June 12, 1923.

1,458,866

C. H. WETZEL

PORTABLE STRUCTURE

Filed July 28, 1921 6 Sheets-Sheet 1

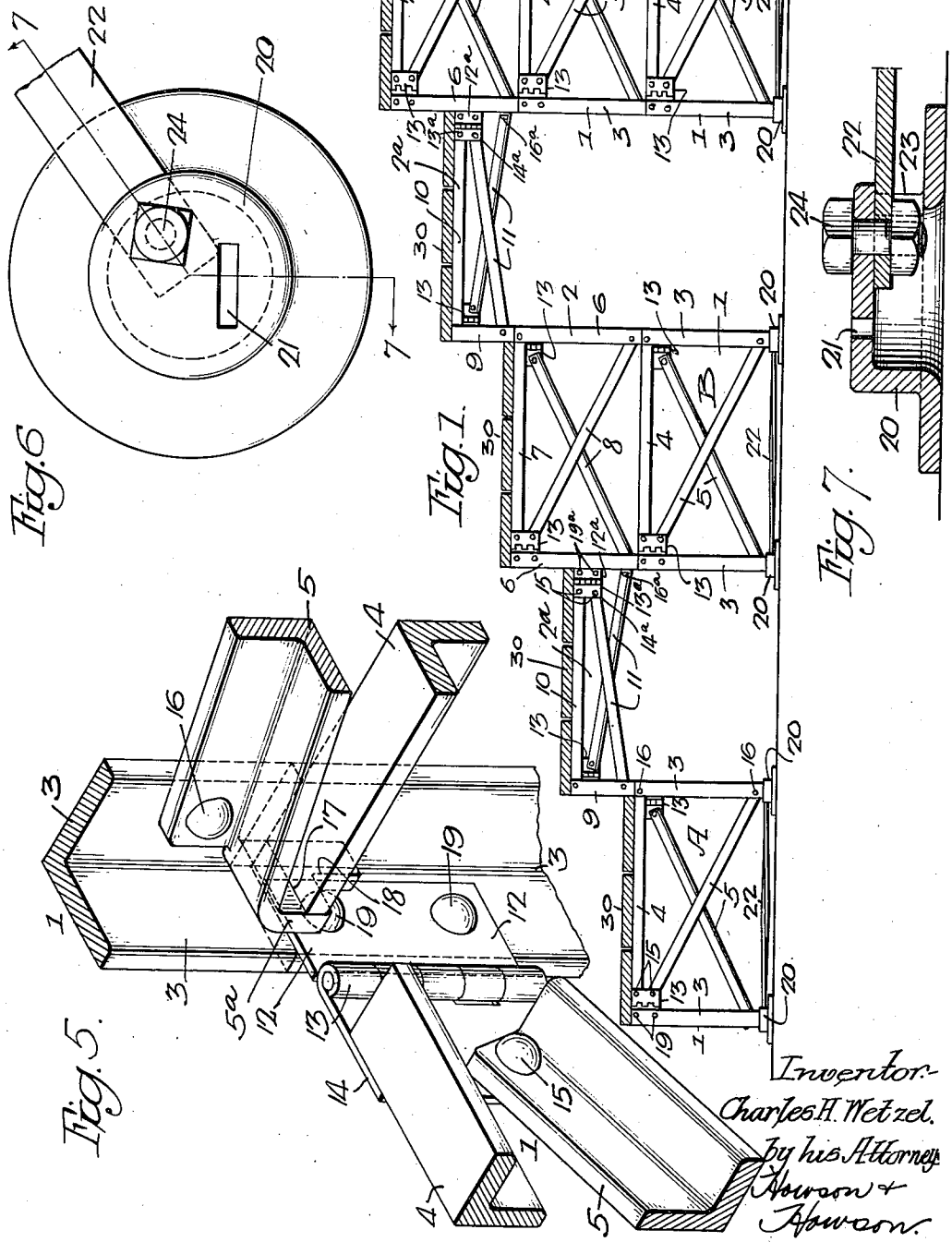


Fig. 1.

Fig. 6.

Fig. 7.

Fig. 5.

Inventor.
Charles H. Wetzel.
By his Attorneys
Howson & Howson.

June 12, 1923.

1,458,866

C. H. WETZEL

PORTABLE STRUCTURE

Filed July 28. 1921

6 Sheets-Sheet 2

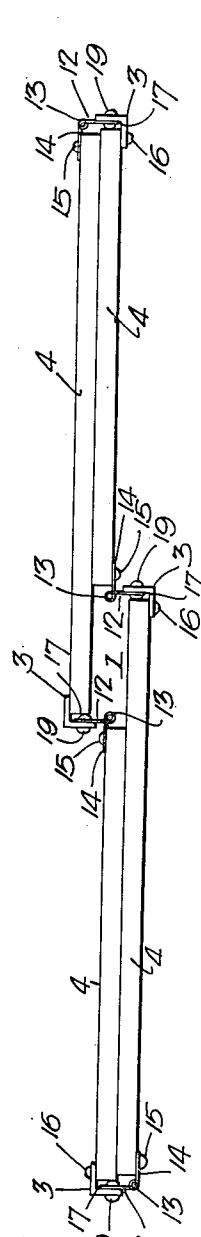


Fig. 1.

