(No Model.)

J. S. ADAMS.

SKELETON IRON TOWER.

No. 294,344. Patented Feb. 26, 1884.

Fig. 3.

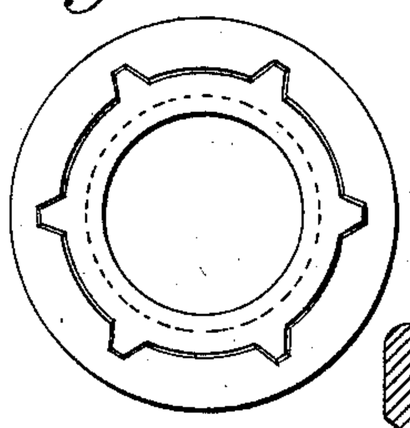
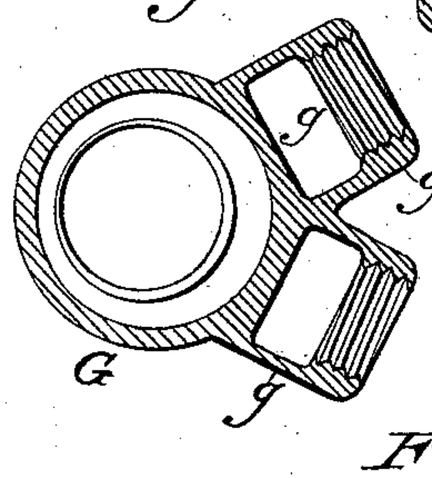


Fig. 4.



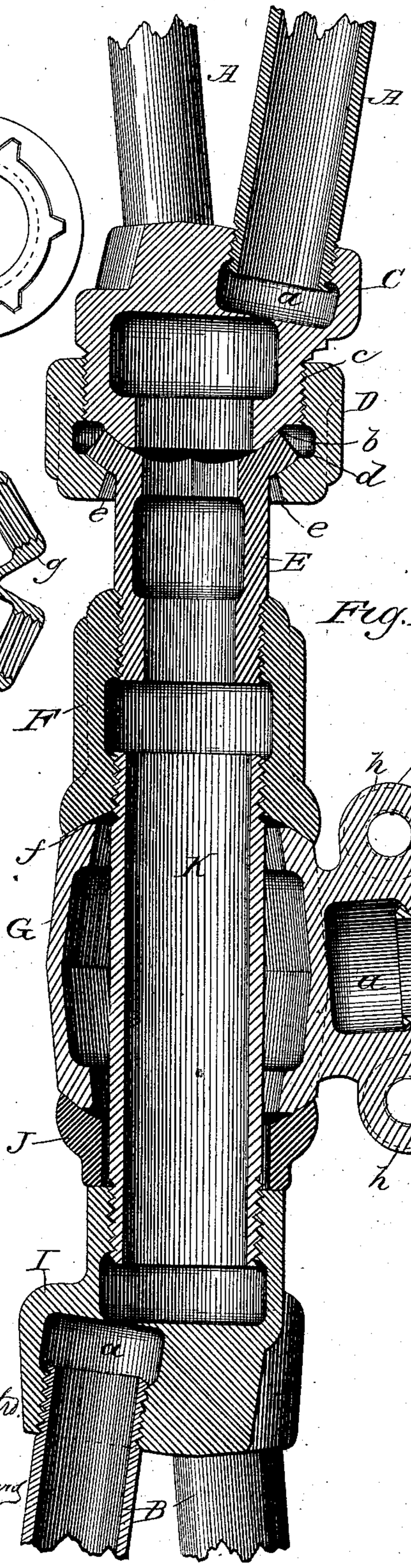


Fig. 2.

