-center window may be provided for the use of panel portions **35**, **36** and **37** with a window unit **38**. All of the above units **35–38** will form a panel the same the same size as panel **26**. The window units **30** as shown in FIGURE 1 are also provided with screens **39** which are attached to framing **40** which in turn is fastened to the side of the building in a convenient manner.

The front and rear walls of the building are formed by end panels **27** and in the case of a rear wall the remaining space would be filled by an additional filler panel **41** (FIGURE 3). However, for the front of the building panel **41** is replaced by a door unit **42** having upper and lower filler slabs **43** and **44**. Alternatively, a door unit **45**, which is of a single door type construction, may be a filter panel **46**.

Additional front door accessories are a porch canopy **47** and a porch deck, stairs, and railing **48** (FIGURE 1). In addition, a louver **49** may be substituted for filler panel **43** at the top of the door unit **42**. Appropriate flashing gutter and down spouts are also provided indicated generally at **50** which will be described in detail below.

The building as described above thus consists of essentially ten basic components which are: side and end panels **26**, **27**; adjustable foundation jacks **11**; truss joists for both floor and roof **12**, **28**; structural steel framing which basically includes the support posts **17**, **17***a*, **17***b* and **17***c* and channel joists, **31**, **33**; floor and roof panels **32**, **34**; interior panels (not shown); window and screens **36**, **37**; porch deck canopy **47**, steps and porch **48**; doors **42**; and flashing, gutters and down spouts **50**.

The modulator construction is shown in FIGURE 3 and consists of three basic modules; namely, an end modulus **51** with door, a center module **52**, and an end module **53** without a door. The first module **51** which, for example, may have a dimension of 8 by 24 feet, contains two sets of truss joists **12**, **28** for both floor and roof with appropriate vertical support members **17** and wall panels. The other two modules, **52** and **53**, contain only set of truss joists along with appropriate foundation jacks. Center module **52** has only side walls **26** which may include windows as shown. End module **53** includes the end filler panel **41**. Thus, it is obvious that by the addition of a series of center modules **52**, a building of any length can be constructed. Interior partition kits, plumbing cores and electrical kits may also be provided for each module.

FIGURES 5 through 11 show several important details of the construction which has been generally outlined above. FIGURE 6 shows an exterior middle support post **17***a* having the flanges **23** and **24** to which side panels **26** are fastened by bolts **55**. These exterior side support posts **17***a* are spaced a predetermined distance so that the side panels **26** will fit between them and their flanges. Truss joist **12** is shown as being interlocked with a support post **17***a*. Floor panels **32** abut the post **17***a* and its associated wall panels **26** and angle trim **54** is provided between the intersection of floor panels **32** and wall panels **26**, the angle trim being fastened by screws **56** to wall panels **26**. Alternatively, wood baseboard may be substituted for angle trim **54**.

In the case of a corner, FIGURE 5 illustrates this construction which includes the use of a special corner post **17***b* which has a single flange **25** for receiving a side panel **26**; an end panel **27** is fastened to the flush side of the post.

Channel joists **31** connecting the floor truss joists are coupled to the floor **32** as best shown in FIGURE 8. The roof construction is essentially identical. The roof and floor construction illustrated is of the honeycomb type and the mode of fastening shown applies only to this type of construction.

Referring to FIGURE 7, the top of the end panels **27** are joined to a roof panel by appropriate metal flashing **57** which is screwed or nailed to the respective roof and wall end panels.

FIGURE 11 illustrates a top portion of the building where a side wall panel **26** meets the roof panel **34** and here a gutter assembly **58** provides a U-shaped trough which catches any rainwater. Gutter **58** is attached to an exterior middle post **17** by fastening members **59** and the other end of the gutter unit **58** is screwed to the roof panel **34** by screws **61**. On the inside of the building the junction between a wall panel **26** and roof panel **34** is joined by angle trim **62** which is fastened to the respective side and roof panels by screws **63**. Wood ceiling moulding may be substituted for angle trim **62**. A bottom portion of the side wall panels **26** on the interior is protected by a side bottom angle plate **64**.