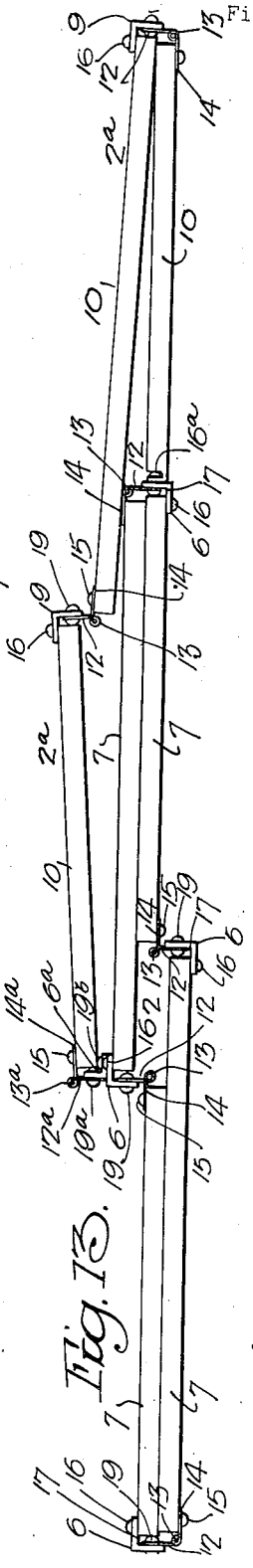


Fig. 1a.

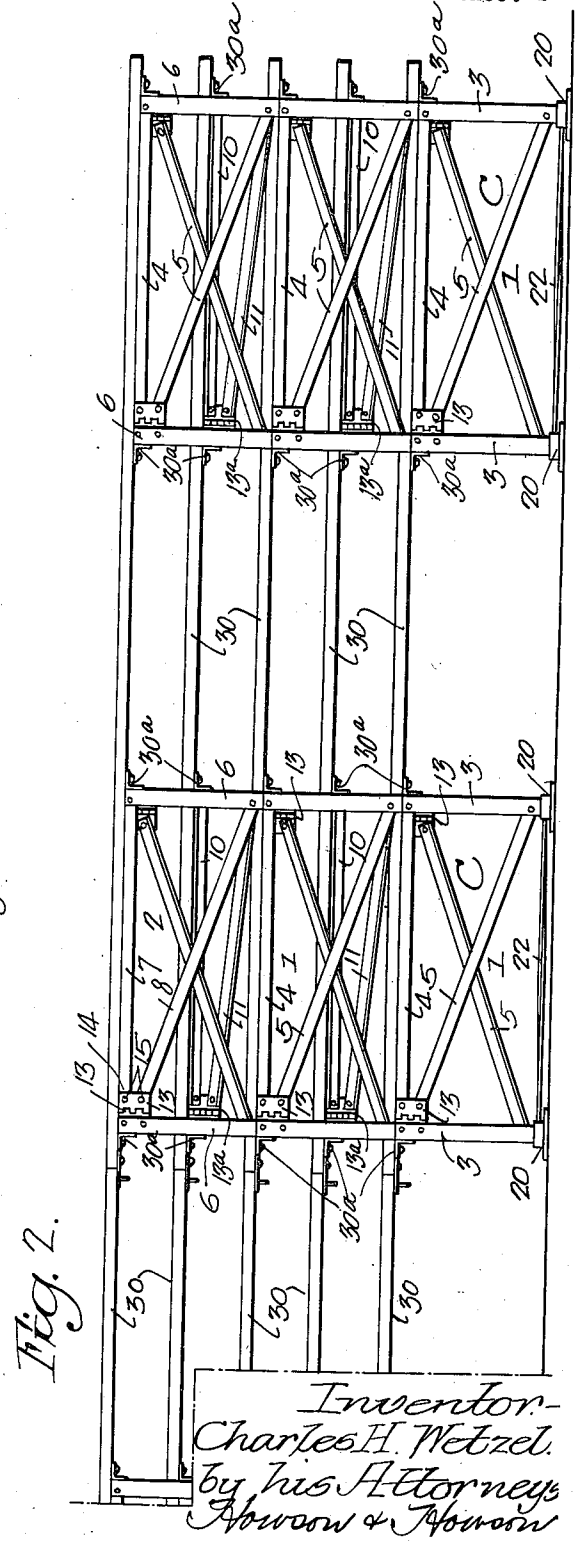


Fig. 2.

Inventor-
Charles H. Wetzel.
by his Attorneys
Howson & Howson

June 12, 1923. 1,458,866

C. H. WETZEL

PORTABLE STRUCTURE

Filed July 28. 1921 6 Sheets-Sheet 3

Fig. 3.

