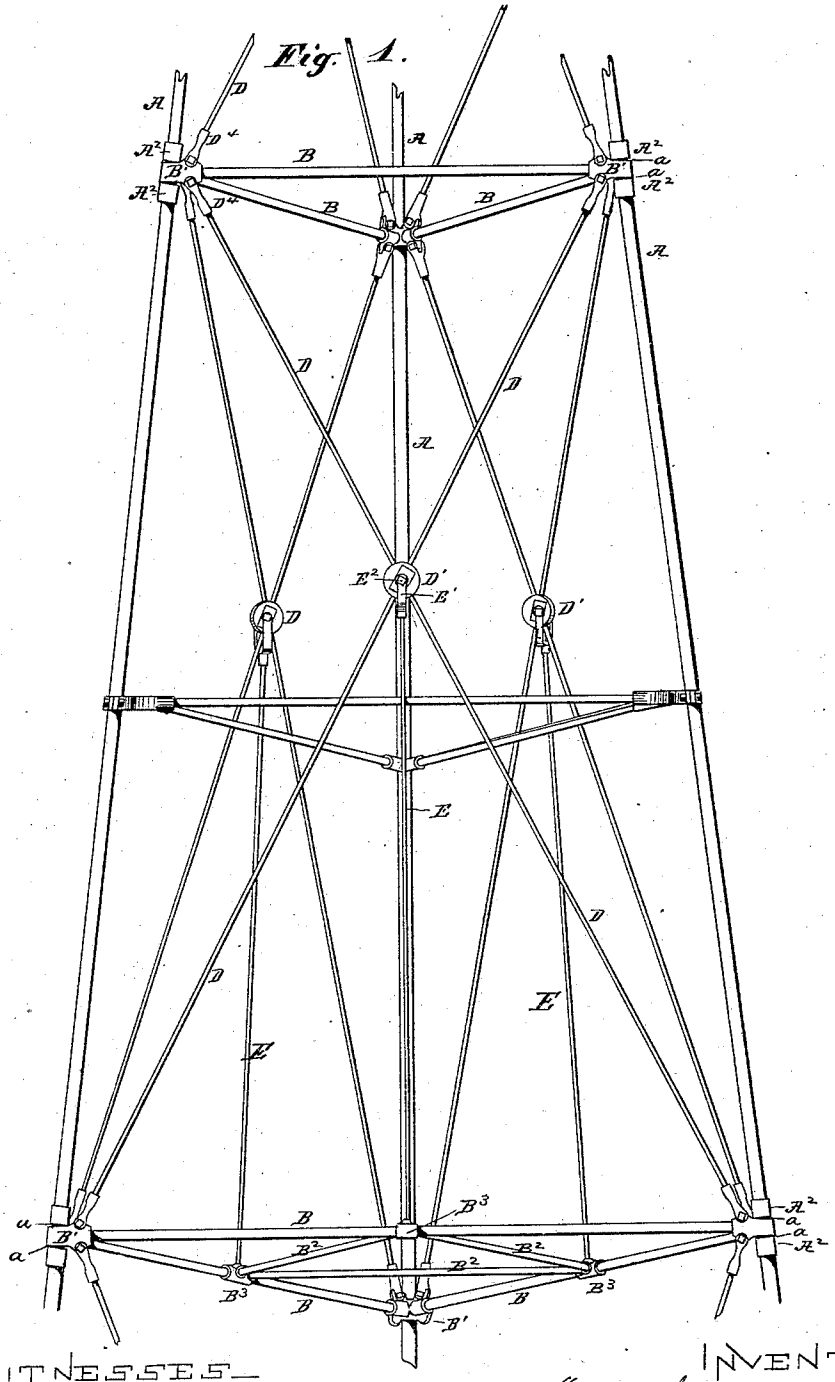
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J. S. ADAMS.

SKELETON TOWER.

No. 311,165. Patented Jan. 27, 1885.

Fig. 1.



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Fig. 4.

