United States Patent [19]

Philp

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[54] **WALL FRAME FOR A FOLDABLE STEEL BUILDING**

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[73] Assignee: **Atco Structures Inc.,** Anchorage, Alaska

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[30] **Foreign Application Priority Data**

Dec. 31, 1970 Sweden 17839/70

[52] **U.S. Cl.** **52/70,** 52/71, 52/729, 52/731, 52/93, 52/641

[51] **Int. Cl.** **E04b 7/16**

[58] **Field of Search** 52/70, 729, 731, 52/69, 71, 93, 641

[56] **References Cited**

UNITED STATES PATENTS

3,296,752	1/1967	Philp	52/90
2,858,916	11/1958	Josephs	52/90
2,291,472	7/1942	Johnston	52/71
304,798	9/1884	Butz	52/731
3,634,992	1/1972	Hughes	52/731
1,451,198	4/1923	Benson	52/93
844,179	2/1907	Niesen	52/92
2,592,610	4/1952	Shumaker	52/69
3,513,608	5/1970	Nagrod	52/93
649,352	5/1900	Rector	52/93

FOREIGN PATENTS OR APPLICATIONS

732,729	9/1932	France	52/729
1,139,511	1/1969	Great Britain	52/70

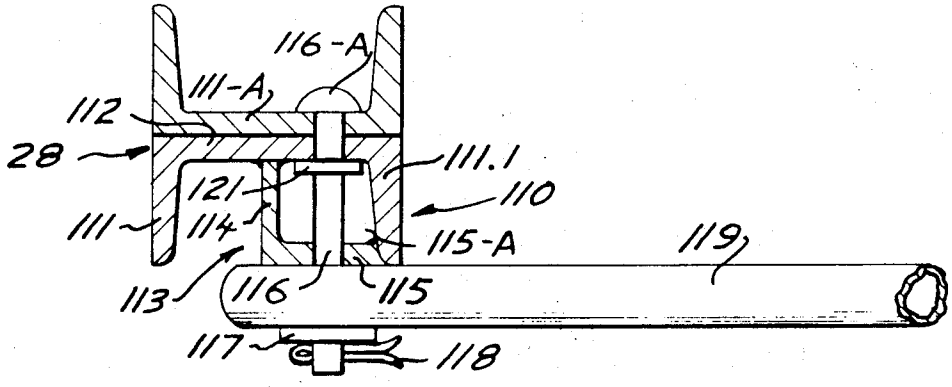
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[57] **ABSTRACT**

U.S. Pat. No. 3,296,752 and Canadian Pat. 723,348 issued to the present inventor in a prefabricated foldable structural steel building. The present invention provides an improved wall frame having improved means (**100**) to secure the wall frames to side wall columns, and an improved releasably secured means (**110**) securing braces to columns. These improvements permit construction of buildings with wider spans than economically practicable in the patented buldings above, and facilitate erection and dismantling.

3 Claims, 8 Drawing Figures



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2 Sheets-Sheet 1

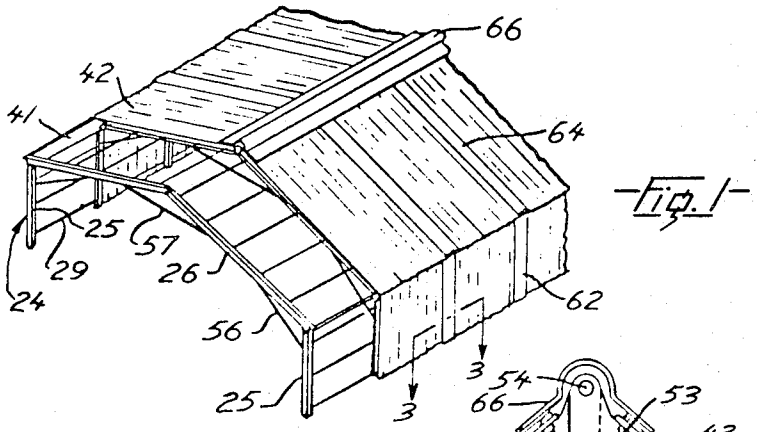
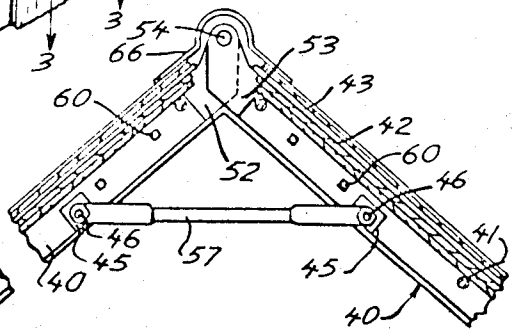