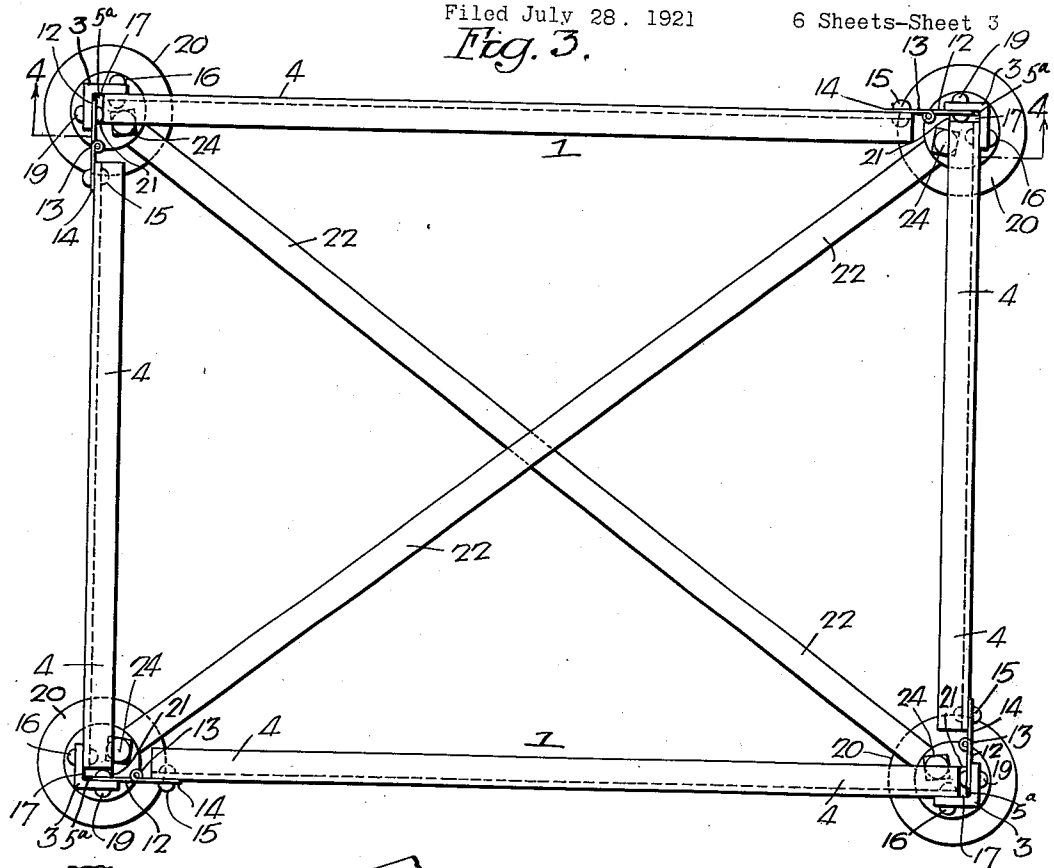
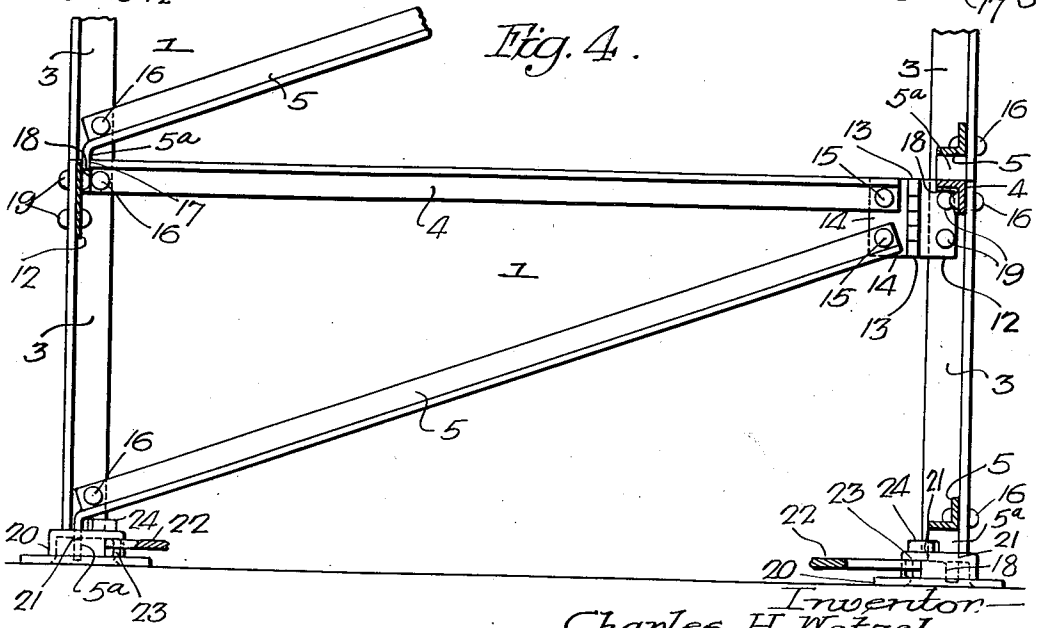


Fig. 4.



Inventor—
Charles H. Wetzel.
by his Attorneys—
Howson & Howson.