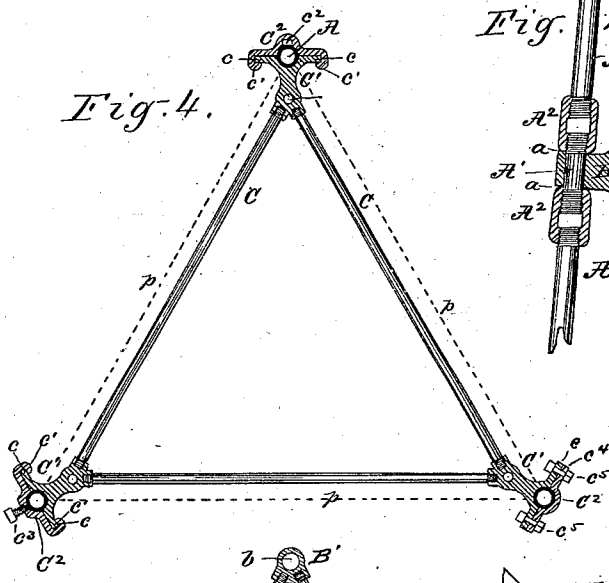


Fig. 2.

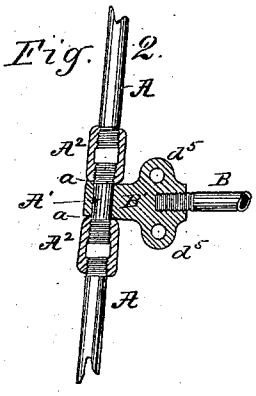


Fig. 6.

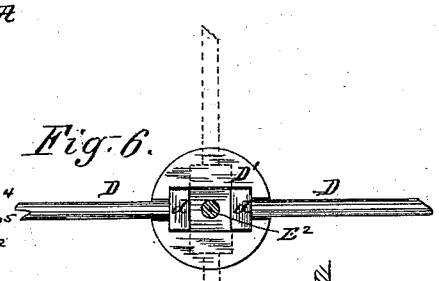


Fig. 3.

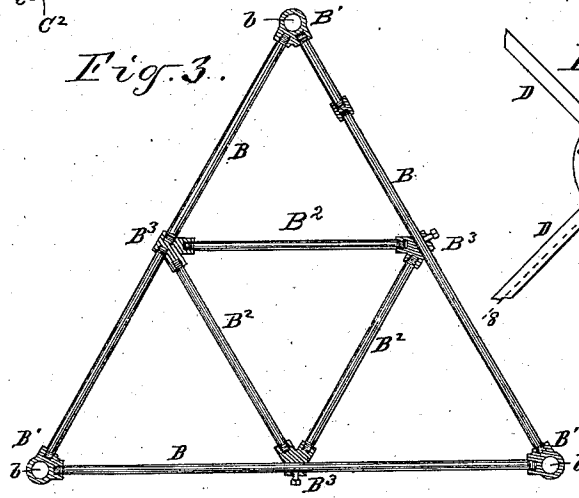


Fig. 5.

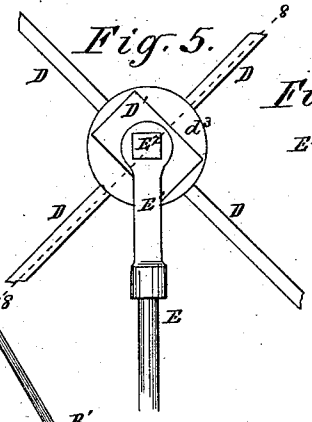


Fig. 7.

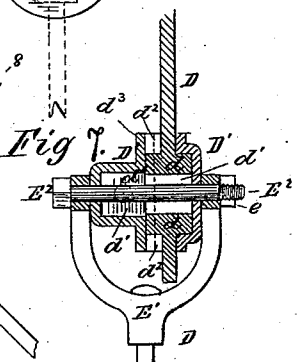


Fig. 10.

