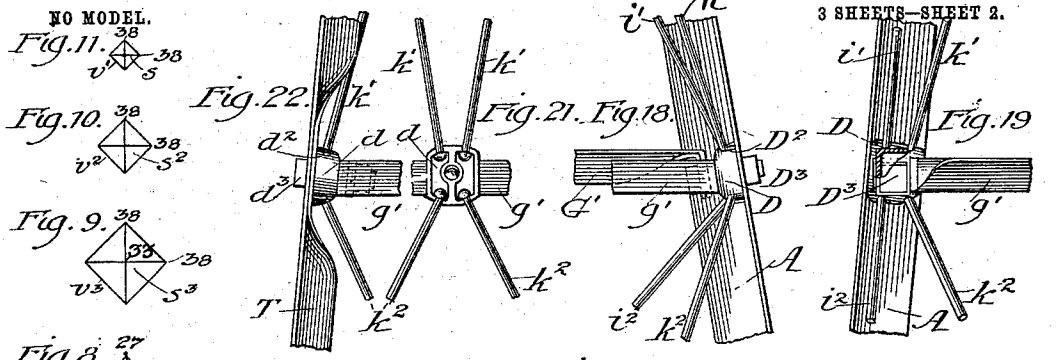
No. 717,916. PATENTED JAN. 6, 1903.

T. O. PERRY.

TILTING TOWER.

APPLICATION FILED MAR. 19, 1900.

NO MODEL. 3 SHEETS—SHEET 2.



Witnesses:

Frank S. Blanchard

Harold G. Barrett.

Inventor.

Thomas O. Perry.

No. 717,916. PATENTED JAN. 6, 1903.

T. O. PERRY.

TILTING TOWER.

APPLICATION FILED MAR. 19, 1900.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 3.

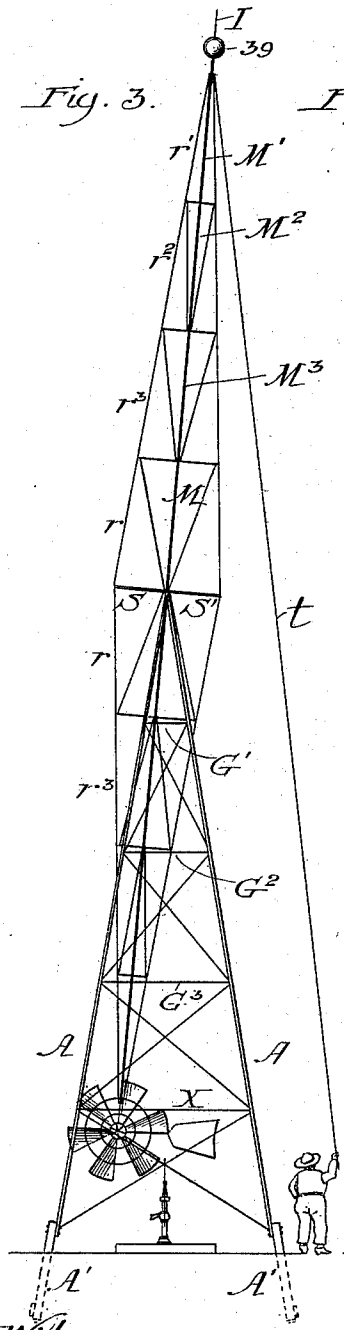


Fig. 2.

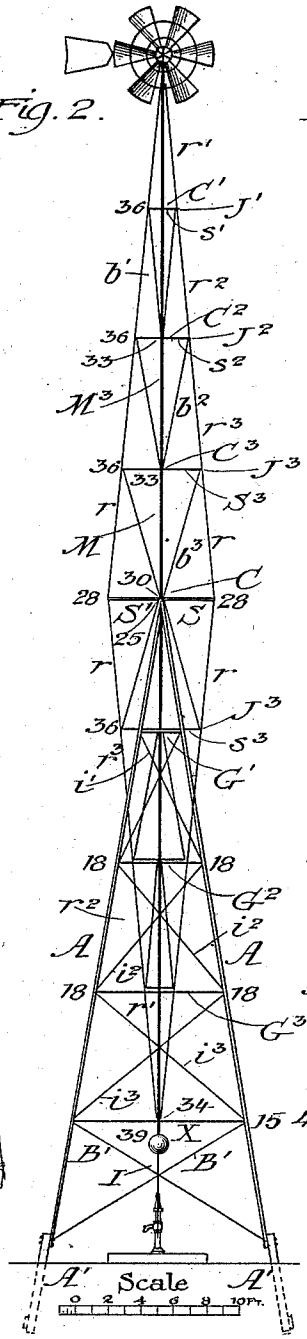
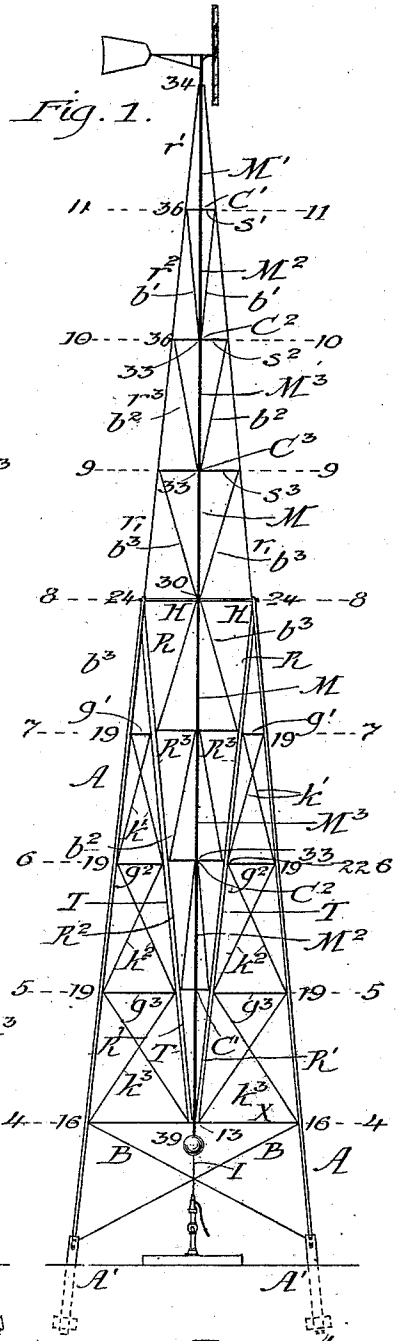