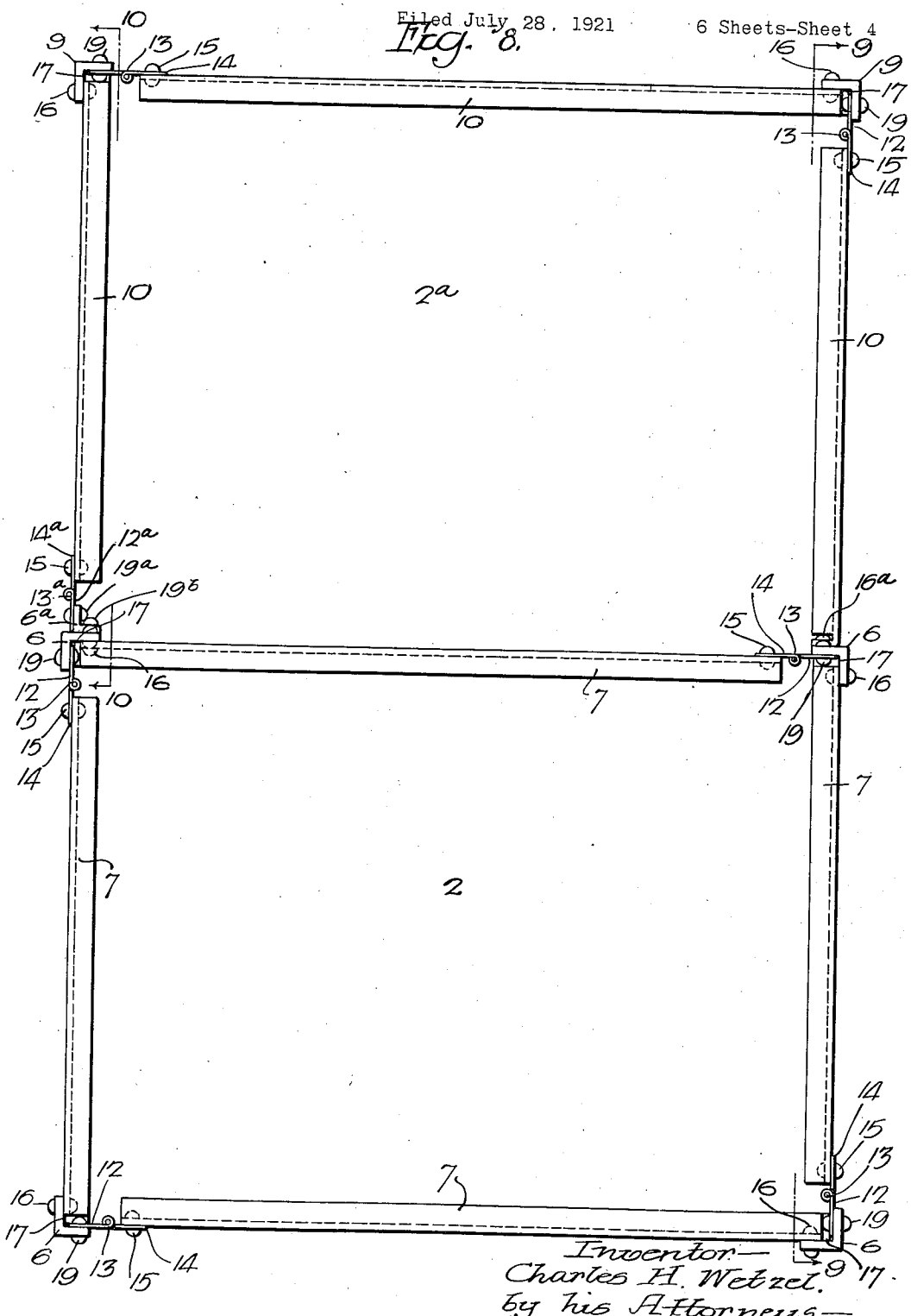
June 12, 1923. 1,458,866

C. H. WETZEL

PORTABLE STRUCTURE

Filed July 28, 1921 6 Sheets-Sheet 4

Fig. 8.



Inventor—
Charles H. Wetzel.
by his Attorneys.—
Howson & Howson

June 12, 1923.

1,458,866

C. H. WETZEL

PORTABLE STRUCTURE

Filed July 28, 1921

6 Sheets-Sheet 5

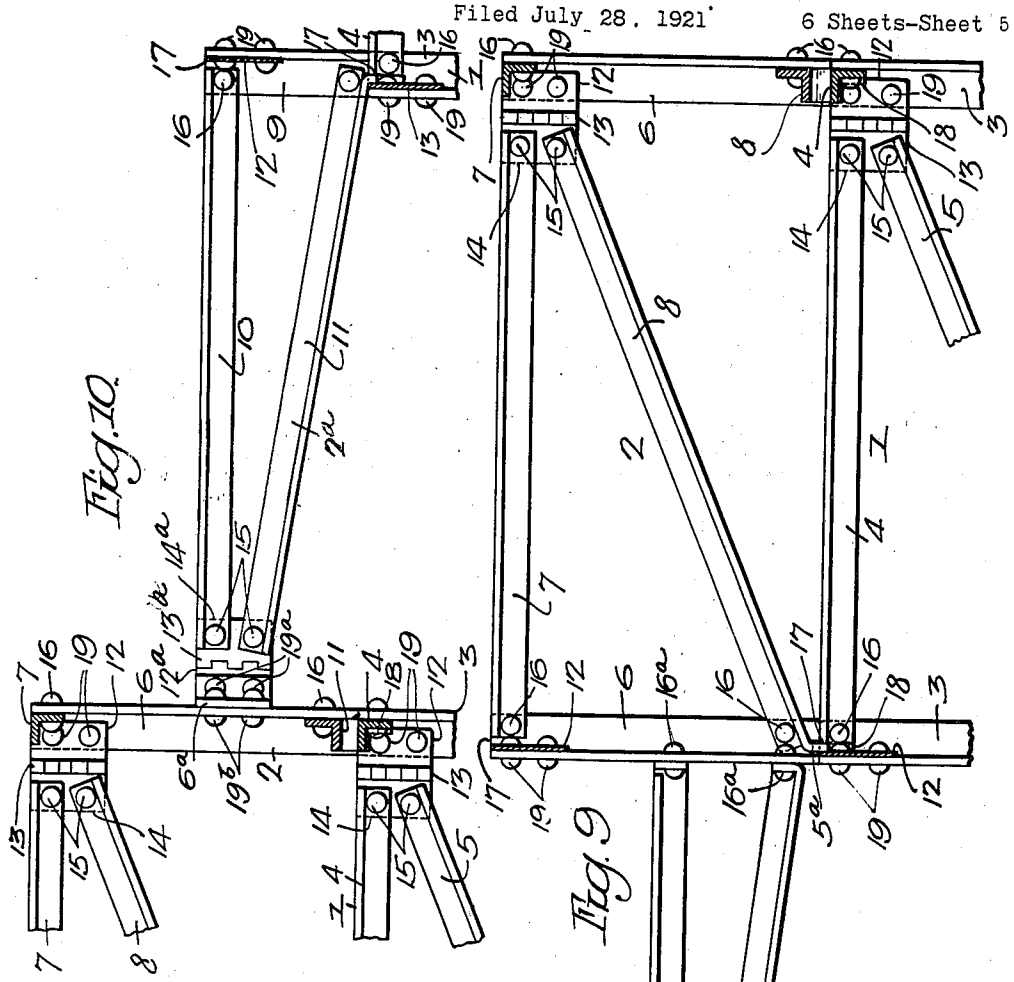


Fig. 10.