Fig. 1



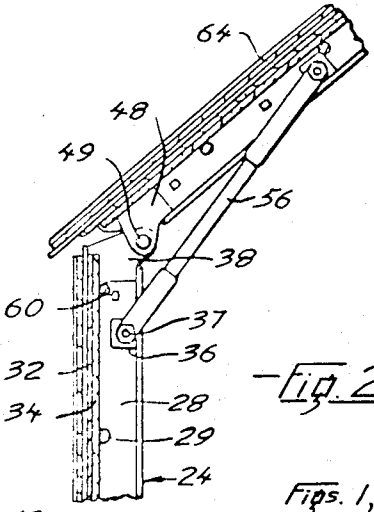
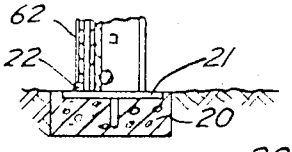


Fig. 2

Figs. 1, 2, 3 are PRIOR ART



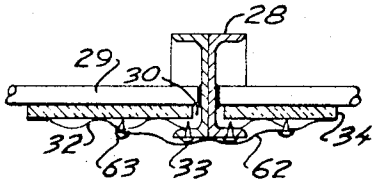


Fig. 3

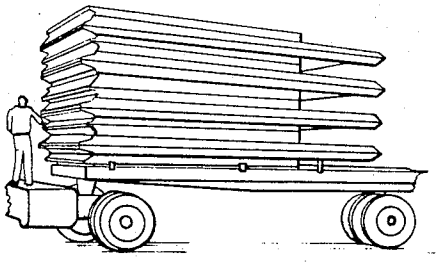


Fig. 4

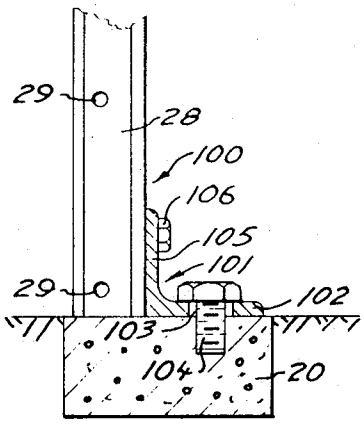


Fig. 5

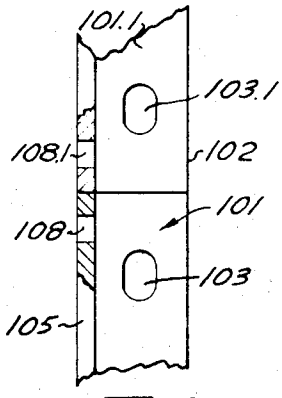


Fig. 6

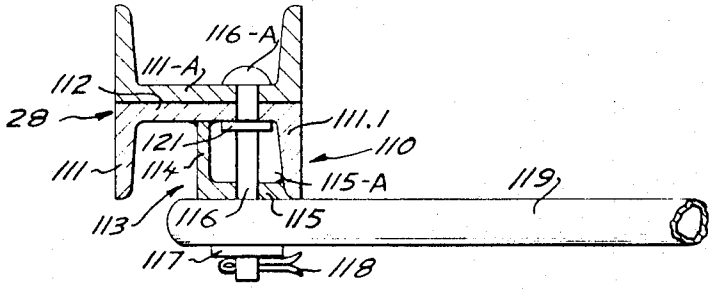


Fig. 7

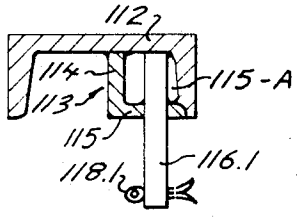


Fig. 7-A

WALL FRAME FOR A FOLDABLE STEEL BUILDING

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an improved wall frame for a prefabricated foldable structural steel building of a type described in Canadian Pat. 723,348/65, United States Pat. No. 3,296,752, and in corresponding foreign patents of the present inventor. The present invention is directed to improved structure adapted for more rapid erection and dismantling particularly adapted for buildings of this type in widths from 40 to 60 feet (about 12 to 18 meters) and upwards, and to other improvements.

2. Prior Art

The patents aforesaid teach a building having side wall frames and roof frames each of the side wall and roof frames being formed of widely spaced edge members and connecting cross members, with a panel extending between the spaced edge members from end to end. Means are provided hinging each side wall frame to an adjoining roof frame for swinging the roof and the side wall frames into face to face contact, together with means for hinging the roof frames to one another at a ridge of the building. Removable braces are provided at the ridge and at hips formed at a junction of side wall panels and roof panels, to provide rigidity to the erected building.

This building is economical to manufacture and is adapted to be dismantled and the roof and wall panels folded together to form a compact package for shipping. Length of the building depends upon the number of structural units, that is to say wall panels and roof panels, used.

