Nov. 10, 1936. C. H. WETZEL 2,060,436

GRANDSTAND CONSTRUCTION

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Fig. 1.

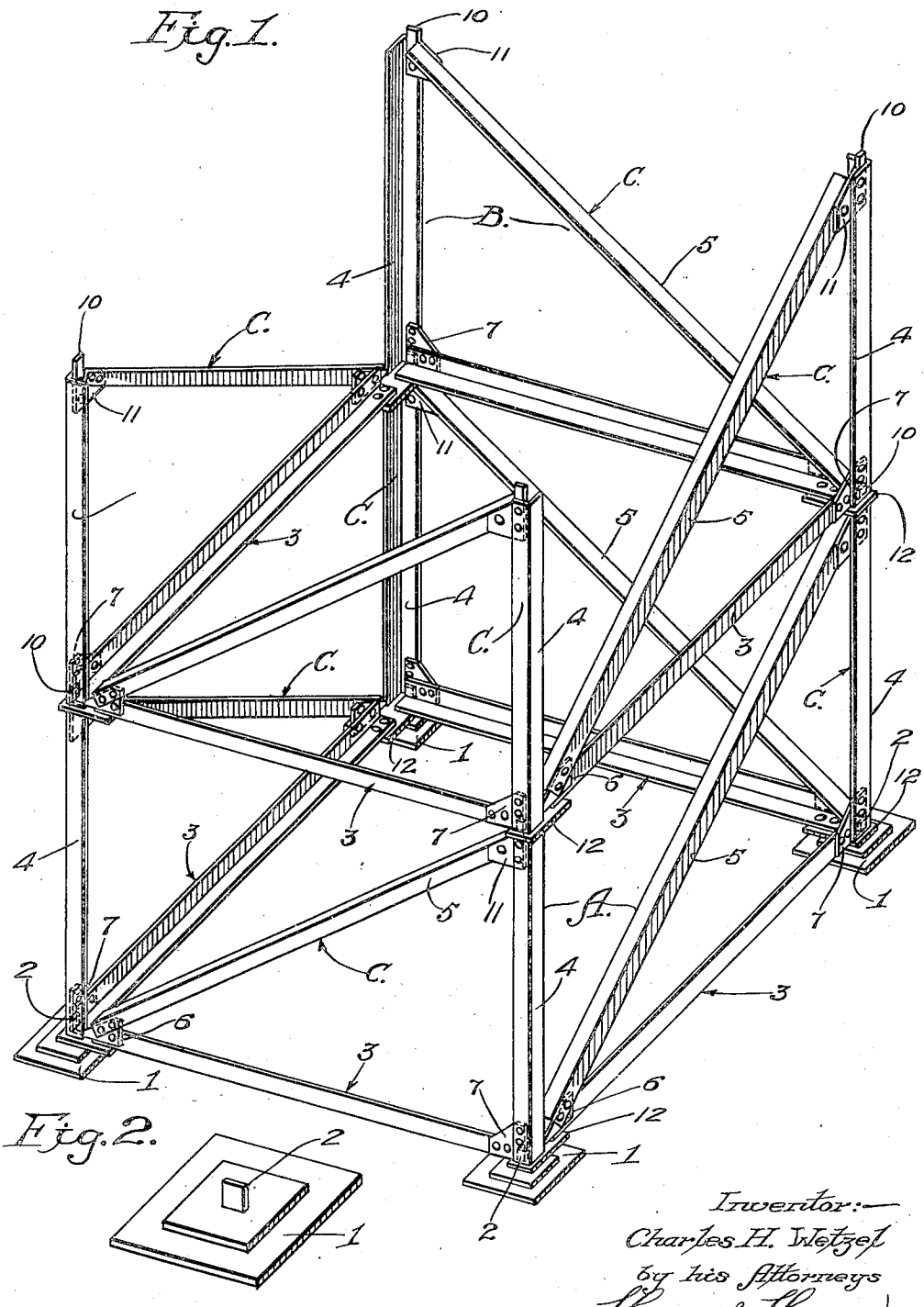


Fig. 2.

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

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GRANDSTAND CONSTRUCTION

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Fig. 3.

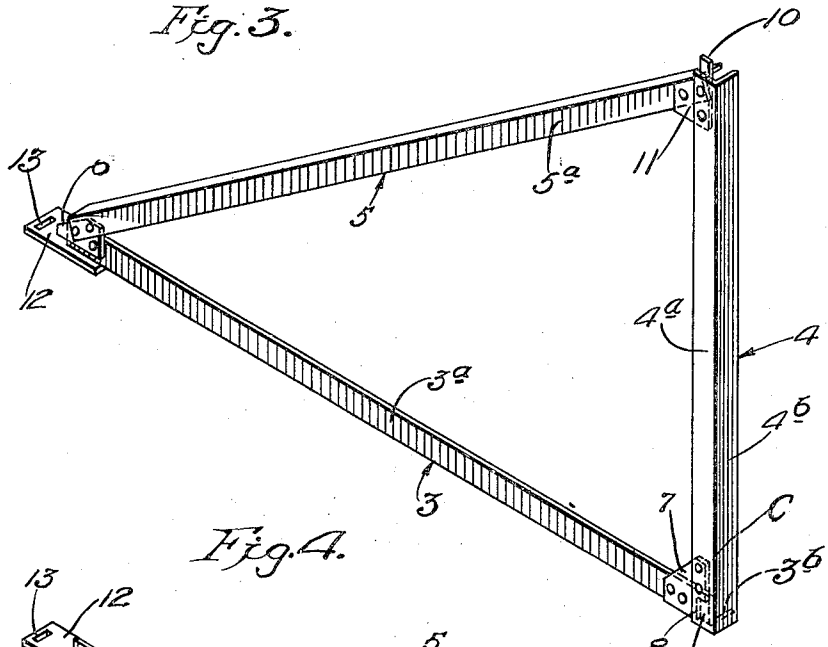


Fig. 4.