Fig. 1.



Witnesses:

Frank S. Blanchard

Harold G. Barnett

Inventor:

Thomas O. Perry.

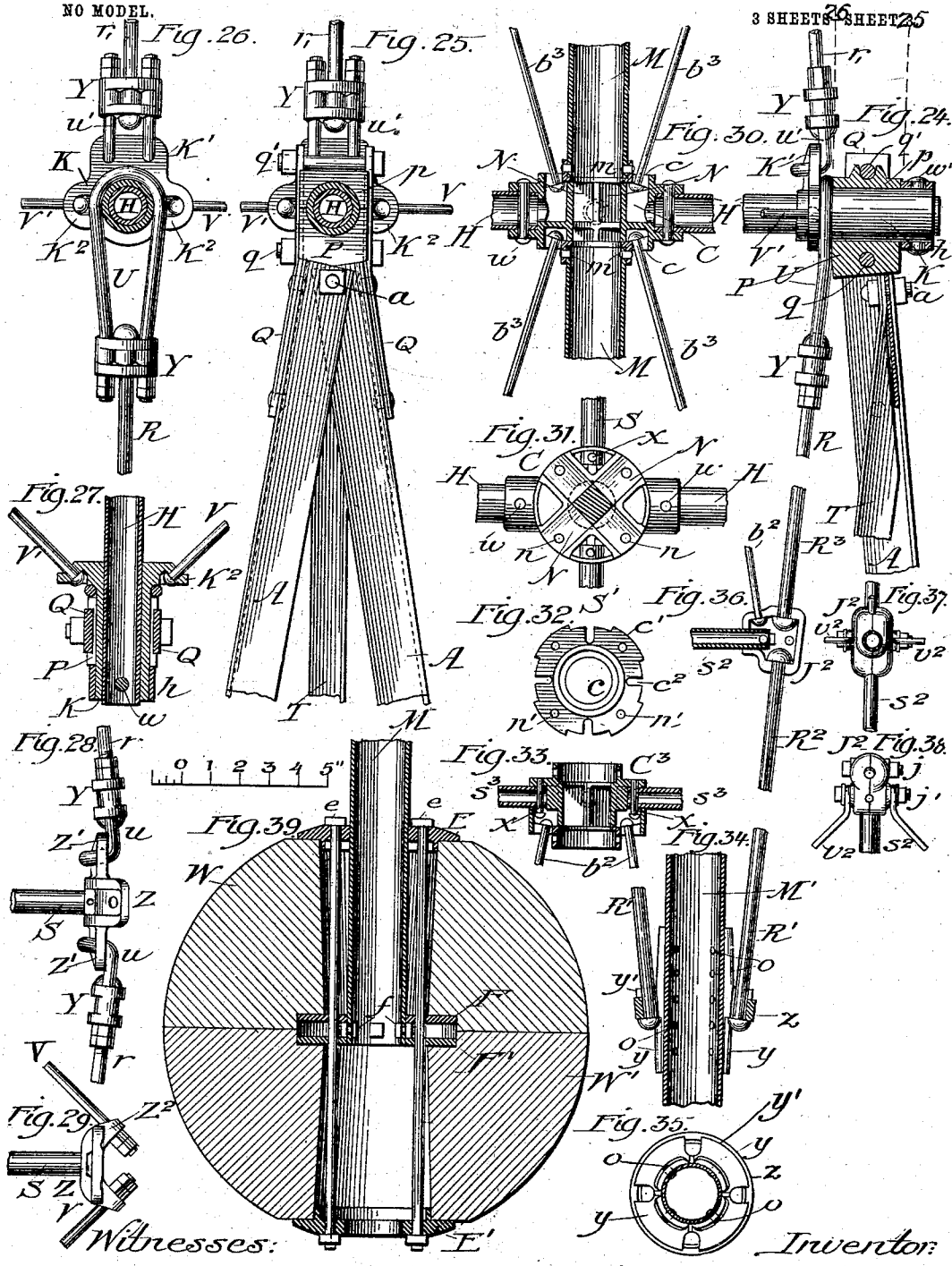
No. 717,916. PATENTED JAN. 6, 1903.