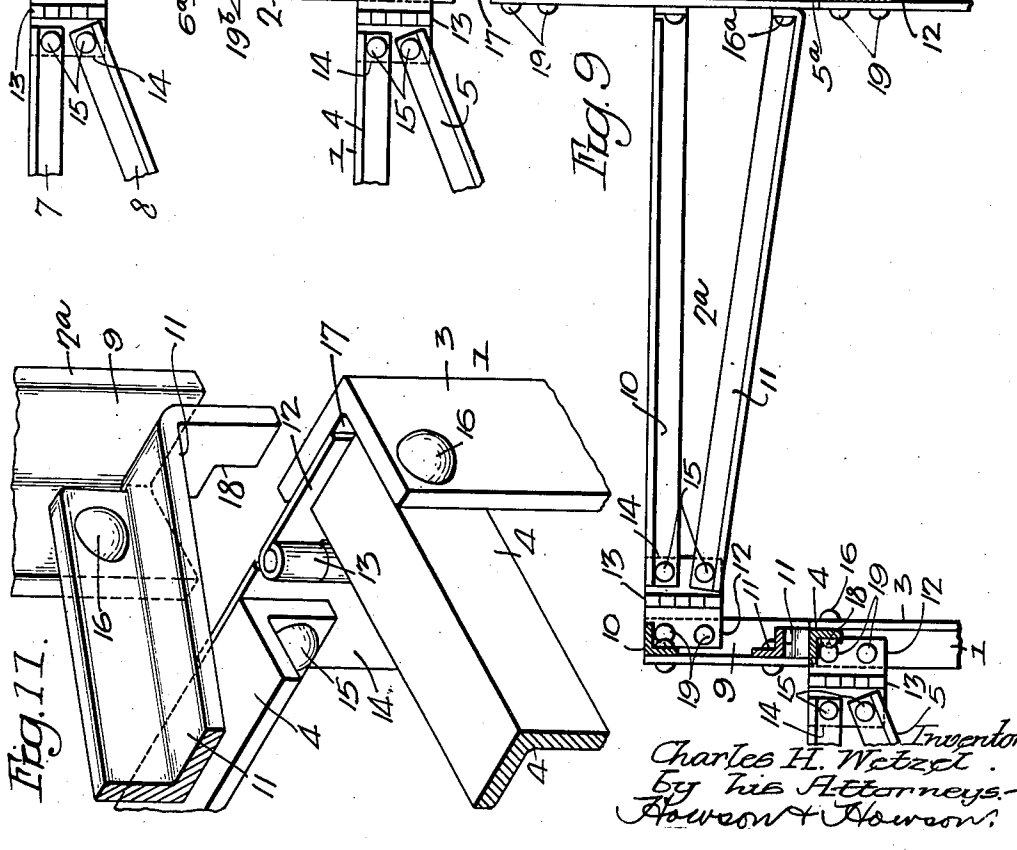


Fig. 9

Fig. 11.

Inventor
Charles H. Wetzel.
by his Attorneys—
Howson & Howson.