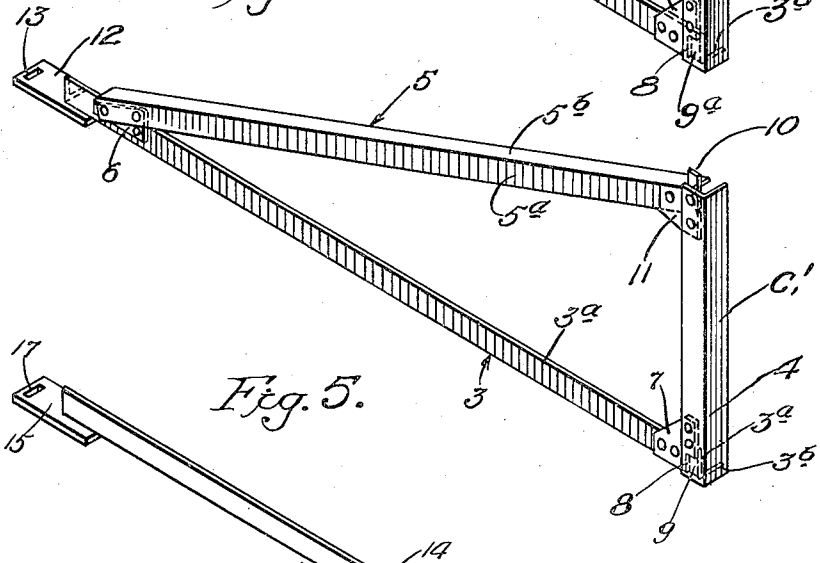
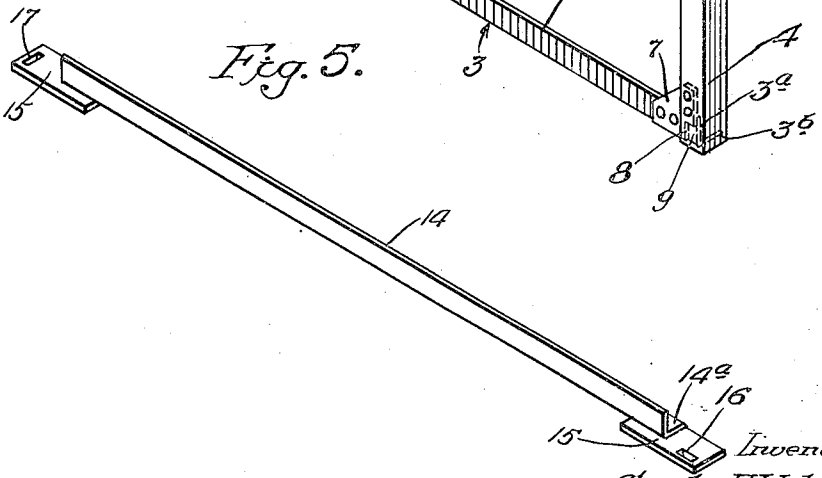


Fig. 5.



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

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GRANDSTAND CONSTRUCTION

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Fig. 6.