T. O. PERRY.

TILTING TOWER.

APPLICATION FILED MAR. 19, 1900.

NO MODEL. 3 SHEETS—SHEET 25



Witnesses:

Frank S. Blanchard

Harold G. Barrett

Inventor:

Thomas O. Perry.

UNITED STATES PATENT OFFICE.

THOMAS O. PERRY, OF CHICAGO, ILLINOIS.

TILTING TOWER.

SPECIFICATION forming part of Letters Patent No. 717,916, dated January 6, 1903.

Application filed March 19, 1900. Serial No. 9,321. (No model.)

To all whom it may concern:

Be it known that I, THOMAS O. PERRY, a citizen of the United States, residing at 1025 Park avenue, Chicago, in the county of Cook and State of Illinois, have invented a new and useful Tilting Tower, of which the following is a specification.

My invention relates to improvements in towers in which a mast is pivoted on a supporting-base and secured in an upright position and provided with means whereby it may be turned over on its pivots to a reverse position, so as to bring its top near to the ground or foot of the base; and the objects of my improvements are to provide for the convenient erection, replacement, and easy care of any objects which may be borne aloft by the top of the mast; to dispense with the necessity for ladders, platforms, and other adjuncts peculiar to ordinary towers; to save material and consequent expense, such as would be additional where the weight and comfort of one or more persons must also be provided for, and especially to avoid excessive strains, due to wind-pressure, by a structure which reduces to a minimum the surface exposed to wind in the upper part of the tower, and also to provide for the guidance, support, and protection of an operating rod or shaft where an object, such as a windmill, is to be supported aloft, with means for operating a pump or other machinery below. These objects in a general way were attained by the devices shown in three previous Letters Patent for tilting towers granted to me, bearing numbers and dates as follows: No. 375,378, issued December 27, 1887; No. 11,181, reissued July 28, 1891, and No. 485,883, issued November 8, 1892.

My present invention relates largely to improvements in details by which these objects are much more effectively attained, and the mechanism is illustrated by the accompanying drawings, in which—

Figure 1 is a front view of my improved tower, showing a windmill surmounted thereon and represented as operating a pump below. Fig. 2 is a side view of the same, but showing the windmill as if furled. Fig. 3 is another side view showing the furled windmill lowered near to the ground by tilting the mast. Fig. 4 outlines a horizontal section of the base of the tower at 4 4 on Fig. 1. Figs. 5, 6, and 7 outline horizontal sections of base and mast respectively at 5 5, 6 6, and 7 7 on Fig. 1. Fig. 8 outlines a central cross-section of the mast, taken through its pivots at 8 8 on Fig. 1. Figs. 9, 10, and 11 are outline cross-sections of the mast respectively at 9 9, 10 10, and 11 11 on Fig. 1. Fig. 12 is a plan, enlarged from Fig. 4, of the mast-lock and intersecting portions of lock-girths. Fig. 13 shows in enlarged elevation how a brace-clamp d' joins the lower end of a truss-post and brace, together with the latch L, to a lock-girth. Fig. 14 is an enlarged plan showing the brace-clamp d' and portions of lock-girths and latch. Figs. 15, 16, and 17 are enlarged views at 15, 16, and 17 on Figs. 2, 1, and 4, showing in side elevation, front elevation, and plan how the brace-clamp D′ joins the brace-rods i^3 k^3, the angle-braces B B′, and the lock-girth X X′ to the post A. Figs. 18, 19, and 20 are enlarged views at 18, 19, and 20 on Figs. 2, 1, 5, 6, and 7, showing in side elevation, front elevation, and plan how the brace-clamp D joins the four brace-rods i' k' i^2 k^2 and the two girths G g to the post A. Figs. 21, 22, and 23 are enlarged views at 22 and 23 on Figs. 1, 5, 6, and 7, showing in side elevation, front elevation, and plan how the four braces k' k^2 and the two girths g' are joined to the truss-post T. Figs. 24, 25, 26, and 27 are enlarged views at 24, 25, and 27 on Figs. 1, 2, and 8, showing in front elevation, side elevation, and sectional plan how the mast is pivoted on the base, Fig. 25 showing the end of pivot-pipe H and journal-casting K cut off inside of collar h at 25 on Fig. 24 and Fig. 26 showing pivot-pipe H and journal-casting K cut off inside of the pivot-box P at 26 on Fig. 24. Figs. 28 and 29 are enlarged views at 28 and 29 on Figs. 2 and 8, showing in side elevation and plan how the clevis-casting Z joins the truss-rods r and center ties V V to the main strut S. Figs. 30, 31, 32, and 33 are enlarged views at 30, 33, and 31 on Figs. 1, 2, 8, and 9, showing in elevation and plan how the mast-sections M, M³, &c., several stays b^3 b^2, &c., pivot-pipes H, struts S³, &c., are joined together by the coupling C and coupling-caps c. Figs. 34 and 35 are enlarged views at 34 on Figs. 1 and 2, Sheet 1, showing in elevation and plan how the truss-