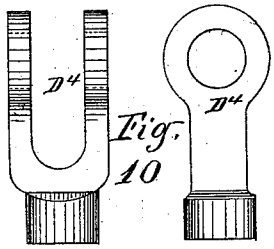


Fig. 9.

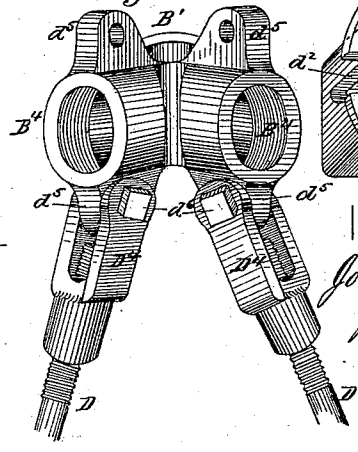
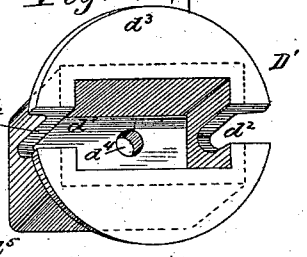


Fig. 8.



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Fig. 11.

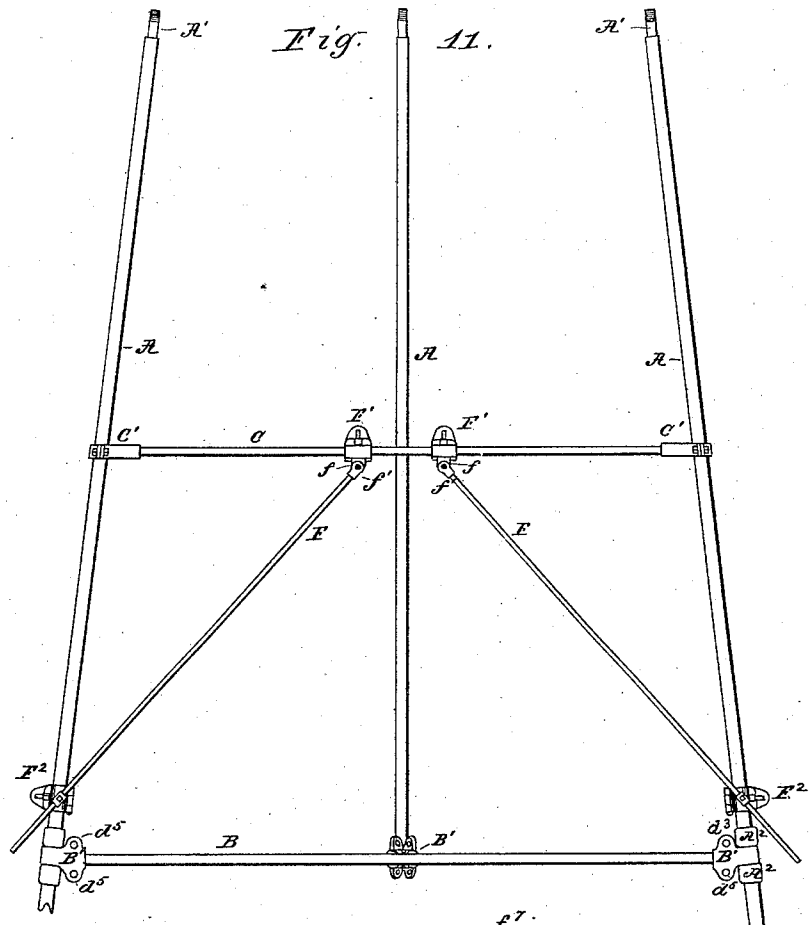


Fig. 12.