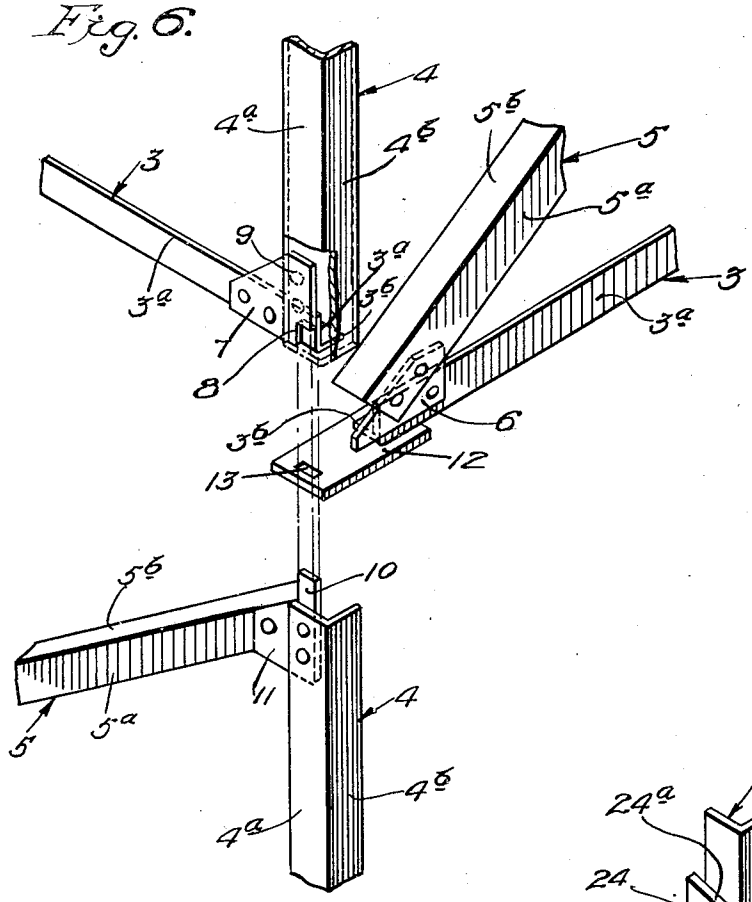
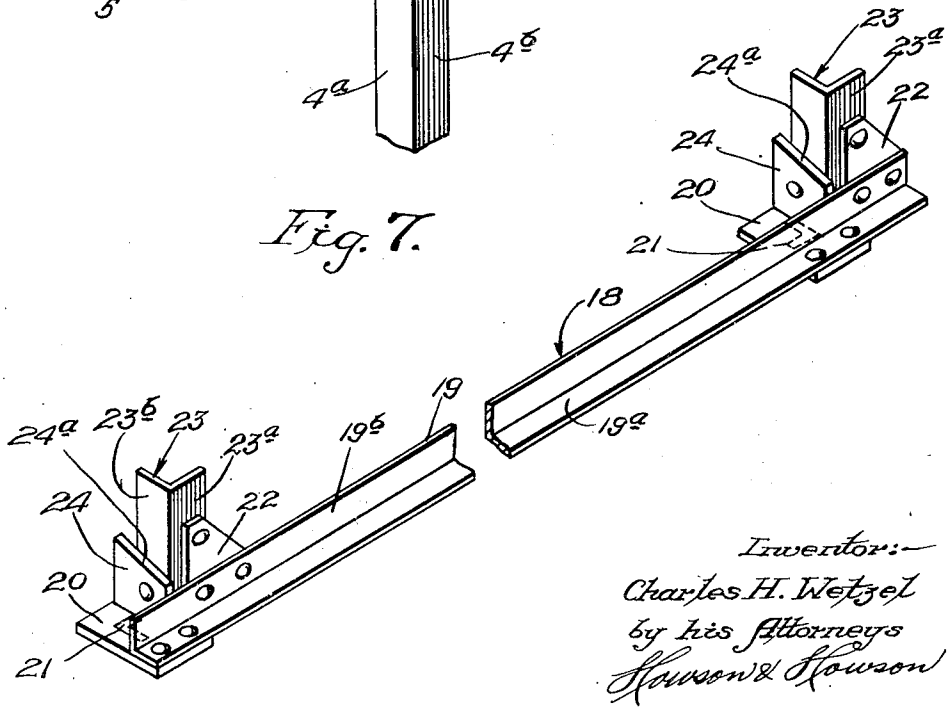


Fig. 7.



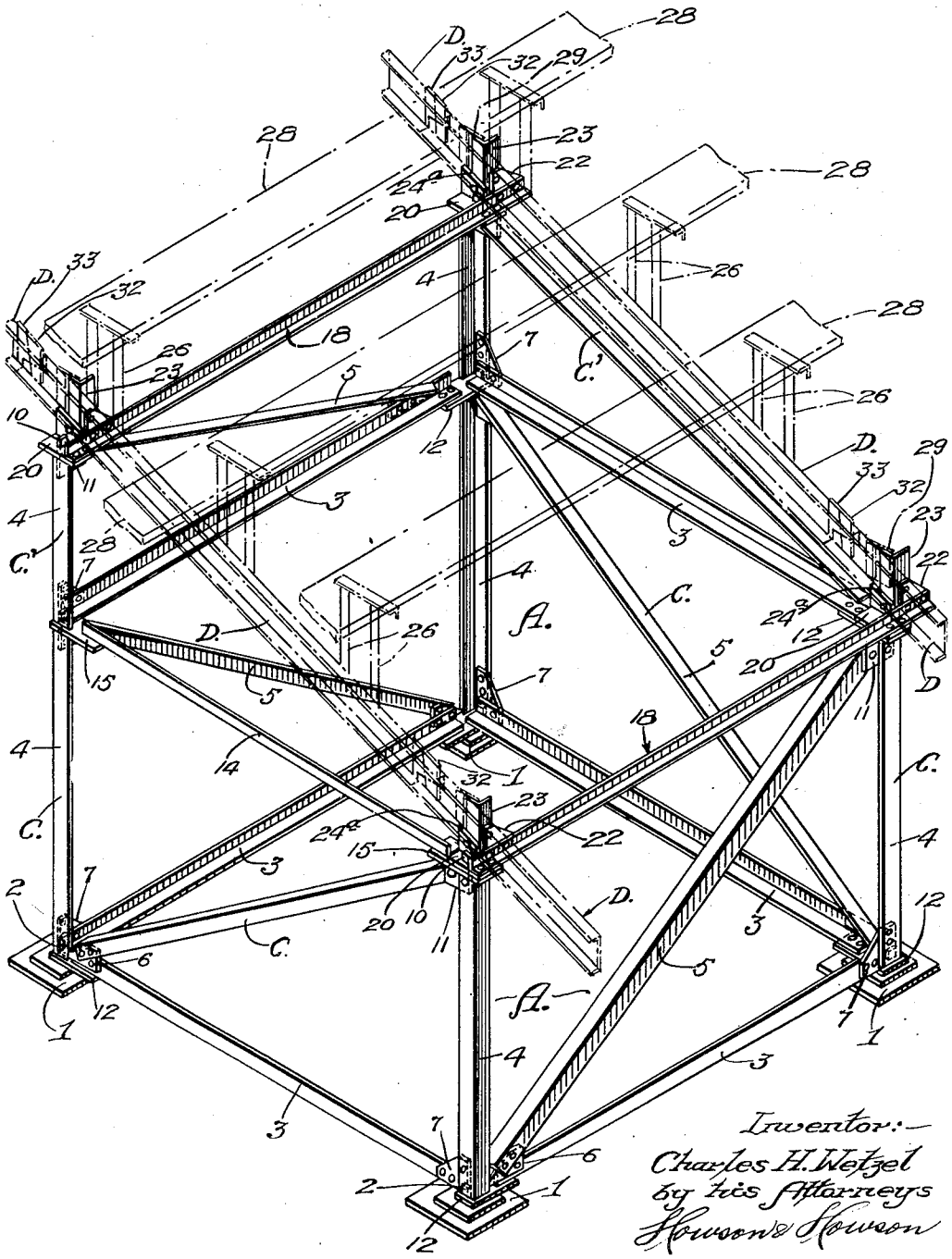
Inventor:—
Charles H. Wetzel
by his Attorneys
Howson & Howson

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GRANDSTAND CONSTRUCTION

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Fig. 8.