rods R′ are joined to the mast-sections M′. Figs. 36, 37, and 38 are enlarged views at 36 and 38 on Figs. 1 and 2 and 5, 6, 7, 9, 10, and 11, respectively, showing in elevation and plan how the junction-clamp J^2 joins two truss-rod sections R^2 R^3 to each other and to a stay b^2, a strut s^2, and to the ties v^2; and Fig. 39 is an enlarged sectional elevation showing how the counterweight W W′ is attached to the lower end of the mast at 39 on Figs. 1 and 2.

Figs. 4 to 11 may be measured by the scale shown on Sheet 1. All other figures on Sheet 2 excepting Fig. 12 may be measured by the scale shown on Sheet 3. Fig. 12 is one-half the size of Fig. 14.

The base on which the mast is pivoted is anchored to the ground by means of the anchor-posts A′ or to any substantial foundation in any suitable way and has for its principal members the four corner-posts A, which are preferably made of angle-iron, though wood or other suitable material may be used. The posts A are joined in pairs converging and connected together at their upper ends, where a pivot-box P is secured. Horizontal girths G' G^2 G^3 connect these side pairs at regular intervals, and in the panels between girths are diagonal intersecting braces i' i^2 i^3. There are two converging pairs of posts which, with their connections, constitute the two sides of the base. These two sides stand facing each other, with their pivot-boxes separated sufficiently to receive the mast between them, and their feet are preferably separated by a still wider interval. The pivoted mast connects and turns in the pivot-boxes, so that the sides are held thereby at a fixed interval. At a short distance above the ground the two sides are rigidly connected by horizontal diagonal lock-girths X X′, preferably of angle-iron, which intersect and interlock a little in front of the vertical axis of the mast, forming an angle, against which the foot of the mast is pressed by the latch L. As the mast usually reaches only slightly below the lock-girths, the base below the lock may be braced on each of the four sides, as is usual in ordinary towers; but I prefer for convenience in entering the base to have braces below the lock on the sides and back only, as these three sets of braces, supplemented by the intersecting lock-girths, adequately provide for rigidly fixing the four corner-posts at their junctions with the lock-girths and braces. Now as the vertical distance between the lock-girths and mast-pivot is usually so great that the posts need staying at intervals to prevent lateral buckling and as the complete tilting of the mast would be interfered with by directly connecting the sides I provide two truss-posts T on each side of the mast, the feet of which are secured, with short interval between, to the lock-girths on each side of their intersection and whose upper ends are bolted to the sides of the base just below the pivot-boxes P, so that each truss-post forms with the two adjacent corner-posts A a triangular pyramid whose base is in the plane of the lock-girths, leaving the space below the lock-girths free from obstruction. The two faces of each pyramid adjacent to the truss-post are divided into panels by horizontal girths to correspond with the girths G' G^2 G^3, and these panels are occupied by diagonal braces k' k^2 k^3, similar to those on the sides of the base. Thus each of the four corner-posts is stayed in every direction against buckling at any desired intervals without interfering with the tilting of the mast to a complete reversal of position, and much saving of material is effected by reason of the short intervals between girths thus permitted, which render excessive stiffness of parts unnecessary. While all the girths and all of the braces below the lock-girths X X′ are preferably made of angle-iron, or at least of material that will effectually resist compression as well as tension, it is more economical to make all braces above the lock-girths of small rods suited to resist tension only, as these are above the reach of injury by collision with cattle or other moving objects near the ground and only have to resist the buckling tendency of the posts. These brace-rods i' i^2 i^3 k' k^2 k^3 are provided with semispherical heads at each end, which are held by brace-clamps D D′ d d', provided with internal shouldered recesses having slots D^2 d^2 open toward the posts A T for inserting the heads, so that when the clamps are drawn against the flanges of the posts A by the bolts D^3 D^4 d^3 d^4 the heads are secured in place. The ends of the girths G' G^2 G^3 g' g^2 g^3 are perforated and bent to fit the backs of the brace-clamps D d, against which they are also drawn and held by the clamping-bolts. The upper ends of the angle-iron braces B′ are perforated and bent to fit the backs of the brace-clamps D′, and the ends of the lock-girths X X′ are perforated and bent to fit the bent ends of braces B′, so that the bolt D^4 serves to clamp together and hold against the post A lock-girths, side angle-iron braces B′, rod-braces, and also the upper ends of back angle-iron braces B, which lie without bending against the outside of the posts. The lower ends of the braces B B′ are perforated to receive and be secured by the anchor-bolts at the feet of the posts A. In each pair the posts A, which serve to form a side of the base of the tower, lap each other at their upper ends, so that the bolt a binds them both to the truss-post T. The pivot-boxes P shoulder on the posts A and are clamped by the bolts q between straps Q, riveted to the upper ends of the posts on the outside. The pivot-box caps p are held in place by the bolts q', which clamp them also between the straps Q.