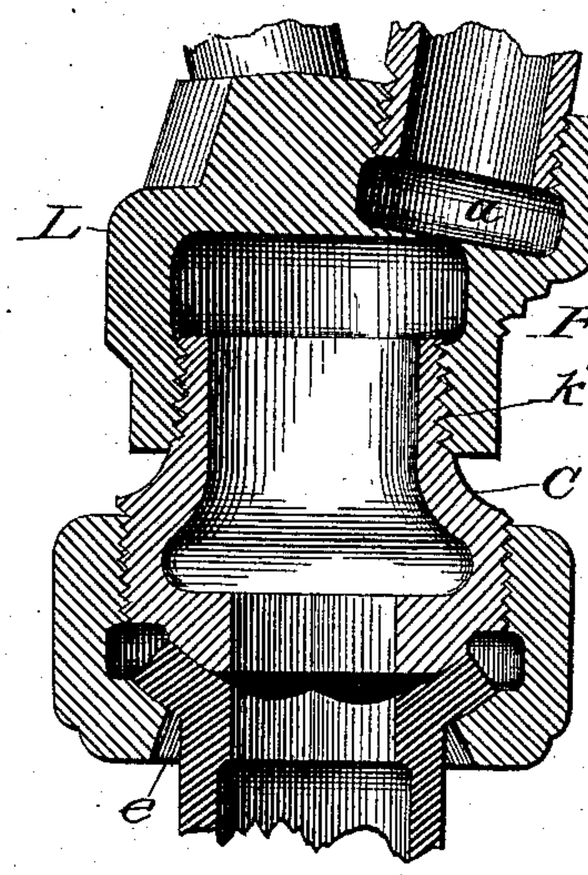
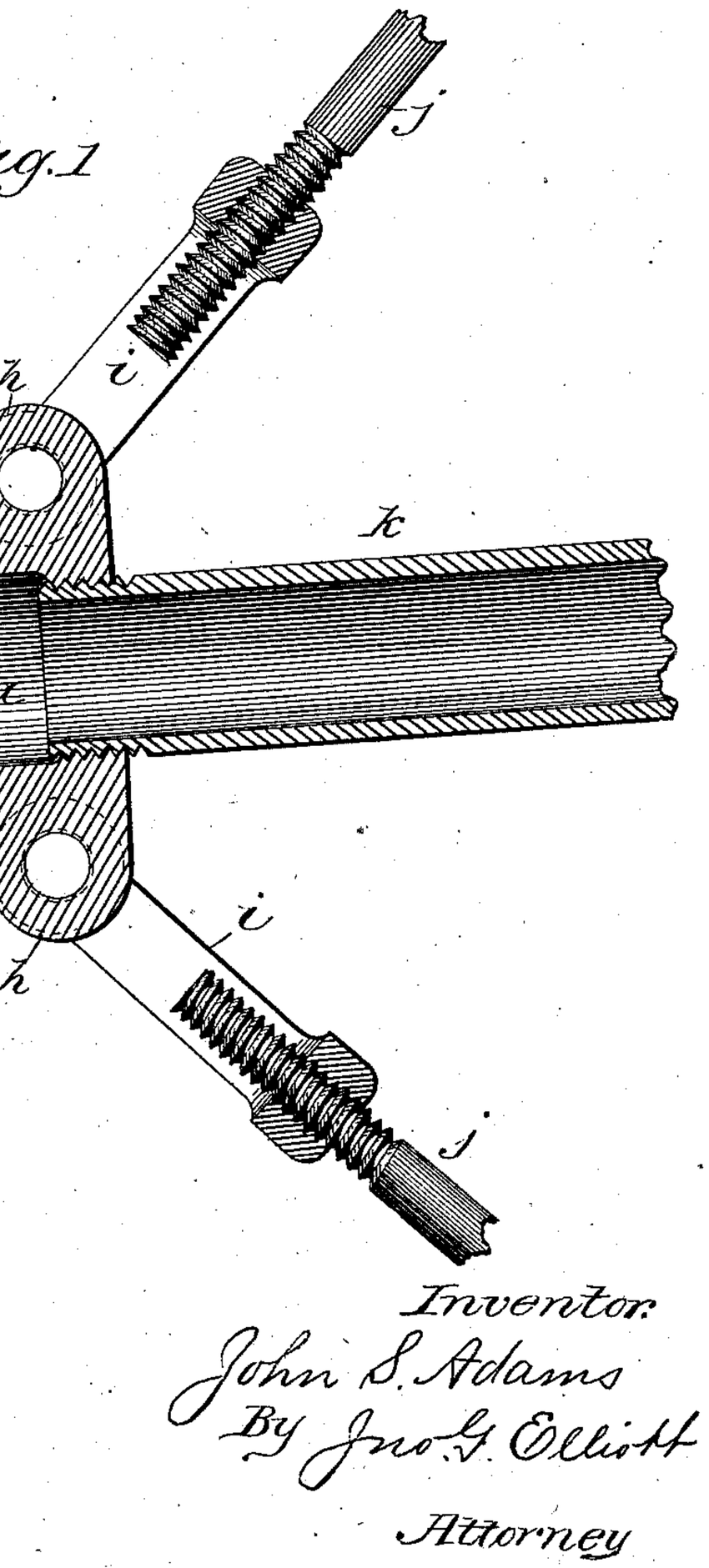


Fig. 1.



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UNITED STATES PATENT OFFICE.

JOHN S. ADAMS, OF ELGIN, ILLINOIS.