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

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GRANDSTAND CONSTRUCTION

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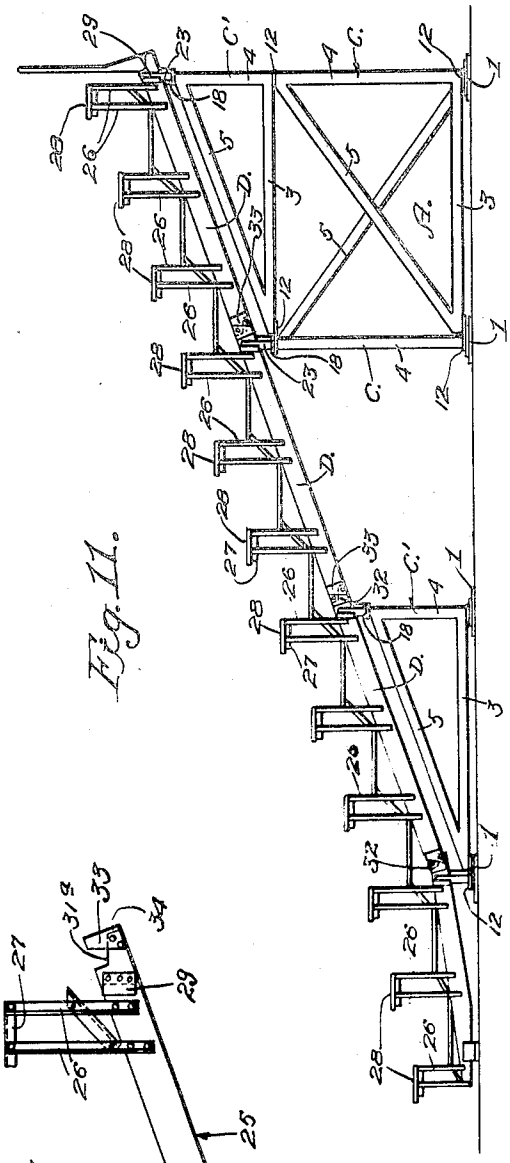


Fig. 11.

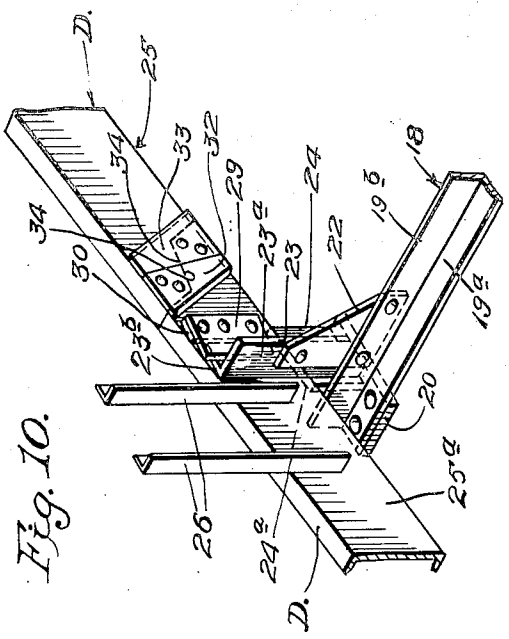


Fig. 10.

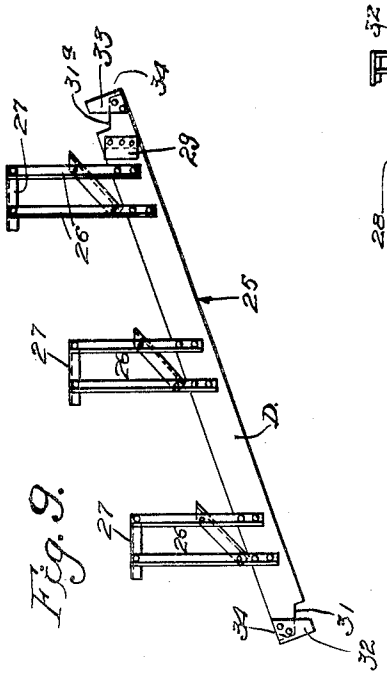


Fig. 9.

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

Patented Nov. 10, 1936

2,060,436

UNITED STATES PATENT OFFICE

2,060,436

GRANDSTAND CONSTRUCTION

Charles H. Wetzel, Wayne, Pa., assignor to Wayne Iron Works, Wayne, Pa., a corporation of Pennsylvania

Application September 23, 1933, Serial No. 690,728

18 Claims. (Cl. 189—2)

This invention relates to new and useful improvements in supporting structures and the structural members comprised therein and has particular relation to structures and structural elements for grandstands and the like.

The principal object of the present invention is to provide a structure of the character set forth composed of a plurality of structural members of the same general configuration which are detachably interlocked one with another.

Another object of the invention is to provide a structure as set forth which may be readily assembled and made rigid by interlocking the constituent members thereof without the use of rivets, bolts or other like permanent securing means.