The pivoted mast consists in the main of a straight central member composed of sections M M′ M^2 M^3, preferably of tubular form, which is adapted to resist compressive strains and is trussed on four sides by means of truss-rods R, R′, R^2, R^3, r, r', r^2, r^3, and r_1, which diverge from near each end until they unite in

pairs with each of four main struts H S S', which radiate from the central member midway at right angles thereto and to each other. These four main struts are preferably made of tubing and have their outer ends securely tied to each other by means of center ties V V'. Two of these main struts H, larger than the other two, extending in line horizontally on opposite sides of the mast, reach beyond their junctions with the truss-rods and center ties and extend into the two pivot-boxes which are supported on the sides of the base and are called the "pivot-pipes," as they constitute the mast-supporting axle. The pivot-pipes H do not directly rest on the pivot-boxes P, but have on their outer ends journal-castings K, which turn in the boxes P when the mast is tilted. The journal-castings K and pivot-pipes H extend through the boxes P far enough to receive collars h and collar-pins w', which, passing through both journal-castings and pivot-pipes, secure them to each other and hold the pivot-boxes from slipping outwardly. The inner end of each journal-casting K has a flange K', perforated with holes, through which the clevis u' is hooked, the two prongs of which extend through a yoke Y and are double-nutted at their ends. Each truss-rod r_1 extends centrally through the yoke in an opposite direction between the prongs of the clevis and ends in a semispherical head, which retains the yoke. A yoke Y in like manner connects the truss-rod R with the clevis U, which, however, instead of being hooked through holes in the flange of the journal-casting is looped directly over the journal, nearly filling the space between flange K' and the pivot-box. When the mast is in an upright position, as shown in Figs. 1 and 2, where it is generally supposed to be except when tilted for temporary attention to a windmill, lamp, or other object carried at the top, its weight is transmitted to the journals through the two truss-rods R' R^2 R^3, and the other truss-rods most of the time are free from severe strains, except such as may be due to occasional wind-storms. Clevis-castings Z are shouldered and pinned on the outer ends of the main struts S S' and have upper and lower flanges Z', through which clevises u are hooked. Yokes Y receive the prongs of these clevises and the headed truss-rods r, making connection in precisely the same way as before described in connection with clevis u'. The journal-castings K and clevis-castings Z are securely tied to each other by means of the center tie-rods V V', whose headed ends are held by the oblique ears K^2 on the sides of the journal-casting and whose other double-nutted ends reach through similar oblique ears Z^2 on the sides of the clevis-castings. When the mast is tilted horizontally, its weight and burdens are transmitted to the journals through the two back truss-rods which connect with the main strut S, thence through both main struts S S', and through the two center ties V', while the center members of the mast and pivot-pipes H are subjected to compressive strains due to weight. The weight of the mast and burdens when tilted to a horizontal position does not appreciably strain the other six front and side truss-rods nor the two center ties V. The pivot-pipes H and main struts S at their inner ends are shouldered and pinned into the sides of the center coupling-casting C, which is in the form of a cylindrical ring with open ends and having an annular transverse web with central opening beneath the strut and pivot-pipe connections, as shown in Figs. 30 and 31. Above the transverse web vertical partitions extend nearly to the top of the coupling-ring, dividing the annular interior space into eight compartments, four of which are triangular in horizontal section with closed sides and open tops. The other four compartments are rectangular in horizontal section with open tops and open exterior and interior ends, the exterior openings being in the cylindrical wall between the pivot-pipe and main-strut connections. The open ends of the cylindrical coupling C are closed by coupling-caps c in the form of disks with central opening and having four peripheral projections which shoulder against the coupling above and below within corresponding notches cut in its cylindrical wall, so that the peripheral projections of the cap cover and overlap the rectangular compartments of the coupling C. The cap c may also rest on the partition-walls, which may extend for that purpose below as well as above the annular web of coupling C. The coupling-caps c also have central exterior sockets, within which the ends of the tubular mast-sections are shouldered and pinned. The pinning of the mast-sections to the coupling-caps and the notching of the coupling-caps into the cylindrical coupling is to make the mast-sections torsionally rigid with respect to the coupling and to each other. The tension of the truss-rods presses the caps against the couplings. The truss-rods are secured to the tubular mast-sections M' near the upper and lower ends of the mast, as shown in Figs. 34 and 35. Four cast mast-clamps y are clamped against the tubular mast-section and prevented from slipping thereon by pins or rivets o. The encircling clamping-ring z, preferably made of wrought iron or steel, rests on one side against shoulders y' on the clamps y, while the other side comes flush with other shoulders on the clamps. The adjoining corners of the clamps y are cut away to make room between each pair and the clamping-ring for the shanks of the truss-rods, and the semispherical heads of the truss-rods draw against the shoulders on the clamps and against the clamping-ring as well, holding it in place. The four clamps y might be embodied in two or even one piece but should lie close to the tubular member M and are more easily cast to fit in four pieces. The mast is now complete for two mast-sec-