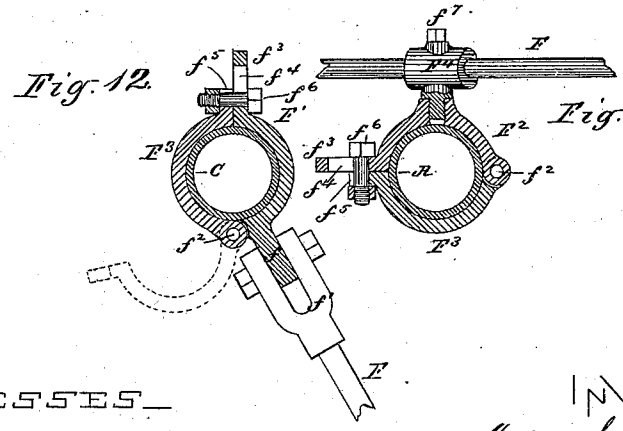


Fig. 13.

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UNITED STATES PATENT OFFICE.

JOHN S. ADAMS, OF ELGIN, ILLINOIS, ASSIGNOR TO THE DETROIT IRON TOWER COMPANY, OF DETROIT, MICHIGAN.

SKELETON TOWER.

SPECIFICATION forming part of Letters Patent No. 311,165, dated January 27, 1885.

Application filed November 26, 1881. Renewed July 30, 1883. Again renewed June 30, 1884. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. ADAMS, of Elgin, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Skeleton Towers; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The objects of this invention are to simplify and cheapen the construction of skeleton iron towers, to facilitate their erection and to increase their strength; and to these ends it consists in the several matters, hereinafter set forth and claimed.

In Letters Patent of the United States No. 187,078, granted to me February 6, 1877, a skeleton iron tower is described, which was originally intended more especially for the support of windmills, and for similar purposes, requiring an elevation of, say, seventy-five or one hundred feet. In the erection of towers of no greater height than that just mentioned, no serious difficulties are encountered in the employment of the devices and modes of construction therein illustrated. The threading of the uprights into the special castings or fittings therein shown, for the common connection of the contiguous sections of the uprights, and the transverse girts or braces is, however, found to be objectionable, for the reason that difficulties are encountered in tapping the several openings of said fittings at exactly proper angles to receive the parts to be joined. In the enlargement of the tower to a height of one hundred and fifty to two hundred and fifty feet, and to a proportionate breadth at the base, as now required for the support of electric lights, and similar powerful illuminating apparatus, peculiar difficulties attend its erection, and the necessity for perfect linear and angular accuracy in the connections is greatly augmented in order to insure a maximum of strength from a minimum of weight in the materials used. Moreover, serious delays are often experienced in procuring special fittings difficult to make, which greatly add to the time and expense of construction. In the present invention, therefore, I employ only such special fittings as are easily made, and for the rest use ordinary forms of fittings always found in stock. In place of the particular casting referred to, I have provided a means of joining the parts, not only by which they are readily and accurately united, but also by which the whole process of erection is materially simplified, cheapened, and expedited. By the addition of other features of improved construction, I am also enabled to use in the tallest towers tubing of the full market length without sacrifice of strength and with the advantage of the utmost economy in material and labor.

In the drawings, Figure 1 is a perspective of a portion of a triangular skeleton iron tower embracing the improvements herein claimed. Fig. 2 is a vertical section of my improved joint uniting the standards and horizontal girts or braces. Fig. 3 is a plan of a main triangular girt the members of which are connected at their ends by means of eyes which form part of the joints shown in Fig. 2. In said Fig. 3 is also shown a triangular arrangement of braces by which the main girts of the lower and broader sections of the tower are strengthened. Fig. 4 is a plan of an intermediate triangular girt the members of which are joined at their ends by special castings suited to be attached to the standards of the tower at any chosen point between their ends. Fig. 5 is an elevation of one of the junction-boxes uniting the parts of each diagonal brace at the point where two such braces intersect, and forming means for connecting the intersecting diagonals to each other, together with the clevis of a rod suspended therefrom. Fig. 6 is a view of the inner face of one of the lock-plates with headed diagonal braces in place therein, and showing in dotted lines the relative position of a second opposite lock-plate joined therewith by the clevis-bolt. Fig. 7 is a central section of the two united lock-plates with depending clevis, taken through 8 8 of Fig. 5, in which, for greater clearness, the plates are supposed to be rotated to bring the line 8 8 vertical. Fig. 8 is a perspective view of one of the lock-plates detached. Fig. 9 is a perspective view of the special casting which forms the common connection of the main girts with each other, and with the tower standards, showing said casting provided with