Another object of the invention is to provide a structure of the character set forth composed of a plurality of superimposed sections each of which latter is composed of a predetermined number of substantially identical structural members detachably interlocked with one another and readily knocked down, each superimposed section of said structure being detachably interlocked with the next lower section.

Another object of the invention is to provide a structure as stated composed of superimposed sections each of which in turn comprises a number of structural members easily handled by a person and of a size permitting storage in a relatively limited area.

A more specific object of the invention is to provide a structure of the stated character in the form of a tower for use with other similar towers of different and/or identical heights as supporting means for horizontal rows of seats constituting a grandstand, said towers increasing successively in height and having cross pieces interlocked therewith to support seat stringers at an inclined angle with respect to the plane surface on which the towers rest.

A further object of the invention is to provide structural members of the character set forth which while having equal base elements, are of different vertical height to enable assembly of supporting tower structures of different heights in a row of towers successively increasing in height so that the slant height of the seat stringers supported by said towers may be set at a predetermined angle.

A still further object of the invention is to provide a structure as set forth which is of simple rugged construction yet may be easily assembled and taken down for transportation or storage when not needed.

Other features and details of the invention are set forth hereinafter and shown in the accompanying drawings, in which:

Fig. 1 is a view in perspective of a tower structure constituting this invention;

Fig. 2 is a view in perspective of one of the base plates on which a tower is erected;

Fig. 3 is a view in perspective of one of the structural elements comprised in the disclosure of Fig. 1;

Fig. 4 is a view similar to Fig. 3 of a structural element having a vertical height approximately one half that of the element shown in Fig. 3;

Fig. 5 is a view in perspective of a brace member;

Fig. 6 is an exploded view in perspective of a sectional joint showing fragments of the constituent elements and their interlocking relationship to each other;

Fig. 7 is a view in perspective of the cross member on which the seat supporting stringers rest;

Fig. 8 is a view in perspective of a tower assembled for a grandstand showing the manner of supporting the seat stringers and cross members thereon;

Fig. 9 is a view in elevation showing the construction of a seat stringer section;

Fig. 10 is a detached view in perspective showing the relation of the interlocking parts of the cross members and stringer sections; and

Fig. 11 is a view in elevation of a grandstand assembled in accordance with this invention.

Referring now more particularly to the drawings, a tower or supporting structure contemplated by this invention comprises a predetermined number of superimposed sections such as are indicated as at A and B respectively in Fig. 1 of the drawings. Each tower structure is mounted upon four base plates 1 which are provided with upwardly projecting tongues 2 of predetermined cross section shape which in the present instance is rectangular. A particular tower may include as many superimposed sections as A, B, etc. as may be necessary for the use to which the structure is to be adapted.

As shown in Fig. 1, each tower section such as A and B, comprises four structural members C which are of a configuration resembling a right triangle and include a base 3, vertical element 4, and an angularly disposed element 5, each joined together in a novel manner, a description of which follows.

Referring particularly to Fig. 3 of the drawings, gusset plates 6 and 7 are secured respectively to

the outer face of the vertical leg 3a of the base angle bar 3 at each end thereof. In the present instance a portion 8 is cut from the gusset plate 7 and the leg 4a of the vertical strut member 4 is secured adjacent its lower end to the outer face of said gusset plate 7, the said vertical member 4 being so secured that the other leg 4b thereof is spaced from the adjacent end of the horizontal leg 3b of the base member. It will be noticed accordingly that the portion 8 cut from the gusset plate 7 and the adjacent legs 3a, 4a, and 4b of the base and vertical elements 3 and 4 respectively, cooperate to form a socket 9 arranged to receive either the upstanding tongue 2 on the base plates 1 or a tongue 10 of similar size and shape formed on a gusset plate 11 rigidly secured to the inner face of the leg 4a of the vertical element 4 of the next lower structural element. The leg 5a of the member 5 is rigidly secured to the plate 11 on the face opposite that to which the element 4 is secured, and the other end of said leg 5a is rigidly secured to the plate 6 on the face opposite that to which the leg 3a of the element 3 is secured. A plate 12 is rigidly secured to the bottom face of the leg 3b of the element 3, said plate extending beyond the end of said element 3 and being provided with a rectangular slot 13 arranged to receive either the tongue 2 or 10 on the base or gusset plates 1 and 11, respectively.

It is pointed out that the longitudinal axis of the socket 9 is disposed axially of the triangular member C, but that the longitudinal axis of the slot 13 in the plate 12 is disposed at right angles to the axis of said triangular member. The triangular structural members set forth above may vary in height, but for a particular structure all members should have bases of equal length and the position and relationship of the various interlocking means should be the same. For instance, a member having a vertical height approximately one half that shown in Fig. 3 is disclosed in Fig. 4 of the drawings and designated as C'.

To assemble, for instance the bottom section A of a tower, the base plates 1, four in number, are positioned one each at the corner of an imaginary square the sides of which are equal to the length of the bases 3 of the triangular structural members C, the upstanding tongues 2 of said plates being suitably arranged to engage the slot 13 in the plate 12 on each member of the four that go to make up the section, that is, one member C is placed on any two base plates 1 so that the tongues 2 thereof engage the slot 13 and socket 9, respectively, of that particular member, the next member of the section is then placed so that the tongue 2 which engages the slot 13 of the first placed member C engages the socket 9 of the second, the slot 13 of the second member being engaged by the tongue 2 of the adjacent one of the two as yet unoccupied base plates 1. The third and fourth triangular members are similarly added to complete the section. It is pointed out that when adding the last member C, the socket 9 of the first member must be disengaged momentarily from the tongue 2 of its base plate 1 and the said tongue made to engage the slot 13 of the fourth member, after which the socket 9 of the first is reengaged by the tongue.

