Aug. 4, 1953 A. DIETRICH 2,647,475

KNOCKDOWN ARCH STRUCTURE

Filed June 19, 1950 2 Sheets-Sheet 1

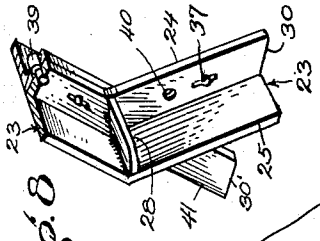


Fig. 8

Fig. 1

Fig. 9

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Filed June 19, 1950 2 Sheets-Sheet 2

Fig. 2

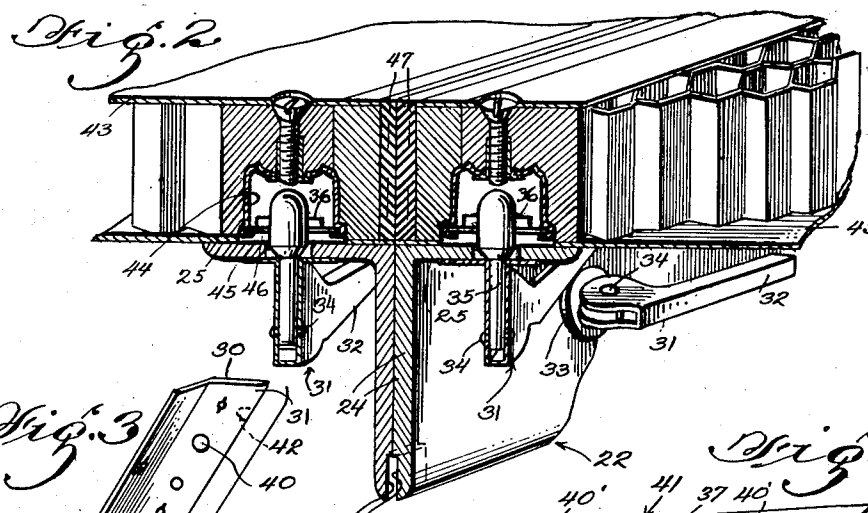


Fig. 3

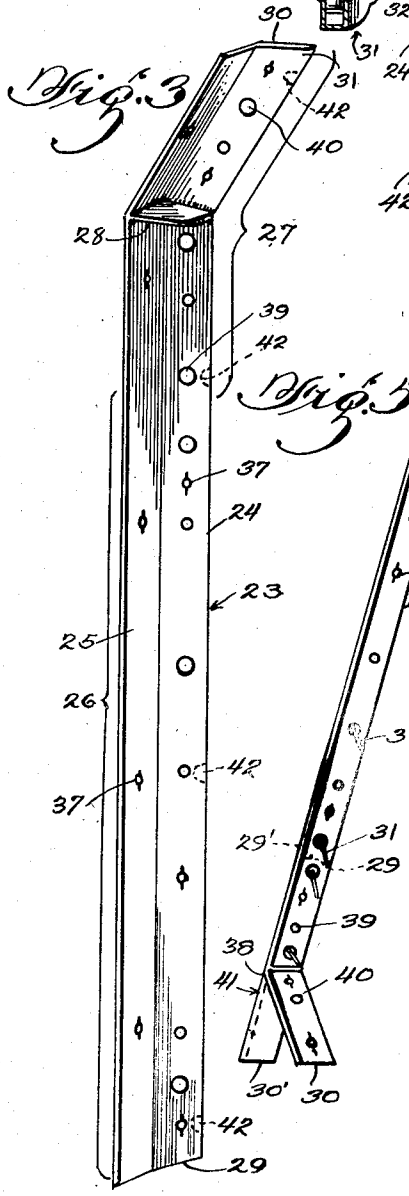


Fig. 4

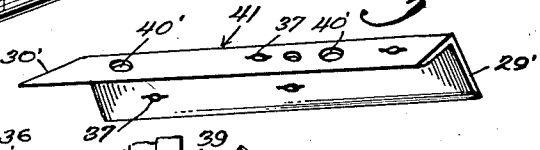


Fig. 5

Fig. 6

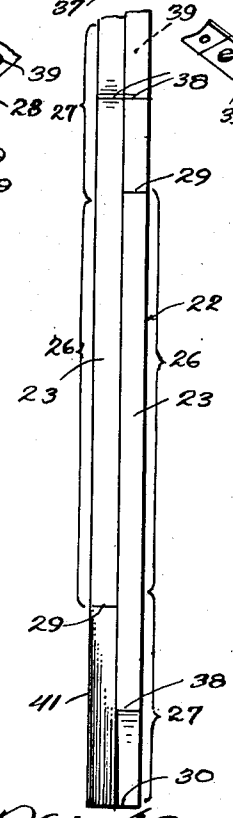
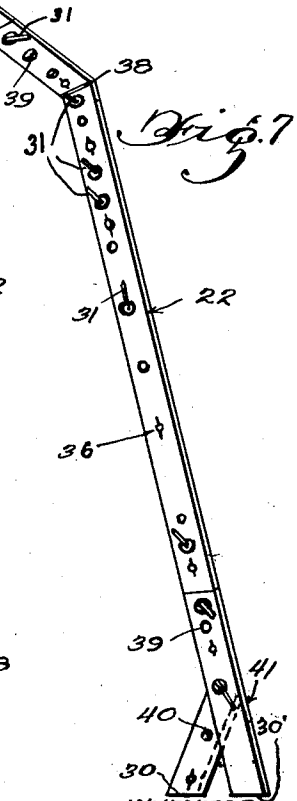


Fig. 7



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KNOCKDOWN ARCH STRUCTURE

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Application June 19, 1950, Serial No. 169,022

5 Claims. (Cl. 108—1)

1

My invention relates to knock-down buildings and structural elements for forming the same. More particularly my invention relates to buildings of the type wherein a number of structural elements are detachably connected together to form a structure which is readily knocked down for transportation or storage to its orignal elements or to units formed by sub-assemblies of such elements. The building according to the invention is particularly adapted for use in cold climates where it may be erected directly on the ground without the use of previously prepared foundations.

With the foregoing in view, an object of my invention is to provide an improved knockdown building and improved structural elements for forming the same.

A further object is to provide an improved structural frame member of arched form as part of the frame for the building.

A further object is to provide an improved structural element, a plurality of which are adapted to be connected together to form an arched structural frame member for the building.

A further object is to provide an improved method of constructing a structural arch.

A further object is to provide an improved arched roof for a knockdown building.

A further object is to provide an improved floor for a knock-down building in combination with an improved arched roof structure for the same.