apertured lugs or eyes for the attachment of the clevises belonging to the diagonal vertical braces, also in part shown. Fig. 10 shows side and front elevations of clevises for the diagonal braces. Fig. 11 is a fragmentary view of a triangular tower in process of construction, showing temporary braces used for purposes that will be explained. Fig. 12 is a view of the hinged clamp by which the upper end of the temporary brace is attached to the girt. Fig. 13 is a view of the similarly-hinged clamp by which the rod is secured to the standard, showing a swiveled adjustable connection of the brace-rod with the clamp.

A A are the standards of the tower. B B are main horizontal girts uniting the standards A A at their extremities. C C are intermediate horizontal girts uniting the standards A between their ends. D D are diagonal braces connecting opposite ends of the adjacent standards A. E E are suspending-rods hung from the intersection of the diagonal braces D, and centrally supporting the main girts B. F F are temporary brace-rods employed in the erection of the tower, to prevent swaying of the several standards while the connected main girts are being put in place, and for the support of the intermediate girts, which are used to sustain a temporary scaffolding.

The standards A consist, usually, of sixteen-foot lengths of tubular iron, right-threaded at both ends. Said standards are secured into any suitable foundation-support at the angles of an equilateral polygon, usually a triangle, and as a preferable construction take at their upper ends the lower coupling, A^2, Fig. 2. Into this coupling is run the short nipple A′, also right-threaded at both ends. The main girts B, usually of tubular iron, are right and left threaded at their ends, and are joined to form the polygon B B B, Fig. 3, by means of special fittings or eyes B′, tapped to receive the ends of the girts B, and provided with the apertures *b*, of proper size to freely admit the nipples A′. Said apertures are preferably inclined at the same angle at which the standards A inwardly incline, and have their upper and lower faces also inclined from the horizontal, to lie parallel with the end of the coupling A^2 when resting thereon, or at right angles with the axis of the standards A. The connected main girts B B B rest by their apertured connections B′ upon the shoulders *a*, formed by the couplings A^2, or equivalent means, as shown in Figs. 1 and 2. The main girt thus supported is confined in place by means of the upper couplings, A^2, which are run down upon the nipples A′, and also form seats for the standards A of the next higher section of the tower. The girt-connections B′ are provided with apertured lugs or eyes d^5, arranged above and below the thimbles B^4, into which the girts B are threaded for the purpose of connecting with the diagonal braces D, as will be explained hereinafter.

Within the lower main triangular girts, B, of large towers, interior braces, B^2, are introduced, being preferably connected by right and left screw-threads at their ends with special fittings B^3, adapted to be secured to the girts B in the relation shown in Fig. 3. Sometimes said girts B will be of such length that two lengths of tubing will be necessary to make one girt, in which case the ends of the parts forming a girt B may be threaded into the fitting B^3, in the manner shown at the left in Fig. 3. In other cases said fittings B^3 may have a horizontal aperture through which the girt B passes, and a set-screw by which to clamp the girt rigidly within the fitting, as also indicated in Fig. 3.

The entire structure shown in Fig. 3, consisting of the girts B and interior braces, B^2, with the several connections B′ and B^3, will be put together on the ground or before being applied to the standards A.

Using sixteen-foot lengths or other long tubes for the sections of high towers, it is desirable to employ girts C C to connect the standards A A between their ends, and thereby prevent their deflection under compressive strain. Said intermediate girts are connected by two-part angle-fittings C′ C^2 to form the unitary structure shown in plan in Fig. 4. The parts of said angle-fittings are constructed to clasp the standards A firmly, and to this end may be simply bolted together, as shown at the right lower corner of Fig. 4, or hooked flanges *c′* on the plate C^2 may embrace the flanges *c* on the body C′ of the fitting, so as to be held and to hold the fitting in place on the standards by means of a set-screw, c^3, or key c^2.