SKELETON IRON TOWER.

SPECIFICATION forming part of Letters Patent No. 294,344, dated February 26, 1884.

Application filed February 20, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. ADAMS, a citizen of the United States, residing in Elgin, county of Kane, and State of Illinois, have invented certain new and useful Improvements in Skeleton Iron Towers, of which the following is a specification.

My invention relates to improvements in skeleton iron towers, the uprights of which are constructed in sections coupled together at their ends, transversely connected by means of girts or struts, and diagonally connected and trussed by means of diagonal ties or braces.

The objects of my invention are to provide a skeleton iron tower with adjustable compound couplings—that is to say, couplings connecting the chord or longitudinal section of the structure with the girts or struts and with the diagonal braces—which couplings are adapted to permit a limited radial oscillation or variation of the angles at which said parts are connected, the purpose being to provide for the erection of towers of a given height over streets, street intersections, or other similar areas of different widths necessitating materially differing widths of base, and consequently a material variation of the angles at which the girts or struts and the longitudinal sections are adjusted without changing the form or the construction of the couplings by which said parts are connected and adjusted; second, to provide a radially-adjustable union-coupling for connecting the several sections of the chords or longitudinal members of a tower or other trussed structure, by means of which couplings the several sections of the longitudinal members, when so connected, may independently of the next section be adjusted to the same or to different angles of inclination, and the several trussed panels of the structure, of which these sections form a part, may be adjusted to the same or to different horizontal or vertical planes. I attain these objects by devices illustrated in the accompanying drawings.

Figure 1 represents a longitudinal section of the several couplings and parts embodying the principal features of my invention, the union-nut being screwed upon the unitary or compound coupling of the upper longitudinal girder-section; Fig. 2, a similar view of a detail in which the union-nut is screwed upon a male threaded coupling or bushing screwed into a compound or unitary coupling; Fig. 3, a plan view of the concave coupling, and Fig. 4 a horizontal section of the girt-coupling.

Similar letters of reference indicate the same parts in the several figures of the drawings.

A A represent in the present instance two of three tubes, forming an upper sectional member of a trussed chord or upright of a tower, and B B a lower and similar trussed or girder sectional member connected with the upper section and with the girts or struts, as hereinafter described. The tubes of the upper and lower sections of the upright or chord, as shown, are arranged at the corners of a triangle and converged toward the ends of the sections, at which point they are in this relative position screwed into unitary or compound couplings C and I, the sockets being chambered, as shown at *a*, to provide for tapping the sockets and adjusting the tubes therein, as are also all parts of these couplings into which tubes are screwed. The lower portion of the compound or unitary coupling C is screw-threaded externally to receive a union-nut, D, and has its lower end made in convex form to fit the concave portion of the union-socket E. This compound coupling C, thus forming a portion of a concavo-convex union-joint, is therefore called a "compound union-coupling."

The union-nut D is provided with external ribs, (indicated by dotted lines in Fig. 1,) to provide a ready means for its manipulation, either by hand or by a wrench, to tighten the concavo-convex joints of the union after the proper angular adjustment of the chord-section is secured. The lower internal portion of the nut D is provided with an annular concave shoulder upon the union-socket member E. The concave surface of the internal shoulder of the union-nut D thus fitting the convex external flange of the union-socket E, and the concave seat of the union-socket fitting the convex end of the compound union-coupling C, form the concavo-convex joints of a radially-adjustable union-coupling. The internal portion of the nut below

the shoulder *d* is made flaring or bell-shaped, as shown at *e*, and the central internal portion of the nut is chambered, as shown at *b*, thereby providing for a limited radial adjustment of the position of the concavo-convex surface of the socket between the convex end of the compound union-coupling and the convex internal shoulder of the nut. It will be noticed that all the convex and concave surfaces of this universal coupling device have a common center, and are therefore concentric or parallel with each other, so that in the union itself means are provided for either maintaining the sectional members in a straight line with or at an angle to each other without injury to the joints or the members connected thereby, and also for preserving a perfect bearing or fit of the concavo-convex surfaces of the union at all points within the radial limits of their oscillatory movements. The lower extremity of the socket E is externally screw-threaded, to fit in a concave coupling, F, provided with external ribs, (indicated by dotted lines,) for manipulation by a wrench, and termed a "concave coupling," because its lower end is concave, as shown at *f*, to form a ball-and-socket joint with the convexed end of a hollow girt-coupling, G, approximately spherical in form.