tions, one above and one below the central mast-coupling C, provided the mast is not very long or if the tubular sections be sufficiently stiff to resist buckling. On economical grounds, however, it is desirable to stay long masts at intervals between the ends and center coupling. Besides, if the mast is to support a windmill, as shown in Figs. 1, 2, and 3, it is necessary to provide guides at intervals for a reciprocating pump-rod or may be for a shaft revolving within the tubular member of the mast. A guide or bearing is easily provided for in connection with the coupling C, for the four rectangular compartments already described are adapted to receiving the shaft-guides N, as shown in Fig. 31. The guides may be held in place by bolts through the bolt-holes n, which also may pass through the coupling-caps at n', clamping them against both the coupling and the guides. Where the tubular member of the mast is divided into several sections, as M M′ M^2 M^3, with additional cast couplings C′ C^2 C^3, it is also desirable to divide the truss-rods into corresponding sections with junctions at J′ J^2 J^3, so that these mast-couplings and truss-rod junctions may facilitate the insertion of struts S′ S^2 S^3 and stays b' b^2 b^3, arranged as shown in Figs. 1, 2, and 3. Each junction-clamp, like J^2, is made, as shown in Figs. 36, 37, and 38, of two castings recessed to receive between them against internal shoulders the headed ends of two truss-rod sections and a stay and the outer end of a strut. The bolts j j' clamp together the two halves of the junction-clamp, and the bolt j' passes through and retains the end of the strut s^2 and also serves to secure the ends of the ties v^2, &c., which retain the truss-rods, in proper relative position against lateral displacement. The other headed ends of the stays b^3 b^2, &c., are held by the mast-coupling caps c, as shown in Figs. 30, 31, 32, and 33, each of which has four slots c^2, which receive the shanks of the stays and are closed by the cylindrical wall of the coupling when in place, so that the heads are retained within the triangular compartments of the coupling previously described. The stays b' b^2 b^3 all extend from their connections at the mast-couplings diagonally outward to truss-rod junctions which are nearer to the extremities of the mast. Therefore, except at the center, it is not necessary to provide more than one coupling-cap for each of the mast-couplings—that is to say, the couplings C′ C^2 C^3 need no coupling-caps on the sides toward the center of the mast and may receive the outer ends of mast-sections M, M^3, and M^2 into sockets integral with the annular internal webs of the couplings, as shown in Fig. 33. Fig. 39 illustrates the construction and attachment of the counterweight, which is designed to counterbalance the windmill or other burden carried by the top of the mast. The mast-sections M′ extend a short distance beyond the junction of truss-rods therewith, and at the lower end of the mast the sides of the tube are pierced by short bolts f, so that the nuts on the outside serve to separate and locate on the tube the two perforated iron disks F F′. The counterweight includes the semispherical halves W W′, having large central openings inclosing the mast-tube and also the long clamping-bolts e, which passing through the locating-disks F F′ and weight-clamps E E′ clamp together the semispherical halves of the counterweight.

The locating-disks F F′ lie in circular recesses in the weights W W′, between which they are in turn clamped against the nuts of the short bolts f, and thus serve to locate the two halves of the weight with reference to each other, as well as on the mast-tube. These semispherical weights may be made of inexpensive material, such as gravel or broken stone and cement, as no external corners are exposed to injury, and their forms are favorable to molding. For convenience in tilting the mast the counterweight should be a little lighter than the windmill or other object on the top end, so that when the foot is unlatched the mast will slowly tilt itself to the position shown in Fig. 3. The tilting-rope t, hitched to the lower end before tilting, serves for restoring the mast to its upright position, where its foot is locked in the angle of the intersecting lock-girths by means of the latch L, hinged at l' on the lock-girth X′ and having a hook L′ to catch over the other lock-girth X.

It may be observed that the sides of the base at the top are held at a fixed interval by the axles of the pivoted mast and that the truss-posts divide the space between the two sides of the base into three triangular sections, thus rendering the base rigid even when the mast is unlatched while tilting. The mast when its lower end is locked at the intersection of the lock-girths fits into the triangular space between the truss-posts and serves to give additional rigidity to the base. The truss-posts leave a space at the foot of the tower free from obstruction which may be housed in and used as a pump or tank room or for operating machinery or for other use. All the figures of the annexed drawings have been copied from working drawing for a tilting tower about seventy-four feet in height. Both higher and lower towers may be made by adding or subtracting from the number of panels, which are made to correspond in height in both mast and base, so that a change in height of tower is easily effected by the addition or subtraction of two panels in the mast for one in the base.

What I claim, and desire to secure by Letters Patent, is—

1. In the tilting tower the combination with the anchor posts or foundation, and the sides of the base, and the pivot-boxes, and the mast pivoted thereon; of a transverse connection between the sides of the base above the foundation, a lock on the transverse connection for securing the mast and truss-posts extending upwardly from said transverse connection

and joining with the sides of the base near the pivot-boxes, each side of the base having pairs of stiffening connections horizontally converging to one of said truss-posts between its extremities, substantially as herein set forth.