In order to enable the diagonal braces to draw straight between their points of attachment with the fittings B′ of the adjacent main girts, the intermediate girts, C, are so connected by the fittings C′ as to set a short distance inside the plane of said diagonal braces, as shown in Fig. 4, wherein said planes are represented by dotted lines *p*.

The diagonal braces D, preferably of solid rods, are made in two unequal parts of such length that the points of connection in the two intersecting diagonals will coincide, as seen in Fig. 1. The parts of each rod are provided at the adjacent ends with solid square heads *d*, and are threaded at their opposite extremities, one right and the other left, into the clevises D^4. Said clevises embrace the lugs d^5 of the angle-fittings B′ belonging to the connected main girts B B B, and are secured to said lugs by the bolts d^6. The headed inner ends of each pair of the said two-part diagonal braces D are connected by means of the special junction-box or "lock-plate" D′. (Shown in perspective in Fig. 8, and in inner elevation, with the rods in place therein, in Fig. 6.)

Each pair of diagonal braces is constructed and connected in the manner described, both junction-boxes D′ being provided with flat circular flanges d^3, by which, when the boxes are held in the position shown in Fig. 7, they mutually close each other and retain the heads

d in place. Before joining the two adjacent lock-plates D′, as set forth, each plate may serve as a wrench (or as a hold for a wrench) by which to run the opposite right and left threaded outer ends of the braces D into the terminal clevises D^4, and thus draw the tower sections or panels of which they form part into proper position. Thus given proper tension the braces are held from being accidentally relaxed by connecting the coincident lock-plates D′ face to face by a central bolt, E^2, as shown. The central bolt, E^2, by which the lock-plates are secured in the position indicated in Fig. 7, is also employed to support the clevis E′, as shown in Fig. 7, but at its lower end is right-threaded into the fitting B^3 on the girt B. By means of such rod E the long transverse girts B are centrally supported from the standards A, and sag of said girts is prevented. Ordinarily the girts B, which will be so supported, will also be trussed by the sub-girts B^2, and a single fitting, B^3, will serve for the attachment of said sub-girts and the suspending rods E; but in the absence of said sub-girts a simple T-coupling or other form of fitting will serve to connect the rod E with the girt B. If preferred, the rod E may be right and left threaded, and screwed into the clevis E′, and its lower end may be similarly threaded into a clevis.

In the erection of towers having the standards A formed of long sections or lengths of pipe, as stated, to be desirable, after the lower ends of the standard-sections of a panel are screwed into the couplings A^2, the intermediate girts, C, first joined with the fittings C′, are lifted and secured in place at a point about midway between the ends of the standard-sections.

In order to give rigidity to the girts C for the support of a platform or staging resting thereon from which to elevate the next main girt, and in order to restrain the incomplete section of the structure from swaying about before being diagonally braced, temporary braces F, are employed which are removably clamped at their ends to the intermediate girts and standards somewhat in the position shown in Fig. 11.

The clamping devices are shown in section, transverse to the axes of the several parts to which they are applied, in Figs. 12 and 13. Said clamps are made in halves, hinged at f^2, one half having the flange f^3 provided with a long closed slot, f^4, and the other half provided with a shorter flange, having an outwardly-open slot whereby the bolt f^6, when its nut is loosened but not run off, may be slipped out clear of the flange f^5, and be still retained in the slot f^4. One hinged part of the clamp is also provided with a lug, *f*, to which the brace-rod F is pivotally attached by a bolt, as shown. This last feature of construction is shown only in connection with the upper clamp, F′; but obviously the lower clamp, F^2, may be of the same construction. It is, however, desirable to sometimes change the length of the brace-rods, and for this purpose the rod F is made longitudinally adjustable through the eye F^4, having a swiveled connection with one part of the lower hinged clamp, F^2, and provided with the set-screw f^7.