June 12, 1923. 1,458,866

C. H. WETZEL

PORTABLE STRUCTURE

Filed July 28, 1921 6 Sheets-Sheet 6

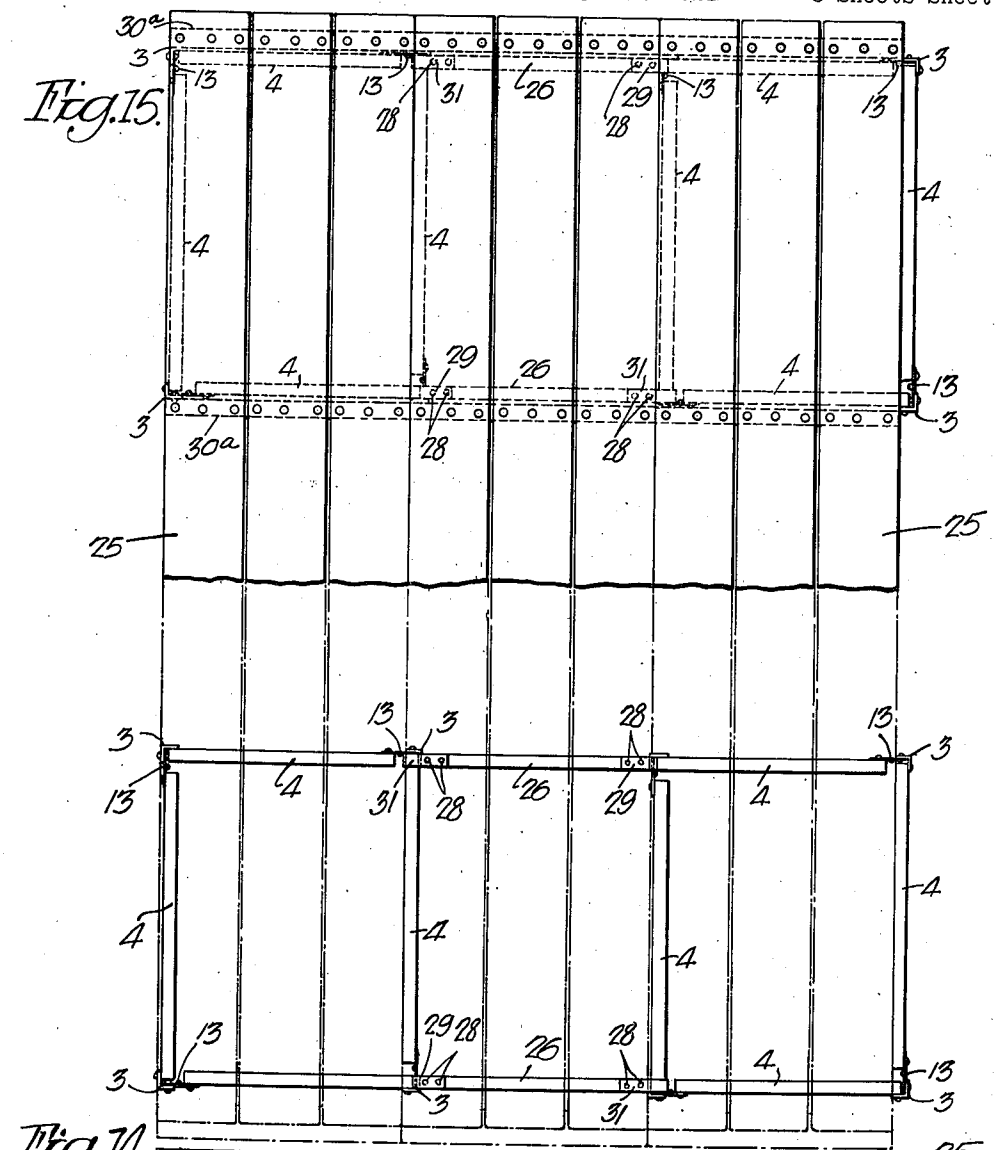


Fig. 15.

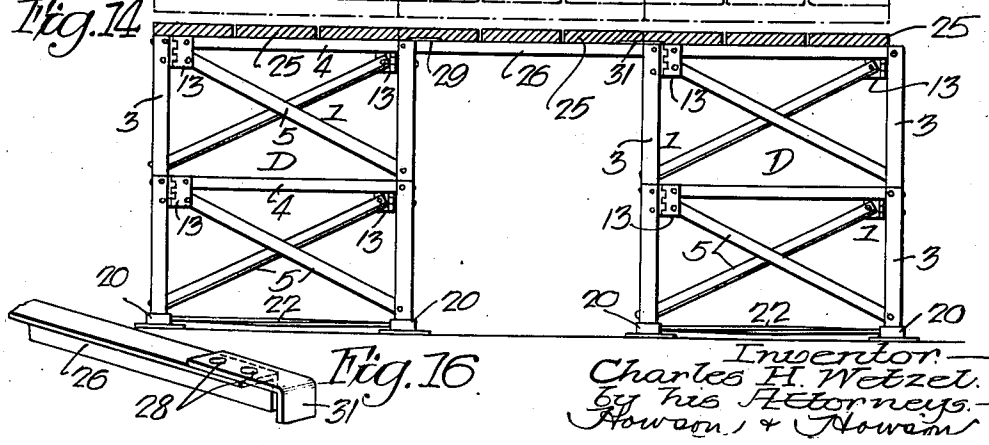


Fig. 14.



Fig. 16.

Inventor
Charles H. Wetzel.
by his Attorneys.
Howson & Howson

Patented June 12, 1923. 1,458,866

UNITED STATES PATENT OFFICE.

CHARLES H. WETZEL, OF WAYNE, PENNSYLVANIA.

PORTABLE STRUCTURE.

Application filed July 28, 1921. Serial No. 488,162.

To all whom it may concern:

Be it known that I, CHARLES H. WETZEL, a citizen of the United States, residing in Wayne, Pennsylvania, have invented certain Improvements in Portable Structures, of which the following is a specification.

The object of my invention is to provide a portable and easily handled structural unit which in conjunction with similar units is adapted to form unified structures assemblable without bolts or other of the commonly employed securing elements, said unit possessing the novel features of construction hereinafter fully described and illustrated in the attached drawings, in which:

Figure 1, is a sectional elevation of a grandstand constructed of units made in accordance with my invention;

Fig. 2, is a rear elevation of the grandstand;

Fig. 3, is a plan view of one of the units of my structure including the flange pieces;

Fig. 4, is a section on the line 4—4, Fig. 3, with a fragment of a superimposed unit visible;

Fig. 5, is a fragmentary enlarged perspective illustrating the means for uniting the units to form the unified structure;

Fig. 6, is a fragmentary plan view of one of the flange pieces;

Fig. 7, is a transverse section on the line 7—7, Fig. 6;

Fig. 8, is a plan view of one of the double or bridge units;

Fig. 9, is a section on the line 9—9, Fig. 8, illustrating the disposition of the double or bridge unit in the structure and the method of uniting the ends of the uprights;

Fig. 10, is a fragmentary section on the line 10—10, Fig. 8, illustrating details in the construction of the bridge unit;

Fig. 11, is an enlarged fragmentary and detached perspective of the adjoining portions at the front of the bridge unit and the underlying unit illustrating the locking means at that point of the structure;

Fig. 12, is a plan view of one of the single units folded;

Fig. 13, is a plan view of one of the bridge units folded;

Fig. 14, is a sectional elevation of a modified structure constructed of units made in accordance with the invention;

Fig. 15, is a plan view of the modified structure, and

Fig. 16, is a perspective view of a detail of the modified structure.

With reference to the drawings, the unit in one of its forms is designated in the drawings by the reference numeral 1, and comprises four uprights 3, connected together by horizontal cross bars 4 extending between the tops of the uprights and by diagonal cross bars 5 secured to the top of one upright and the foot of another.

The uprights 3 are made of angle iron, and each upright has secured to one leg of the angle by rivets 19 one section 12 of a hinge 13. To the other section 14 of this hinge is secured by rivets 15 the cross bars 4 and 5 constituting the respective sets thereof which bind the uprights together. The opposite ends of the cross bars 4 and 5 of the respective sets are secured by rivets 16 to the opposite leg of the adjacent upright. In this way there extends between each pair of adjacent uprights one set of the cross bars 4 and 5 which are hinged at one end to one of the uprights and rigidly secured at the other end to an adjacent upright. This construction, as shown in Fig. 12, permits folding the section substantially flat from its normal rectangular form, thereby materially increasing the portability and facilitating the handling.