2. In a tilting tower, the combination with the pivoted mast, and pivot-boxes on each side and the supporting-posts diverging downward in pairs from each pivot-box, and the anchor posts or foundation; of a transverse connection binding together the supporting-posts above the foundation, a lock on said transverse connection for securing the mast, and truss-posts extending upward from said transverse connection and joining with each pair of posts at or near the pivot-boxes, each truss-post having between its extremities pairs of stiffening connections diverging horizontally to the adjacent pair of posts, substantially as herein set forth.

3. In a tilting tower, the combination with the pivoted mast and the pivot-boxes, and the supporting sides of the base, and the anchor posts or foundation; of a transverse connection between the sides of the base above the foundation, a lock on said transverse connection for securing the pivoted mast in an upright position, and truss-posts diverging from proximate points on said transverse connection at or near the lock to the sides of the base at or near the pivot-boxes, substantially as herein set forth.

4. In a tilting tower, the combination with the pivoted mast and the pivot-boxes and the supporting sides of the base, and the anchor posts or foundation; of diagonal transverse intersecting lock-girths uniting the sides of the base above the foundation, a lock for securing the pivoted mast at the intersection of the lock-girths, and truss-posts diverging upward from proximate points on the lock-girths near their intersection to the sides of the base near the pivot-boxes, substantially as herein set forth.

5. In a tilting tower, in combination with the pivoted mast, and the pivot-boxes on each side thereof, and the supporting-posts diverging downward in pairs from each pivot-box, and the anchor posts or foundation; of diagonal transverse intersecting lock-girths uniting the two pairs of supporting-posts above the foundation, a lock for securing the mast at the intersection of the lock-girths, and truss-posts diverging upward from the lock-girths near their intersection on each side thereof and joining with each pair of supporting-posts near to each pivot-box, each truss-post forming with its adjacent pair of supporting-posts the outline of a triangular pyramid on either side of the mast, substantially as herein set forth.

6. In a pivoted tilting mast, the combination with a longitudinal member adapted to resist compressive strains, and having midway of its length transverse pivotal axles projecting in line from opposite sides; of main struts projecting oppositely from the longitudinal member between and at right angles to said axles, and truss-rods uniting the extremities of the longitudinal member with the outer ends of the main struts and also with the projecting axles near their outer ends, the extreme outer ends of the axles extending beyond their connections with the truss-rods to serve as mast-pivots, substantially as herein set forth.

7. In a pivoted tilting mast, the combination with a hollow or tubular longitudinal member having midway of its length transverse pivotal axles projecting in line from opposite sides; of main struts projecting oppositely from the longitudinal member between and at right angles to said axles, and truss-rods uniting the extremities of the longitudinal member with the outer ends of the main struts and also with the projecting axles near their outer ends, the extreme outer ends of the axles extending beyond their connection with the truss-rods to serve as mast-pivots, substantially as herein set forth.

8. In a pivoted tilting mast, the combination with a longitudinal member adapted to resist compressive strains, and having midway of its length transverse pivotal axles projecting in line from opposite sides; of main struts projecting oppositely from the longitudinal member between and at right angles to said axles, ties directly connecting the main struts with said axles, and truss-rods uniting the extremities of the longitudinal member with the outer ends of the main struts, and also with the projecting axles near their outer ends, the extreme outer ends of the axles extending beyond their connections with the truss-rods to serve as mast-pivots, substantially as herein set forth.

9. In a pivoted tilting mast, the combination with a longitudinal member adapted to resist compressive strains and having midway of its length transverse pivotal axles projecting in line from opposite sides; of main struts projecting oppositely from the longitudinal member between and at right angles to said axles, truss-rods connecting the extremities of the longitudinal member with the outer ends of the main struts and also with the projecting axles near their outer ends; substruts laterally connecting the longitudinal member with the truss-rods at points intermediate of their aforesaid connections, and diagonal stays diverging from the longitudinal member near its junction with axles and main struts to the junctions of truss-rods with substruts, said stays also diverging outwardly from both sides of a plane cutting the longitudinal member at right angles near their junction therewith, substantially as herein set forth.

10. In a trussed tilting mast, the combination with the truss-rods, R r_1, and axles H, of the tubular journals K surrounding and se-

cured at their outer ends to the axles and connected at their inner ends with the said truss-rods, substantially as herein set forth.

11. In a trussed tilting mast, the combination with the truss-rods, R r_1, and axles H, of the tubular journals K surrounding and secured at their outer ends to the axles and connected at their inner ends with the said truss-rods, and having collars or shoulders at their outer ends, substantially as herein set forth.

12. In a trussed tilting mast, the combination with the truss-rods, R r_1, axle H and pivot-box P, of the connecting tubular journal K, surrounding and secured at its outer end to the axle, and having a flange at its inner end, and the loop or clevis U looping over the tubular journal between the flange and pivot-box, and connection between said loop or clevis and truss-rod R, substantially as herein set forth.