In the erection of the tower in which the parts are connected as above set forth, the tower may be conveniently built either by beginning with the top section and raising and adding at the bottom, or by building from the bottom upward. In the latter case stagings are laid on the succeeding main and intermediate girts, and the next higher connected girts are conveniently raised and applied from such stagings.

The girts being united on the ground or on the scaffold to form unitary compound members, and the fittings by which they are joined to the standards being of the form shown, it is obvious that the difficulties of screwing parts together by right and left threaded screws while supporting them in elevated positions, are wholly obviated.

I claim as my invention—

1. In combination with the standards A and with the girt-coupling B′, provided with the eye *b* for the admission of the threaded part A′, connecting adjacent standards, the couplings A^2, or their equivalent shouldered parts, arranged above and below the coupling B′, whereby the latter may be confined in place, substantially as described.

2. In combination with the girts B, joined by the couplings B′, having eyes *b*, the standards A, of an incomplete skeleton iron tower provided with shoulders *a*, and short vertical threaded nipples A′, whereby the couplings B′ of the previously-connected girts B may be set over the said nipples A′, to rest on the shoulders preparatory to the addition of the next sections of standards, substantially as described.

3. In combination with the standards A, provided with shoulders *a* near their upper ends, and having their upper ends threaded, the girts B, connected with each other at their extremities by the couplings B′, rigidly secured to said girts, and provided with the aperture *b*, adapted to set over the upper ends of the standards, substantially as described.

4. In combination with the standards A, the girts C, joined by the two-part couplings C′ C^2, recessed to receive the standards, and provided with fastenings, whereby the parts of the coupling may be clamped about the standards, substantially as described.

5. In combination with the sectional standards A, diagonally braced from end to end, the girts C, arranged inside the plane occupied by the diagonal braces, substantially as described.

6. In combination with the inclined standards A, provided with shoulders *a* near their ends, which shoulders support the girt-couplings B′, said couplings rigidly secured to the

horizontal girts and having their faces inclined to bear squarely against the shoulders *a*, substantially as described.

7. In combination with the diagonal brace D, formed of two headed parts, as shown, the connection D′, having the recess *d*′ and slots d^2, substantially as and for the purposes stated.

8. In combination with the standards and girts, the intersecting screw-threaded diagonal braces D D, each formed of two parts, and connecting-plates D′, joining the parts of the several diagonals at the intersection of the latter, and means for locking said plates to each other, substantially as described.

9. In combination with the headed rods D and recessed connecting-plates D′, brought to position with their open faces opposite each other, the central bolt, E^2, operating to hold the parts in place and to confine the rod-heads *d*, substantially as described.

10. In combination with the girts B and with the intersecting diagonal braces D D, connected to each other at their intersection, the suspending rod E, arranged to centrally support the girts from the braces, substantially as described.

11. In combination with the plates D′, connecting the parts of the several braces D, and with the bolt E^2, connecting said plates, the clevis E′, forming an attachment for the suspending rod E with the braces, substantially as described.

12. In combination with the diagonal braces D, threaded at their ends, the girt-couplings B′, provided with eyes d^5, and the threaded clevises D^4, pivoted to said eyes, substantially as described.

13. In combination with the standards A and girts C, temporary braces F, adapted to be removably attached to the standards and girts, substantially as described, and for the purposes set forth.

14. In combination with the tower standards and girts, the brace-rods F, provided with detachable clamps F′ and F^2, the latter longitudinally adjusted upon said rods, substantially as and for the purposes set forth.

15. In combination with the tower standards and girts, the brace-rods F, provided with detachable clamps pivotally connected with the rods, substantially as described, and for the purposes stated.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

JOHN S. ADAMS.

Witnesses:
M. E. DAYTON,
F. U. ADAMS.