The units 1 are subject to various modifications to suit the requirements of the particular structure. Such a modification I have illustrated in Figures 8, 9, 10 and 13. This unit, designated in the drawings by the reference numeral 2, consists of the previously described unit 1, to which is added an extension 2^a on one side. In this unit, the uprights corresponding to the uprights 3 of the previously described section 1 are designated by the reference numeral 6, while the extension consists of a pair of uprights 9, in the present instance approximately half the height of the uprights 6, and connected together and to two of the latter uprights by means of horizontal cross bars 10 and diagonal cross bars 11. The uprights 6 are connected together by horizontal and diagonal cross bars, 7 and 8 respectively, in exactly the same manner as are the uprights 3 of the section 1, while the cross bars 10 and

11 are, after the fashion of the previously described cross bars 4 and 5, rigidly secured at one end to one of the connected uprights and at their opposite ends are hinged to the other of the connected uprights. The particular sets of the cross bars 10 and 11 which unite the uprights 9 with the uprights 6 are at one side of the unit rigidly connected to one of the uprights 6 by rivets 16^a which pass through the bent ends of one of the legs of each bar, while at the other side the said cross bars are attached to one section 14^a of a hinge 13^a whose other section 12^a is secured by rivets 19^a to one leg of a short section of angle bar 6^a, the other leg of which is secured by rivets 19^b to a leg of the other upright 6. As shown in Figure 13, the units 2 are foldable in the same manner as the units 1.

The units are adapted to be arranged end to end in substantially vertical alignment to form the desired structure, and for the purposes of illustration I show in the present instance a grandstand for the formation of which the units of 1 and 2 are adapted. As shown in Figures 1 and 2, these units are superimposed one upon another to form a series of spaced tower structures represented respectively by the reference letters A, B and C, with the extensions 2^a bridging the space between and connecting the said towers. In superimposing the units, the respective uprights are disposed end to end in longitudinal and substantial vertical alignment with their adjacent ends flush, and suitable means to be described hereinafter is provided at the ends of the uprights to prevent lateral displacement and to retain the units in their proper relative position. It will be noted that the extensions 2^a are, in the present instance, substantially half the height of the units 2 of which they are a part and of the units 1, and that accordingly when the units are assembled in the structure the steps formed are but one-half the height that they would be were the extensions the same height as the units 1 and 2. By making the extensions but half the height of the sections 1, a material saving is accomplished and a more gradual slope formed in the stand than would be the case were the extensions of the same height as the units 1 and 2, since in the latter case in order to construct a stepped structure of the type shown in which the steps are of uniform height and width, it would be necessary to add to the top of each of the bridge units an additional single unit 1.

As clearly illustrated, the horizontal cross bars 4, 7 and 10, are adapted to support planks or boards 30 which constitute the floors of the structure, and spaced downward projections 30^a are provided on the under side of the planks which are adapted to prevent longitudinal movement of the boards on the structure, and which further function to retain the respective sets of graduated tower structures properly spaced with respect to each other.

The lower end of each of the diagonal cross bars 5, as best shown in Fig. 4, is secured near the bottom of one of the associated uprights and is turned downwardly substantially into alignment with the said associated upright in such manner as to extend beyond the end of said upright, said extensions 5^a constituting a lug or lip which, projecting beyond the end edge of each of the said uprights, is adapted to overlap the joint between that upright and the immediate underlying upright whereby the said uprights are retained in their substantially vertical alignment, and lateral displacement of the units with respect to each other prevented.

To provide for the passage of the extension 5^a, the inner ends of the upper legs of the horizontal bars 4 are stopped short of the opposed leg of the uprights to which they are rigidly attached, thereby forming an opening 17 through which the extension passes, there being formed in this way a pocket for the reception of the extension between the end of the cross bars 4 and the opposed leg of the upright. The hinges 13 being secured to the tops of the uprights at the points where the extensions 5^a are disposed when the units are assembled, a portion of the extension 5^a is cut away to form a recess 18, which is occupied by the head of the rivets or bolts 19 which secure the said hinges to the uprights. It will accordingly be seen that the extensions 5^a when once in place are prevented from moving in any direction; in two of them by the legs of the uprights in the angle between which the said extension is disposed, and in the other two directions respectively by the said rivet head 19 and the ends of the cross bars 4. This unifying effect being had at each joint between the contiguous ends of uprights, a singularly rigid and unified structure is obtained which resists all normal stresses regardless of the direction in which they are applied to the structure.

In the units 2, the construction of the lower ends of the diagonal cross bars 8 is in every way similar to that of the cross bars 5 previously described, and the same is true of the diagonal cross bars 11 of the extensions 2^a, the extensions of the said diagonal cross bars 11 entering the pocket formed therefor in the top of the uprights 3 or 6 of the underlying units, as shown in Figs. 8, 9 and 10, which illustrate the joints between the forward end of the bridge unit and the said underlying units.

Since the units 1 are uniform in construction and standardized, it becomes necessary

to make allowance for the extensions 5ª at the bottom of the uprights of the base units, and for this purpose and further to provide means for preventing any folding movement of the said units after they are set up, I provide flange pieces 20 consisting in the present instance of round plates having their center portion elevated, as best shown in Fig. 6, and provided in their elevated surfaces with slots 21 for the reception of the said projections 5ª of the base units. These flange pieces 20 are also connected in pairs by means of bars 22, the ends of which extend through suitable openings 23 in the sides of the elevated portions of the pieces, and are secured to said plates by means of bolts or rivets 24, said connecting bars 22 being sufficiently long to extend between diagonally opposite uprights of the base units when the projections 5ª associated with said uprights occupy the apertures 21. As shown in Fig. 2, the retaining elements formed by the connected pairs of flange pieces and their connecting bars are disposed between each diagonally opposite pair of uprights in the base units whereby the units are retained rigidly in the open position, and all folding action prevented.