The present invention provides improved means of securing the wall frames to foundations and improved means of securing braces to the wall frames, in buildings wider than contemplated in the patents, and provides improved structure which is lighter, stronger, cheaper to manufacture, and more readily erected, then corresponding structures taught in the patents aforesaid. These and other improvements herein have resulted from several years experience in the use of these buildings.

A detail description following, related to drawings, gives particluars of a prior art building according to the patents above covering common features of the prior art building and a building according to the present invention to such an extent as is deemed adequate for recital of structure embodying improvements contemplated in the present invention. The prior art description is followed by a detail description, related to drawings, of exemplification of structure expressing the present invention.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective of a prior art building with some parts omitted,

FIG. 2 is a fragmented transverse section of a main structural unit of the building,

FIG. 3 is a detail section on 3—3 FIG. 1,

FIGS. 1 through 3 are prior art,

FIG. 4 is a small scale perspective of main structural units according to the present invention folded for transportation and loaded on a truck,

FIG. 5 is a generally sectioned elevation showing means of securing a wall frame to a concrete sill,

FIG. 6 is a part sectioned fragmented plan of an angle section of the securing means,

FIG. 7 and 7A is a part sectioned fragmented plan showing means to secure a brace to a column.

DETAIL DESCRIPTION

PRIOR ART BUILDING

A description of a prior art building according to the patents above follows, the description including structure generally relevant to the present invention and being given in detail sufficient for understanding structure and function of improvements according to the present invention.

Figs. 1, 2, 3

The building is erected over a concrete foundation as indicated at 20 in FIG. 2, being effectively a concrete sill. Embedded in the sill are a number of longitudinally spaced metal plates 21 stops 22 being provided near outer edges of the plates.

A main structural unit 24 of the building is a transversely extending section having hinged side wall frames 25 and hinged roof frames 26 FIG. 1.