Passing through the girt-coupling, and screw-threaded in the concave coupling, is a nipple, K, screw-threaded at its lower end in a compound coupling, I, supporting on its upper end a concave collar, J, forming a ball-and socket joint with the lower convexed end of the girt-coupling, said collar and the girt-coupling being loosely sleeved upon the nipple, and the compound I receiving the tubes B B, forming the compound member of the structure. As will be seen, girt-coupling G forms the ball of a ball-and-socket joint, the sockets of which are formed by the concave coupling F and concave collar J, or by two concave couplings, as the requirements of the case may be, said girt-coupling being provided with bifurcated extensions *g g*, (see Fig. 4,) each being internally screw-threaded and receiving, respectively, a girt, *k*, the extensions being arranged for a girted structure triangular in cross-section, but may be arranged for a structure quadrangular in cross-section, wherein the extensions would be at a right instead of an oblique angle, as shown. Extensions *g g* are (see Fig. 1) provided with perforated lugs *h*, in which are pivoted clevises *i*, provided at their bent ends with screw-threaded perforations, receiving rods *j*, forming the diagonal braces of the structure, which, secured in this manner, may be adjusted to the desired tension by turning them back and forth in the clevises.

With the coupling and members in the vertical position shown in Fig. 1, it will be seen that the upper member may be adjusted radially—that is, at an oblique angle to and without disturbing the lower member—by loosening the nut D and correspondingly shifting the angle of bearing of the ball or coupling on the socket, and, on the other hand, the socket, the lower member, and the parts intermediate may be set at an oblique angle to the upper member by correspondingly shifting the socket-joint in the nut, and on the ball-joint, the nut being tightened after either adjustment, to rigidly lock the opposing members of the union.

The girt-coupling may be adjusted by loosening either the concave or the compound coupling, and this adjustment may be made and the girt coupling secured without disturbing the members or so much of the coupling as connects them.

As these towers are sometimes erected by beginning at their top section and then elevating this and other sections next below it and each other, and at other times by building from the base-section up, the advantages of the adjustments of the coupling as above set forth may be readily understood. It may also be noted that if the girt-coupling is not tightened when erecting the structure the coupling will adjust itself, and consequently needs only to be tightened after the members or uprights have been fixed in their adjustment.

In Fig. 2 the convex member C is modified by screw-threading its projecting end, as shown at *k'*, to provide for connecting the union by means of a compound coupling, L, with a section of a tower, whether such section be trussed, as shown, or composed of a single chord, of which latter the upper portion of the tower is usually composed.

In application the improvements herein described are not limited to tower structures, for they are equally adapted to bridges and other trussed structures in which the several members or elements and the necessities of their adjustment substantially correspond with those of a tower, except in direction.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a skeleton tower, the combination, with one element thereof, of another joined thereto by a universal joint, whereby the two may be adjusted at any angle with each other, substantially as described.

2. In a skeleton tower, the combination, with one element thereof, of another element joined thereto by a ball-and-socket joint, whereby the elements may be adjusted at any desired angle with each other, and means for rigidly setting or fixing the joint when the adjustment has been effected, substantially as described.

3. In a skeleton tower, the combination, with one element thereof, of another element joined thereto by a ball-and-socket joint, one of said elements being made to pass axially through the ball and sockets of said joint, substantially as described.

4. In a skeleton tower consisting of several uprights joined by lateral braces and tie elements, which constitute with said uprights a trussed structure, a universal joint uniting

said lateral braces with the upright, whereby the two may be adjusted to any required angle with each other and brought into proper relation with each other regardless of the angle of spread between the upright elements.

5. In a skeleton tower, an upright or corner element consisting of two or more sections, one or more of said sections united to its adjacent section by a flexible joint, thus permitting the said adjacent sections to stand at different angles with the axis of the tower, substantially as described.

6. The combination, with the uprights and a coupling connecting the sections thereof, of a girt and a ball-and-socket coupling, the socket of which is formed in two parts opposing each other, substantially as described.

7. The combination, with the uprights and girts, of a tower with a ball-and-socket joint-coupling the socket of which consists of two parts opposing each other, and one of said parts being adjustable and adapted to be tightened upon the ball and the ball in turn upon the opposing socket-piece, substantially as described.

8. In a coupling, the combination of the universal joint, the compound coupling I, and the nipple, all arranged and operated substantially as described.

9. The combination of the coupling I, collar J, ball G, concave coupling F, and nipple K with a universal joint having one of its members screw-threaded in the concave coupling F, substantially as described.

10. The combination, with the concave coupling F, the coupler I, ball G, and collar J, of the nipple K, passing through said ball and collar and screw-threaded in the opposing couplings, F and I, substantially as described.

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