The next higher section B and subsequent sections are assembled and interlocked upon the bottom section A or next lower section in a manner substantially the same as that described for assembling said bottom section, the projecting tongues 10 of the gusset plates 11 of each of the four structural members C comprising the bottom section, taking the place of the upstanding tongues 2 on the base plates 1 of the first or bottom section A as shown in Figs. 1 and 6 of the drawings.

In constructing a supporting tower of the character described comprising a plurality of superimposed sections A, B, etc., for use in a grandstand as in Fig. 8, which is the preferred form of the present invention, the bottom or base section A is assembled from the structural members C previously described in the manner set forth above and these sections are built up one upon another until the desired tower height is reached. In order to provide an inclined support for the seat stringers, which will be described in detail hereinafter, a half section is superimposed on the tower proper and includes but two of the structural members C', one of said members C' being disposed at the rear side of the tower and interlocked with the latter substantially in the manner set forth above for assembling the structural members of each of the superimposed tower sections, and the other structural member C' is disposed along one side of the tower so that the two rear tower posts will be greater in height than the two forward or front tower posts as shown in Fig. 8 of the drawings.

A brace member shown in detail in Fig. 5 in the form of an angle iron 14 is provided and plates 15 having slots 16 and 17 formed therein are secured to the underside of the leg 14a of the member 14, and this brace member is positioned horizontally at the other side of the tower square from the second member C' in the absence of the customary structural member to render the tower substantially rigid. The slots 16 and 17 in the plates 15 are disposed respectively at right angles to each other so that they are in a proper position for engagement by the upstanding tongues 10 of the lower side and rear structural members C of the next lower section. The brace 14 should be so positioned on the preceding section prior to the two structural members C' so that the slot 17 may be freely engaged by the tongue 10, which subsequently engages the socket 9 of the rear member C'.

Cross members 18 are mounted respectively between the forward and rear pairs of vertical tower posts and these cross members comprise an angle bar 19 to the horizontal leg 19a of which are secured plates 20 adjacent extremities thereof. The plates 20 are provided with substantially L-shaped slots 21 as shown in Fig. 7 for reception of the upstanding tongues 10 of each of the uppermost structural members C. It will be noticed that the slots 21 in the plates 20 are of substantially L-shape and these slots are so formed because of the different axial position of the tongues 10 at the front of the tower with respect to the tongues 10 at the rear thereof. Consequently by making the slots 21 of this shape any one cross member 18 may be mounted and interlocked between either the front or rear pair of posts in each tower.

A plate 22 is rigidly secured to the inner face of the vertical leg of the angle bar 19b adjacent the ends thereof and to the inner face of each of said plates 22 is secured one leg 23a of an angle piece 23, and another plate 24 is rigidly secured to the outer face of the other leg 23b of

said piece 23 at the left side thereof with respect to Fig. 7. The plates 24 are of such configuration that the upper edge 24a thereof is inclined at an angle with respect to the plane of the plates 20 and this edge 24a of the plates 24 constitutes a support for the seat stringers, the angle of which determines the angle of inclination of the seat stringers.

In Fig. 8 of the drawings is shown a grandstand tower, the upper half section of which is assembled from structural members such as C' of smaller vertical height than the structural members C comprised in the bottom or base section A thereof, but it is pointed out at this time however, that in place of the structural members C' shown, structural members C of a height similar to those comprised in the base section could be readily employed in place of the former and this latter arrangement would form an angle of inclination for the seat stringers which is greater with respect to the horizontal plane than the angle of inclination afforded by use of the structural members C' of less vertical height.

Referring now particularly to Figs. 9 and 10 of the drawings, reference character D designates a seat stringer section contemplated by this invention and these stringers are composed of a channel member 25 to which are secured a number of pairs of angle bars 26 having a cross member 27 to which the seats 28 of the stand are secured. Since the axis of the channel member 25 of the stringer section D is disposed at an angle with respect to the plane of the supporting structure thereof, the bars 26 will be disposed at such an angle with respect to the axis of the channel member 25 that the same will be approximately at right angles to the surface on which the stand is mounted. The channel members 25 of the stringers D are arranged to rest upon the inclined surface 24a of the plates 24 as shown in Fig. 10 of the drawings, in such manner that the intermediate web 25a of said channel abuts the outer leg 23b of the angle pieces 23. A plate 29 is rigidly secured to and spaced from the web 25a of the channel 25 by means of a substantially smaller plate 30, thus forming a socket or recess between the overlying portion of the plate 29 and the channel member which is engaged by the edge of the leg 23b of the member 23. Portions of the front and rear ends of the stringer channel 25 are cut away as indicated by the reference numerals 31 and 31a, at the top and bottom thereof respectively and plates 32 and 33 are rigidly secured to the projecting portion 34 of the channel 25 formed by said cutouts 31 and 31a. The plates 32 and 33 are so formed with respect to the cutouts 31 and 31a that the ends of successively aligned stringer sections D will overlap in the manner indicated in Fig. 10 and permit interlocking of the plates 32 and 33 as shown. The uppermost tower section, that is that supporting the cross members to which are attached the seat stringers, will vary in form depending upon the depth of the grandstand and the desired slant height of the said stringer sections. For instance, and referring particularly to Fig. 11 of the drawings, the grandstand shown is twelve seat rows deep and requires two supporting towers as shown. Now supposing that a stand nine rows deep is desired. If the three higher rows of seats were removed from the structure shown together with the tower, there would be no support for rows seven, eight and nine. Accordingly, in a stand containing nine rows as stated, but one supporting tower is employed and this is erected in a position corresponding to the space existing between the towers shown in Fig. 11, under the three upper rows of seats in the nine row stand. Obviously a tower erected in this position must be assembled of two units C and two of the C' or smaller units, that is the rear side of the shorter tower in Fig. 11 would be the front side of the new tower and the front of the existing taller tower would be in the place and the size of the rear side of said new tower. Numerous other arrangements of tower assemblies may be devised to meet the requirements of a particular installation but the same do not change or otherwise alter the spirit of the invention.