Each wall frame has two columns 28 FIG. 2 spaced some 10 feet (3 meters) apart. Lower ends of the columns rest upon the plates 21 in engagement with the stops 22 and can be secured to a plate part by suitable means, not shown. The two parallel columns are channels with open sides opposed webs of the channels defining side edges of the frames as best seen in FIG. 3. At spaced intervals the columns 28 are joined by horizontal rods 29, the rods being welded to the webs of the channels and spaced from the outer flanges. The spacing of the rods with respect to the outer flanges of the channels defines a pair of opposing grooves 30, outer edges of a rectangular panel 32 being received in the grooves. The panel 32 can be a sheet of corrugated galvanized metal as shown, and is suitably secured to the inner face of the outer channel flange by use of self-tapping metal screws 33. If the side walls of the building are required to be insulated, the grooves 30 are made wide enough to accommodate a layer of insulating material 34. The insulating material can be bonded to the inner face of the panel 32, or simply wedged or fastened in a known manner between the panel and the rods 29.

A bracket 36 FIG. 2 for a bolt 37 is secured to each column spaced below its upper end, being welded to the open side of the channel near the inner flange. A top hinge plate 38 is welded to the web between the flanges, the plate having a free end which projects inward beyond the inner flange.

Roof frames 22 are generally similar in construction to the wall frames. Two spaced rafters 40 form side edge members of the roof frames and are connected by spaced parallel longitudinal rods 41 FIGS. 1 and 2. A panel 42 is fitted to the frame 40 as before and can be insulated as at 43 FIG. 2. Ridge brackets 45 having projecting bolts 46 are provided on each rafter spaced from its upper end. Near their lower ends the rafters are fitted with a pair of hinge plates 48, the plates having inwardly projecting free ends and being spaced apart so as to receive the hinge plates 38 of the columns 28. Hinge pins 49 connect the plates 38 and 48, the pins being located at the intersection of lines projected from the inner faces of the columns and rafters.

Then two roof frames are also connected by a hinge structure including ridge plates **52** secured to the upper ends of the rafters of one frame. The rafters of the other frame each have a pair of spaced ridge plates **53** the plate **52** of the adjoining rafter extending between them. A ridge hinge pin **54** passes through plates **52** and **53.** In the roof frames the hinge pins are disposed on an intersection of the rafters.

The wall and roof frames are connected together by diagonal hip braces **56.** Horizontally disposed ridge braces **57** are bolted to the ridge brackets **45.**

The sections **24** are secured together by means of bolts **60,** some of which extend through the webs of the channels forming the rafters **40.** Other bolts **60** similarly connect abutting webs of the columns **28.** Thus a rigid structure is provided without additional support members within the building.

Joints between the columns **24** are made weatherproof by corrugated sealing strips **62** FIGS. **1** and **4,** secured to underlapping edges of the wall frame panels by screws **63.** Similar sealing strips **64** seal the joints between the roof frames and again screws **65** secure the strips to the panels. The upper ends of the roof strips **64** are covered by lengths of ridge cap **66** which lengths are suitably lapped from one end of the building to the other.

A building so constructed has a length according to the number of main structural units **24** used.

IMPROVED STRUCTURE ACCORDING TO THE PRESENT INVENTION

Figs. **5** and **6**

As previously described with reference to FIG. **2** longitudinally spaced plates are embedded in the concrete sill **20.** As seen in FIG. **5** structure generally **100** includes an angle section sill **101** having horizontal flange **102** with spaced slotted openings **103** for lag bolts **104** securing the angle iron sill to the concrete foundation or sill **20.**

The means **100** described and illustrated, being means to secure a wall frame to a foundation, does away with the previous plates **21** FIG. **2** and increases strength and rigidity of the wall frames. With this construction, spaced concrete blocks can be substituted for the continuous foundation sill.

The columns **28** are secured to a vertical flange **105** of the angle section, with horizontal rods **29** extending between the columns as before described, the wall construction also being as before described.

In FIG. **6** an angle section **101.1** of an adjacent wall frame is shown butted, as they appear when adjacent frames are joined to one another, slots **103.1** and **108.1** of the adjacent angle section sill being shown. Alternatively - which alternate is not shown - the angle section can be continuous, with the wall panels being successively bolted to the continuous angle section. As seen in FIG. **6,** bolts **106** pass through spaced slotted openings **108** of the vertical flange **105** of the angle section, which bolts secure the columns **28** to the angle section.