In Figs. 14 to 16, both inclusive, I have illustrated a modified form of stand in which the units 1 alone are employed, this structure consisting of a plurality of independent tower structures D built up of the units 1, over which supporting planks or boards 25 are laid to form a flat elevated platform. In this structure, the towers, which are in line transversely of the direction of the said boards, are joined together by means of elements 26, consisting of a length of angle iron having attached at each end by rivets 28, hook-like elements 29 and 31, which are adapted respectively to hook over adjacent sides of the tower structures, one of the hooked elements at one end being relatively short and being adapted to fit into one of the sockets formed for the reception of the lips 5ª at the bottoms of the uprights of a superimposed unit, and the other hooked end being sufficiently long to pass entirely over the horizontal leg of the cross bar 4 of the adjacent top unit. The usual spacing elements 30ª are provided on the under side of the planks to prevent longitudinal movement thereof and to assist in retaining the tower structures together.

It will be apparent that this type of unit, either in the form illustrated or modified to suit the various conditions and requirements of the particular structure desired, may be employed in making structures other than those herein illustrated, as, for example, scaffoldings and other temporary stands.

By forming my unit of angle iron, I not only have taken advantage of the lightness and strength of this material, but I have been able by its adaptation to eliminate all cast fittings of one sort or another, and have reduced the structure to a minimum of material and cost of production.

It will be understood, however, that while I prefer to use angle iron, other somewhat similar forms may be employed with no departure from the essential features of the invention.

I claim:

1. A structural unit comprising a plurality of uprights and adapted for end to end attachment to like units with the uprights of one unit in substantially vertical alignment with those of another, and cross bars connecting said uprights and extending beyond the ends thereof to overlap the joints where the aligned uprights meet, thereby to prevent displacement of the units with respect to each other.

2. A structural unit comprising a plurality of uprights and adapted for end to end attachment to like units with the uprights of one unit in substantially vertical alignment with those of another, and horizontal and diagonal cross bars connecting the uprights, the diagonal cross bars extending beyond the bottom ends of the uprights and being adapted to enter a space between the uprights and the ends of the horizontal cross bars of an underlying unit, thereby to prevent lateral displacement of the units with respect to each other.

3. A structural unit comprising a plurality of uprights, a hinge at the top of each upright, horizontal cross bars having one end thereof attached to the hinges and the other end attached to an adjacent upright, diagonal cross bars having one end attached to the said hinges and the other end attached to the adjacent upright, said units adapted to be superimposed upon like units with the uprights of one unit in substantially vertical alignment with those of the other, and means for preventing lateral displacement of the abutting ends of said uprights with respect to each other.

4. A structural unit comprising a plurality of uprights each having a hinge secured at the top thereof, and a pair of cross bars each having one end secured to the hinge and the opposite end secured respectively at top and bottom of another of the uprights whereby the said uprights are secured together to form an independent foldable structure.

5. A structural unit comprising a plurality of angle iron uprights each having secured to one leg and at the top thereof a hinge, and a pair of cross bars extending from each of the hinges and secured respectively to top and bottom of that leg of another of the uprights unoccupied by the hinge.

6. A structural unit comprising a plu-

rality of uprights each having at the top thereof a hinge, a pair of cross bars extending from each hinge to top and bottom respectively of another of the uprights, with the ends of the cross bars which are secured to the bottoms of said uprights projecting beyond the bottom ends of the uprights, substantially for the purpose set forth.

7. A structural unit comprising a plurality of uprights connected by means of cross bars extending between the tops of adjacent pairs thereof and by cross bars one end of which is attached to the bottoms of the respective uprights, the ends of said latter cross bars projecting downwardly beyond the bottom edges of the uprights to which they are attached and being adapted to enter a space between the uprights and the ends of the top cross bars of a like unit upon which the said first unit is superimposed, with the uprights of the units in substantially vertical alignment, whereby lateral displacement of the units with respect to each other is prevented.

8. In a portable structure, a plurality of independent units each comprising a plurality of uprights connected together by cross bars and adapted to be superimposed one upon another with the said uprights end to end substantially in vertical alignment, the said cross bars being connected to each of the uprights at an end thereof and projecting beyond the said end to overlap the joints between the adjoining uprights to prevent lateral displacement of the uprights with respect to each other.

9. In a portable structure, a plurality of independent units each comprising a plurality of uprights connected by means of cross bars extending between the tops of the adjacent pairs thereof and by diagonal cross bars, one end of which is attached to the tops and the other end to the bottoms of the respective uprights, the ends of said diagonal cross bars projecting downwardly beyond the bottom edges of the uprights to which they are attached, and said projecting ends being adapted to enter a space between the uprights and the ends of the top cross bars of the underlying sections, thereby to prevent lateral displacement of the units with respect to each other.

10. In a portable structure, a plurality of independent units each comprising a plurality of uprights in the form of angle irons with cross bars secured to the legs of said angle bars and extending therebetween, said units being adapted to be superimposed one upon another with the said uprights disposed substantially in vertical alignment with their end surfaces flush against each other, and a lug projecting beyond an end of each of said uprights and into the angle between the legs of the adjoining upright and overlapping the joints therebetween to prevent lateral displacement of said uprights with respect to each other.

11. In a portable structure, a plurality of independent units adapted to be superimposed one upon another to form a plurality of spaced tower structures, certain of said units comprising an extension adapted to bridge the space between said towers, said extensions being less in height than the height of the units to which they are attached, substantially as and for the purpose set forth.

CHARLES H. WETZEL.