While the invention has been described particularly with relation to structures specifically adapted to grandstands and the like, it is pointed out that sectional towers assembled in the manner shown in Fig. 1 may be adapted to innumerable uses. Towers assembled in the manner set forth herein are extremely rigid and strong and are available for use as supports for scaffolding as well as many other uses in construction work, such as frames or cages for small material carrying elevators and the like.

A particular feature of the invention resides in the relatively small number of different structural members necessary and the novel construction of these members for interlocking one with another to effect a strong rigid structure which may be easily disassembled or knocked down and stored when not needed.

The specific details of construction of the sectional tower and its component structural members have been set forth for the purpose of description but it is not intended that the invention be limited precisely thereto within the scope of the annexed claims.

What is claimed is:

1. A structural unit in the form of a triangular frame member including a base element, a plate having a portion cut therefrom secured to said base adjacent one end thereof and a second element secured to said plate and extending at right angles from the base element, the cutout in the plate cooperating with the adjacent surfaces of the base and second elements to form a socket arranged for engagement by projections formed on similar structural units.

2. A structural unit in the form of a triangular frame member including a base element, a plate secured to said base adjacent one end thereof and a second element secured to said plate and extending at right angles from the base element, said plate cooperating with the adjacent surfaces of the base and second elements to form a socket, a plate secured to the other end of said second element, said plate having a tongue projecting therefrom arranged to engage the socket formed in a similar structural unit, and a plate secured to the opposite end of the base element, said plate having an aperture therein arranged to receive the projecting tongue of still another similar structural unit.

3. A structural unit in the form of a triangular frame member, including a base element, plates secured to said base element adjacent the ends thereof, and an element secured to one of said plates and extending at right angles from the base element, said latter plate cooperating with the adjacent surfaces of the base and second element to form a socket, a third plate secured to the other end of said second element, said plate having a tongue projecting therefrom to

engage the socket of a similar structural unit, and a third element rigidly secured adjacent its ends to the third plate and the plate secured adjacent the extreme end of the base element.

4. A structural unit in the form of a triangular frame member, including a base element, plates secured to said base element adjacent the ends thereof, and an element secured to one of said plates and extending at right angles from the base element, said latter plate cooperating with the adjacent surfaces of the base and second element to form a socket, a third plate secured to the other end of said second element, said plate having a tongue projecting therefrom to engage the socket of a similar structural unit, a third element rigidly secured adjacent its ends to the third plate and the plate secured adjacent the extreme end of the base element, and a fourth plate secured to the same end of the base member, said plate having an aperture therein arranged for engagement by the projecting tongue of still another similar structural unit.

5. A supporting structure in the form of a sectional tower, each of said sections comprising an equal number of independent structural units each defining one side only of said structure, projections formed on each of said units, and means forming a socket in each of the units, said projections and sockets being similarly arranged in each unit for interlocking engagement with others of the same and adjacent tower sections.

6. A supporting structure in the form of a sectional tower, each section of which comprises an equal number of triangular structural units, each of said units having a projection at one corner thereof, means forming a socket at another corner, and a plate having an opening therein mounted at the remaining corner, said projection, socket and slot being similarly arranged in each of said units for interlocking engagement with the projections, sockets and slots of other units in the same and adjacent sections.

7. A grandstand structure including base elements, a square sectional tower mounted thereon, the sections of which are composed of four structural units each having respectively a projection, socket and an opening for interlocking engagement with other units of the same and adjacent sections, a half section composed of two of said structural units superimposed upon and interlocked with the uppermost of said other sections and arranged so that certain posts of the tower are of greater height than other posts, a cross member interlocked between each similar pair of said end posts, means on said cross members providing an inclined surface, seat stringer sections arranged to rest on said inclined surfaces and be supported at an angle with respect to the plane of the base elements, means for interlocking successively aligned stringer sections with each other, and means for interlocking said stringer sections with the cross members.

8. A supporting structure in the form of a sectional tower, each of said sections comprising an equal number of independent structural units each defining one side only of said structure, projections formed on each of said units, means forming a socket in each of the units, said projections and sockets being similarly arranged in each unit for interlocking engagement with others of the same and adjacent tower sections, and a half section composed of two structural units superimposed upon and interlocked with the uppermost of said other sections.

9. A supporting structure in the form of a sectional tower, each section of which comprises an equal number of triangular structural units, each of said units having a projection at one corner thereof, means forming a socket at another corner, a plate having an opening therein mounted at the remaining corner, said projection, socket and opening being similarly arranged in each of said units for interlocking engagement with the projections, sockets and openings of other units in the same and adjacent sections, and a half section composed of two structural units superimposed upon and interlocked with the uppermost of said other sections.