FIGURE 9 is a detail view showing the intersection of a floor truss joist **12** with a typical exterior side post **17***a* and also illustrates the manner in which the floor panel **32** is joined to the side wall panel **26** by the angle trim **54** as also shown in FIGURE 6. In addition, the detail illustrates the interlocking of the top and bottom chords **13**, **14** or a floor truss joist **12** with post **17***a* at two spaced points.

FIGURE 10 illustrates a front wall panel **27** cross-section showing its relationship to a floor panel **32** and a floor truss joist **12**. More specifically, the floor panel **32** is coupled to the end panel **27** by angle trim **66** and the side panel **26** (as also illustrated in FIGURE 9) is coupled to the same floor member by angle trim **54**. Coupling of the side panels may also be accomplished by use of wood blocking in cavity **65** and the use of a wood baseboard and floor covering. Side wall panel **26** is received in the flange **25** of the exterior corner type post **17***b*. Side bottom plate **64** is fastened on the bottom portion of panel **26**. The mode of joining the two floor panels **32** is also illustrated in FIGURE 10 where two panels are shown resting on a top chord **13** of a floor truss joist **12**. Suitable sealing material **67** is applied between the two floor panels such as neoprene tape. A suitable floor covering may also be used to cover the joint between panels.

The wall panels **26**, end panels **27**, and roof and floor panels **32**, **34** as illustrated in the preferred embodiment are of a honeycomb core structure. However, where greater load bearing capacity is necessary, the roof and floor panels may be of a stressed skin-type construction which is surfaced with plywood with an appropriate inner core. FIGURE 12 illustrates the tie-down of a floor or roof panel of this type on a wood truss joist **12** where a machine bolt **71** joins the two panels together and holds a tie-down angle **72** through which a nail **73** is driven to affix the panels to the top chord **13** of the truss joist. Different panel materials may be substituted if the specific application permits. The roofing panels are surfaced with neoprene roofing materials and all joints are taped before coating.

Where the elimination of interior support posts is desired, a steel truss joist construction is used as illustrated in FIGURE 13. More specifically all steel floor and roof truss joists **76** and **77** are provided to which exterior support posts **17** interlock at two spaced points in a manner similar to the wood truss joists **12** and **28**. Diagonal angle bracing **78** between parallel joists maintains the rigidity of the building. Special channel joists **79** couple the truss joists for supporting the roof and floor panels.

FIGURE 14 shows the connection of the steel truss joists **76** and **77** to stress skin-type roof and floor panels. A machine bolt **81** couples the two panels and the bolt itself tied down to the top chord of steel truss **76** by an eyebolt **82**.

Thus, in summary, the present invention has provided a building system in which units are durable in that they are made of plywood or other similar materials and metal frames, and are easily erected by two men such that each separate wall panel or end panel is small enough and lightweight enough to be handled by two men; in addition the structural steel is easily handled such as the vertical support posts. Moreover, because of the bolt and screw type construction, the building is easily put up and

taken down many times during its life span. The design is highly flexible in that additional modules may be added at any time and in a very relatively simple manner.

We claim:

1. In a building system, a plurality of exterior wall panels having a predetermined width, a plurality of floor truss joists supported from a ground plane by spacer means so that the top surfaces of the joists are coplanar and horizontal, each of said floor truss joists comprising top and bottom chords connected by bracing members, a plurality of roof truss joists identical to said floor joists, a plurality of vertical support members each having U-shaped ends sitting astride said floor and roof joists, said U-shaped ends being interlocked with the top and bottom chords of each joist, at least a part of said supports being on an exterior side or end wall, said vertical supports which are on an exterior side wall being spaced from each other substantially the width of a side wall panel and having at least flange for receiving an edge of a side wall panel, a plurality of substantially identical channel joists coupled and perpendicular to adjacent roof and floor truss joists and including a plurality of substantially identical floor panels and a plurality of substantially identical roof panels similar in configuration to said floor panels, said floor panels being affixed to channel joists coupled between said floor truss joists and said roof panels being affixed to channel joists coupled between said roof truss joists, said building system having three basic

modules, consisting of first and second end modules and a center module, said modules having as components said floor and roof truss joints, wall panels, and said vertical support members adapted for interlocking with said joists, said first module having two pairs of floor and roof truss joists and a plurality of said vertical support members for coupling said truss joist pairs, predetermined pairs of said support members being spaced and having flanges for receiving a wall panel, said second and center modules having one pair of truss joists.

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