A further object is to provide an improved knock-down building which includes a sectional floor and roof which are so related as to permit a larger or smaller building to be erected merely by the addition or subtraction of floor and roof sections or wherein the floors may be extended beyond the roof in any direction merely by the addition of additional floor sections whereby to provide uncovered floors or walks capable of being connected to the floors of adjacent buildings of like structure.

Other objects and advantages reside in the the particular structure of the building and elements thereof, combination and arrangement of the structural elements and assemblies thereof for forming the building, and/or in the particular mode or method of constructing the building or portions thereof, all of which will be readily apparent to those skilled in the art upon reference to the attached drawing in connection with the following specification wherein the invention is shown, described and claimed.

In the drawing:

Figure 1 is a fragmentary perspective view of

2

one end of a building according to the invention;

Figure 2 is an enlarged fragmentary vertical sectional view taken substantially on the plane of the line 2—2 of Figure 1;

Figure 3 is a perspective view of a structural element according to the invention;

Figure 4 is a perspective view of a supplemental structural element according to the invention;

Figure 5 is an elevation of one end of a structural arch showing a plurality of structural elements connected together according to the invention;

Figure 6 is a front view of Figure 5 looking from the left thereof;

Figure 7 is an elevational view like Figure 5 but showing the opposite end of the structural arch;

Figure 8 is a fragmentary perspective view on an enlarged scale showing certain details at one end of the structural arch; and

Figure 9 is an exploded fragmentary bottom plan view of the arch showing an alignment feature of the invention, parts being broken away and shown in section.

Referring specifically to the drawing, wherein like reference connections have been used throughout the several views to designate like parts, and referring at first to Figure 1, 10 designates generally a knock-down building according to the invention. The building 10 basically comprises the floor which is generally indicated by 11 and a combined side wall and roof structure which is generally indicated by 12.