10. In a grandstand, a supporting structure composed of a predetermined number of substantially similar structural units of substantially triangular shape arranged so that at least one side of said supporting structure is of greater height than the opposite side thereof, cross members disposed respectively in said side of the structure of greater height and the opposite side of lesser height at the upper ends thereof, means respectively forming a part of each of said units and cross members constructed and arranged for mutual cooperative engagement to detachably connect said units and cross members together, seat stringer sections supported by at least one of said cross members, and means respectively forming a part of each of said stringer sections and cross members constructed and arranged for mutual cooperative engagement to detachably connect said stringers and at least one cross member together.

11. In a grandstand, a supporting structure composed of a predetermined number of substantially similar structural units of substantially triangular shape arranged so that at least one side of said supporting structure is of greater height than the opposite side thereof, cross members disposed respectively in said side of the structure of greater height and the opposite side of lesser height at the upper ends thereof, means respectively forming a part of each of said units and cross members constructed and arranged for mutual cooperative engagement to detachably connect said units and cross members together, means on each of said cross members providing an inclined surface, seat stringer sections supported on said inclined surfaces of at least one of the cross members, and means respectively forming a part of each of said stringer sections and cross members constructed and arranged for mutual cooperative engagement to detachably connect said stringers and at least one cross member together.

12. In a grandstand, a supporting structure composed of a predetermined number of substantially similar structural units of substantially triangular shape arranged so that at least one side of said supporting structure is of greater height than the opposite side thereof, cross members disposed respectively in said side of the structure of greater height and the opposite side of lesser height at the upper ends thereof, means respectively forming a part of each of said units and cross members constructed and arranged for mutual cooperative engagement to detachably connect said units and cross members together, successively aligned seat stringer sections each supported by at least one of said cross members, means forming a part of each of said seat stringer sections constructed and arranged for mutual cooperative engagement to detachably connect the latter together, and other means respectively forming a part of each of said stringer

sections and cross members constructed and arranged for mutual cooperative engagement to detachably connect each of said stringer sections with at least one of said cross members.

13. In a grandstand, a supporting structure composed of a predetermined number of substantially similar structural units of substantially triangular shape arranged so that at least one side of said supporting structure is of greater height than the opposite side thereof, cross members disposed respectively in said side of the structure of greater height and the opposite side of lesser height at the upper ends thereof, means respectively forming a part of each of said units and cross members constructed and arranged for mutual cooperative engagement to detachably connect said units and cross members together, means on each of said cross members providing an inclined surface, successively aligned seat stringer sections each supported on said inclined surface of at least one of the cross members, means forming a part of each of said seat stringer sections constructed and arranged for mutual cooperative engagement to detachably connect the latter together, and other means respectively forming a part of each of said stringer sections and cross members constructed and arranged for mutual cooperative engagement to detachably connect each of said stringer sections with at least one of said cross members.

14. In a grandstand, a sectional supporting structure each section of which is composed of a predetermined number of similar structural units of substantially triangular shape, a half section composed of a predetermined number of similar structural units of substantially triangular shape superimposed upon said first mentioned structural units and arranged so that at least one side of said supporting structure is of greater height than the opposite side thereof, cross members disposed respectively in said side of the structure of greater height and the opposite side of lesser height at the upper ends thereof, means respectively forming a part of each of said structural units and cross members constructed and arranged for mutual cooperative engagement to detachably connect said units and cross members together, seat stringer sections supported by at least one of the cross members, and means respectively forming a part of each of said stringer sections and cross members constructed and arranged for mutual cooperative engagement to detachably connect said stringers and at least one cross member together.

15. In a grandstand, a sectional supporting structure each section of which is composed of a predetermined number of similar structural units of substantially triangular shape, a half section composed of a predetermined number of similar structural units of substantially triangular shape superimposed upon said first mentioned structural units and arranged so that at least one side of said supporting structure is of greater height than the opposite side thereof, cross members disposed respectively in said side of the structure of greater height and the opposite side of lesser height at the upper ends thereof, means respectively forming a part of each of said structural units and cross members constructed and arranged for mutual cooperative engagement to detachably connect said units and cross members together, means on each of said cross members providing an inclined surface, seat stringer sections supported by said inclined surfaces of at least one of the cross members, and means respectively forming a part of each of said stringer sections and cross members constructed and arranged for mutual cooperative engagement to detachably connect said stringers and at least one cross member together.

16. A sectional supporting structure composed of a predetermined number of independent substantially similar structural units, means forming a projection on each of said structural units, means forming a socket in each of said structural units, and a plate having an opening therein mounted on each of said structural units, said projections, sockets and openings being similarly arranged in each of said structural units for mutual cooperative engagement with the projections, sockets and openings of adjacent structural units to detachably connect said units together.

17. A sectional supporting structure composed of a predetermined number of independent substantially similar structural units of substantially triangular shape, means forming a projection adjacent one corner of each of said structural units, means forming a socket adjacent one corner of each of said structural units, and a plate having an opening therein mounted adjacent the remaining corner of each of said structural units, said projections, sockets and openings being similarly arranged in each of said structural units for mutual cooperative engagement with the projections, sockets and openings of adjacent structural units to detachably connect said units together.

18. In a grandstand, a supporting structure composed of a predetermined number of substantially similar structural units arranged so that at least one side of said structure is of greater height than the opposite side thereof, each of said structural units having respectively a projection, socket and an opening constructed and arranged for mutual cooperative engagement with the projections, sockets and openings of other units to detachably connect said structural units together, cross members disposed respectively in said side of the structure of greater height and the opposite side of lesser height at the upper ends thereof, seat stringer sections supported by at least one of said cross members, and means respectively forming a part of each of said stringer sections and cross members constructed and arranged for mutual cooperative engagement to detachably connect said stringers and at least one cross member together.

CHARLES H. WETZEL.