Figs. **7, 7-A** means releasably to secure a brace

Means generally **110** releasably to secure a brace to a column are shown in FIG. **7,** the column **28** of a channel **111** having an inner flange **111.1** and a web **112.** An angle member **113** has flanges **114, 115,** outer edges of which are welded respectively to the web and inner flange as shown defining a rectangular space **115 - A** having inner and outer side walls defined by the web **112** and flange **115.** A brace pin **116** extends through the web of the column **28** and through the column of an adjacent frame, which column has a web **111 - A,** through the flange **115,** serving to pin joint a hip brace **119** to the column. A washer **117** and cotter **118** at an outer end of the brace pin secure the hip brace as shown. A circlet **121** can be provided adjacent the web **112,** and a circlet (not shown) can be used in lieu of the cotter **118.** It is seen that the engagement of the head **116A** of the pin **116** and the circlet **121,** with opposite sides of the column webs prevents movement of the pin and are means to secure the pin against axial movement relative to the column.

FIG. **7** shows an end of the hip brace **119** secured to a column **28,** an opposite end of the hip brace is similarly secured to a rafter, the hip brace being disposed generally as shown in FIG. **2.** In each case the braces are lengths of structural pipe.

Fig. **7-A**

FIG. **7-A** shows a pin **116.1** passing centrally through the side wall (flange) **115** through the space **115-A** being welded to the angle member **113** and to the web **112** at its inner end. This is an alternative equivalent to the construction shown in FIG. **7.** A cotter **118.1** is provided, being releasable means securing the brace to the pin, other releasable means e.g., a circlip or a nut (the pin being threaded) can be used.

MATERIALS AND SIZES

Materials typically used are as follows

26 gauge galvanized steel cladding
7 in. channel steel in wall frames
6 in. channel steel in roof frames
2 in. structural pipe struts and roof purlins
2 only 2 ft. by 4 ft. (nomial) fibreglass skylights in each 10 in. section
1 only 32 in. by 80 in. solid core walk in door c/w hardware
2 only 8 ft. by 14 ft. sliding doors (16 ft. wide 14 ft. high opening);

or in corresponding metric sizes and gauges.

The foldable building is an expandable relocatable, steel structure suited for use as an equipment storage or repair shop. The building is fabricated in roof/wall sections 10 ft. (3M) long that provide a 40 ft. (12M) clear span with walls 14 ft. (4M) high. Sections can be added in multiples of 10 ft. (3M) to increase the size of the building as required, and width to 60 ft. (18M) or more can be supplied. Weight per section for a building 40 ft. (12M) wide is some 2,800 pounds (1,300 Kg) including hardware. FIG. **4** shows a number of 40 ft. (12M) sections folded and loaded on a truck for shipment to a building site.

I claim:

1. In a foldable building frame having hingedly interconnected side columns and rafters each column having a web and inner and outer flanges and braces extending between and connected to each column and an adjacent rafter; means securing each brace to its respective column, each of said means comprising:

a. an angle section bracket rigidly connected to the web and inner flange of the column being disposed so that one leg is parallel to and spaced from the column web, said one leg having an opening therethrough,

b. a pin connected to the column web against movement relative thereto and having a portion project-

ing through the opening in said one leg of the angle bracket,

c. means connecting an end of one of said braces to said projecting portion of the pin.

2. Means for securing a brace to the column as claimed in claim **1** in which the means for connecting the pin to the column web includes:

a. an opening in the column web for receiving the pin,

b. a head at the inner end of the pin engagable with one face of the column web for restricting movement of the pin in one direction relative to the column web and a circlet mounted on the pin engaging an opposite face of the column web for preventing movement of the pin in an opposite direction.

3. Means for securing the brace as claimed in claim **1** in which the inner end of said pin is welded to the column web.

* * * * *