The floor 11 is more specifically shown and described in my copending application filed July 14, 1950, Ser. No. 173,735. Briefly, the floor 11 comprises a rectangular assembly comprising a plurality of like rectangular floor panels 13. The assembly is bounded on two opposite sides by rows of sill panels 14. Each floor panel 13 and sill panel 14 is of laminated structure and in the embodiment of the invention here illustrated, each includes a relatively thick foundation-providing lamination 15 of yieldable insulating material of the nature of sponge rubber. Likewise, each floor and sill panel 13 and 14 includes a relatively thinner rigid floor-providing lamination 16 of any suitable material. Two adjacent edges of each floor-providing lamination 16 are provided with tongue receiving grooves 17 while the remaining two adjacent edges are provided with complementary tongues 18 for interlocking engagement with the grooves 17 of adjacent panels. The floor panels 13 are connected together to form a rectangular floor by any suitable

fastening elements diagrammatically indicated at 19 and more specifically disclosed in my copending application aforesaid. Likewise, opposite sides of the assembly of floor panels are connected to the rows of sill panels 14 by similar fasteners 19. The yieldable foundation-providing laminations 15 are adapted to rest directly on the ground whereby to envelope minor surface irregularities so as to minimize the labor of preparing the foundation for the building. The assembled floor may be anchored to the ground by a plurality of anchor stakes 20 which pass downwardly through inclined holes formed in the sill panels 14. Each sill panel 14 has secured to the upper surface thereof in any suitable manner, one or more sill boxes 21 which are in longitudinal alignment and to which the roof 12 is adapted to be secured to secure the floor and roof together.

The roof 12 is supported by and detachably connected to a plurality of spaced structural arches generally indicated at 22. The lower ends of the arches 22 rest upon the upper surface of the sill panels 14 and are supported thereby. Each structural arch comprises a plurality of structural elements 23 all of which are substantially identical whereby it will suffice to describe but a single one of them. As best seen in Fig. 3 each structural element 23 comprises an L-shaped angle iron having a vertical flange 24 and a laterally directed flange 25 extending from the vertical flange at right angles.

In the embodiment illustrated each of the arches 22 is of regular semi-polygonal form. That is, each arch 22 comprises one half of a regular polygon. Each arch 22 is T-shaped in cross section throughout substantially its entire length. Obviously the arches could be semi-circular and still retain the T-shaped cross section. However the illustration of the invention has been restricted to a regular semi-polygonal arch whereby the particular structural elements 23 are in some respects superior to similar arcuate angle irons. For instance, the structure shown permits the use of flat roof panels which are more readily formed than arcuate panels. Thus, each structural element 23 comprises an elongated straight major section 26, Fig. 3, and a shorter minor section 27 integral therewith. The inner portion of the minor section is a straight continuation of the major section. However, the outer portion of the minor section 27 is vertically angularly directed relative to its inner portion. That is, the outer portion of each minor section 27 extends from the inner portion thereof at a slight vertical angle. This angle may vary depending upon the number of elements needed to provide the arch. As the arch here illustrated is of 180° and utilizes six pairs of elements 23, the angle is 30°. Obviously variations in the angle and in the degrees in the arch are possible and are contemplated. A stiffening plate 28 is welded or otherwise suitably secured to the flanges 24 and 25 of the minor section 27 at the point where the outer portion of the minor section angles off from the inner portion thereof and provides the apex 38. The ends of the elements 23 are beveled with corresponding bevels 29 and 30 for a purpose to be apparent hereinafter.

In one method of constructing each arch 22, pairs of structural elements 23 are first reversed end-for-end and connected together in longitudinally offset back-to-back relation so that the minor section 27 of one element 23 extends beyond the opposite end of the major section 26 of the reversed and connected element 23 and vice versa. This structure is best seen in Figure 6. The structural unit thus formed is T-shaped in cross section throughout the entire length of the connected major sections 26 but is of oppositely disposed inverted L-shaped cross section in the minor sections 27 which comprise the opposite ends of the structural unit. As best seen in Figs. 5 and 7 in connection with the Figure 1, a series of structural units thus formed are connected together in end-to-end relation with the L-shaped minor sections of adjacent units lapped and registered and connected together in back-to-back relation to provide an arch which is T-shaped in cross section throughout substantially its entire length. The provision of the corresponding bevels 29 and 30 at opposite ends of each element 23 permit flat butt joints with complementary beveled ends of adjacent elements. The elements 23 are connected together by any suitable cam fasteners 31, best seen in Figure 2, which in themselves form no part of my invention.

Each cam fastener 31 includes a lever arm 32 and a cam portion 33 which is pivoted as at 34 to a bolt 35. The cam portion 33 bears on the vertical flange 24. Each bolt 35 has a T-shaped head 36 which extends through registering key hole slots 37 formed in the vertical flanges 24 of each element 23. After passage through a pair of registering slots 37, the fastener is rotated 90° on the axis of the bolt 35. Thereafter, the lever 32 is rotated on the axis of the pivot 34 to the position shown in Figure 2 whereby the cam 33 partially withdraws the bolt 35 and causes the T-head 36 thereof to engage the flange 24 of the opposite element and clamp the opposed elements 23 together in a well known manner. Obviously, other forms of connections could be utilized. However, threadless cam fasteners of the general type here shown or the equivalent are particularly useful in constructing a building of this type in frigid climates as they permit actuation of the fasteners while the operator is wearing gloves. In assembling adjacent pairs of structural units to form the structural arch 22, I have provided complementary aligning members on each element which also strengthen the lapped joints. These are best seen in Figures 8 and 9. Thus, each structural element is provided in the minor section 27 on the vertical flange 24 thereof at a given distance from the apex 38 with any suitable aligning member such as the stud 39. Likewise on the opposite side of the apex 38 and at a like distance therefrom each flange 24 is formed with a stud socket 40 for receiving the stud 39 of the opposed element 23. Thus, in the assembly of a pair of structural units in end-to-end relation to form an arch 22, the apices 38 of the lapped minor sections 27 are automatically aligned as well as the key hole slots 37 thereof. Also, the studs and sockets strengthen the joints and relieve the cam fasteners from shearing strains. Inasmuch as the structural elements 23 are identical, the connecting together of a plurality of pairs thereof in the same manner will inherently form identical structural units. When enough of such units are connected together in end-to-end relation they will of necessity form a regular semi-polygonal arch as shown in Figure 1.

However it will be noted that the lower ends of the arch will normally not be T-shaped in cross section as they will be formed by the angularly inwardly extending outer portions of the minor sections 27 of the lowermost structural elements 23. To strengthen the arches at these points, I

have provided the supplemental structural elements 41 best seen in Figures 4 to 7. Each supplemental structural element 41 is an L-shaped angle iron having beveled ends 29' and 30' corresponding to the beveled ends 29 and 30 of the elements 23. As best seen in Figures 5, 6, 7 and 8, the supplementary elements 41 are connected to those minor sections 27 which comprise the lower ends of the lowermost elements 23 so that the beveled ends 30' thereof are flush with the beveled ends 30 of such elements so as to rest atop the upper surfaces of the sill panels 14. Likewise, this arrangement provides diverging lower ends of inverted V-shaped form for the opposite ends of the arch whereby the weight of the same is distributed, to some extent, upon the sill panels 14.

When knocking down the building in frigid country, there is a distinct possibility that the abutting flanges 24 of the connected elements 23 will tend to freeze together by the freezing of condensation of other moisture on the abutting surfaces thereof. To facilitate separation of such elements, the lower edges of the flanges 24 are provided with complementary recesses 42 which register to provide screw driver slots when elements 23 are connected together, Figure 2. Thus, a screw driver or like tool may be readily inserted between frozen flanges to pry the elements 23 apart.

To complete the roof 12 a plurality of roof panels 43 have been provided. Each panel 43 is substantially identical and is provided on its under surface adjacent the marginal edges thereof with a series of recesses 44, Figure 2. The recesses 44 have closure plates 45 formed with key hole slots 46 for receiving the T-heads 36 of cam bolts 35 of fasteners 31. Such bolts 35 extend through key hole slots 37 in the lateral flanges 25 of members 23 whereby the roof panels may be detachably connected to the arches 22. The roof panels 43 have edges formed with resilient gaskets 47 which are adapted to be abutted and compressed to form fluid-tight joints between adjacent roof panels 43.

As clearly seen in Figure 2 the fastening and unfastening of the several elements, panels and units may be readily accomplished from within the building 10 whereby the erection and taking down of the building in inclement weather is facilitated.

The lower edges of the lowermost roof panels 43 are detachably secured to the sill boxes 21 in any suitable manner (not shown) as by bolts or cam fasteners, whereby the roof 12 is rigidly connected to the floor 11. In view of the rigid connection between the roof 12 and the arches 22, the latter need not be connected to the floor but simply rest thereon. Obviously, if desired, the lower ends of the arches 22 could be detachably connected to the sill boxes 21 or to the sill panels 14 in any suitable or well known manner.

As best seen in Figure 1 it is noted that the outer edges of the sill panels 14 extend outwardly of the roof panels 43 and that the end edges of the floor panels 13 extend forwardly and rearwardly of the front and rear edges of the roof 12. Thus it is apparent that such extending edges of the sill and floor panels may be readily connected to complementary edges of the floors of adjacent buildings for mutual support and/or to porches or sidewalks formed by single or multiple assemblies of floor panels or sill panels. Obviously, the length of the building may be varied by adding or subtracting appropriate sub-assemblies of roof and floor sections.

Moreover, while I have shown and described what is now thought to be a preferred embodiment of the invention, it is to be understood that the same is susceptible of other forms and expressions. Consequently I do not limit myself to the precise structures shown and described hereinabove except as hereinafter claimed.

I claim:

1. A regular semi-polygonal arch, comprising a plurality of substantially identical angle elements of L-shaped cross section, each element comprising a relatively long leg and a relatively short leg extending from said long leg at an angle, each element comprising a major section comprising the major portion of said long leg and a minor section comprising said short leg and an adjacent portion of said long leg of the same length as said short leg, a plurality of arch forming units, each unit comprising a pair of said elements, said elements of each pair being reversed end-for-end and disposed with the major sections thereof in registered back-to-back relation, means connecting said registered major sections together and thereby forming a plurality of arch units, each arch unit having a central portion of T-shaped cross section and end portions of L-shaped cross section, said end portions comprising the minor sections of the paired elements, and means connecting the end portions of a plurality of said units together in registered back-to-back relation and thereby forming said arch.

2. The structure of claim 1, wherein said minor section of each element is formed with a laterally directed alignment stud and an oppositely directed and complementary stud socket in spaced relation thereto, and said studs and sockets of said connected end portions of said units being interengaged.

3. A structural unit for constructing a regular semi-polygonal arch, said unit comprising a pair of substantially identical angle elements of L-shaped cross section, each element comprising a relatively long leg and a relatively short leg extending angularly of said long leg, each element comprising a major section comprising a major portion of said long leg and a minor section comprising said short leg and an adjacent portion of said long leg of the same length as said short leg, said elements being reversed end-for-end and disposed with the major sections thereof in registered back-to-back relation, means connecting said registered major sections together and thereby forming said unit, and said unit having a central portion of T-shaped cross section formed by said connected major sections and end portions of L-shaped cross section formed by said minor sections.

4. The structure of claim 3, wherein said minor section of each element is provided with a laterally directed alignment stud and an oppositely directed and complementary stud socket in spaced relation thereto, and said studs and sockets of each minor section being on opposite sides of and equally spaced from the intersection of said long and short legs.

5. The structure of claim 1, wherein the uppermost of said connected end portions of said units comprise the apex of said arch and the lowermost end portions on opposite sides of said apex comprise the lower termini of said arch, a pair of straight supplementary terminal

elements of L-shaped cross section, means rigidly connecting said terminal elements to said lowermost end portions in back-to-back relation to those parts thereof which comprise said adjacent portions of the long legs of the respective elements, said terminal elements having lower ends comprising downward continuations of such long legs, and said lower ends diverging from the associated angularly directed short legs and providing rigid and inverted V-shaped ends of said arch.

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