13. In a trussed tilting mast, the combination with the truss-rods, R r_1, axle H, and pivot-box P, of the tubular journal K surrounding and secured at its outer end to the axle and having a flange K′ at its inner end, and the loop or clevis U joined to truss-rod R and looping over the tubular journal between the flange and pivot-box, and the clevis u' hooked through the flange K′ and joined to truss-rod r_1, substantially as herein set forth.

14. In a trussed mast, the combination with the tubular mast-section M, and the truss-rods having headed ends R r, of one or more mast-clamps y pinned or riveted to the tubular mast-section, and having an external shoulder or shoulders y' and a clamping-ring inclosing the clamp or clamps and resting, on one side, against said shoulder or shoulders, and notches in or between the clamp or clamps to receive the shanks of the truss-rods, and second shoulders on the clamp or clamps flush with the other side of the clamping-ring, so that the headed ends of the truss-rods may draw against both the clamping-ring and the second shoulders, substantially as herein set forth.

15. In a trussed mast, the combination with the mast-sections M, truss-rods, R r, struts H S s, stays b having headed ends, and mast-couplings C provided with coupling-sockets, of the coupling-caps c attached to the ends of the mast-sections and having peripheral slots c^2 to receive the headed ends of the stays, said coupling-sockets being adapted to close the slots when the coupling-caps are in place, substantially as herein set forth.

16. In a trussed mast, the combination with the mast-sections M, truss-rods, R r, struts H S s, stays b having headed ends, and mast-couplings C provided with notched coupling-sockets, of the coupling-caps c attached to the ends of the mast-sections and having peripheral projections c', and slots c^2 between projections to receive the headed stays, all adapted to fit the notched coupling-sockets so that when in place the slots are closed by the sides of the couplings, substantially as herein set forth.

17. In a trussed mast, the combination with the tubular mast-sections M, the hollow mast-couplings C, and the pole or shaft of a windmill inclosed within the tubular mast-sections, of the guides N secured within the coupling, substantially as herein set forth.

18. In a trussed mast, the combination with the tubular mast-sections M, the hollow mast-coupling C, the coupling-caps c, and the pole or shaft of a windmill inclosed within the tubular mast-sections, of the guides N secured between couplings and coupling-caps, substantially as herein set forth.

19. In a trussed mast, the combination with the truss-rods, R r, struts s, and stays b, of the junction-clamp J composed of halves with corresponding internal shouldered recesses adapted to receive the ends of struts and retain the headed ends of truss rods and stays, and the clamping bolt or bolts j piercing the sides of the junction-clamp between the ends of the several connected members, substantially as herein set forth.

20. In a trussed mast, the combination with the truss-rods, R r, struts s, stays b, and ties v, of the junction-clamp J composed of halves with corresponding internal shouldered recesses adapted to receive the ends of struts and retain the headed ends of truss rods and stays, and the clamping-bolt j' piercing the sides of the junction-clamp between the ends of the several connected members, and also piercing and holding the ends of struts and ties, substantially as herein set forth.

21. In a pivoted tilting mast, the combination with the tubular mast-section M′ at one extremity, of the counterweights W W′ each having large central openings around the mast-tube and corresponding annular recesses in their adjoining faces, and the locating-disks F F′ surrounding the tube and fitting respectively the said recesses, and the pins or bolts f piercing the sides of the mast-tube between the locating-disks, and the weight-clamps E E′, and the clamping-bolts e, substantially as herein set forth.

22. In a tilting tower, the combination with the pivoted mast, and the base-posts A converging upward in pairs on each side of the mast, of the box-straps Q secured to and projecting above the top of the posts, and the pivot-boxes P shouldered on each pair of posts and clamped between the box-straps, substantially as herein set forth.

23. In a tilting tower, the combination with the pivoted mast, and the base-posts A converging upward in pairs on each side of the mast, of the box-straps Q secured to and projecting above the tops of the posts, and the pivot-boxes, having box-caps p, shouldered on each pair of posts and clamped between the box-straps by means of the bolts q q', the bolt q' holding down the box-cap over the box, substantially as herein set forth.

24. In a trussed tower, the combination with the posts A, the girths G and the headed brace-rods *i*, of the brace-clamps D having interior shouldered recesses with slots D^2 opening toward the posts adapted to receive and retain the headed ends of the brace-rods, and the bolts D^3 clamping the brace-clamps and their slot-openings against the posts, substantially as herein set forth.

25. In a tilting tower, the combination with the pivoted mast, the base-posts A, truss-posts T, girths G *g*, and headed brace-rods *i k*, of the brace-clamps D *d* having interior shouldered recesses with slots D^2 d^2 opening toward the posts adapted to receive and retain the headed ends of the brace-rods, and the bolts D^3 d^3 clamping the brace-clamps and their slot-openings against the posts, substantially as herein set forth.

26. In a tilting tower, the combination with the pivoted mast, the base-posts A, truss-posts T, headed brace-rods *i k*, lock-girths X X′, and braces B B′ of the brace-clamps D′ *d*′ having interior shouldered recesses with slots opening toward the posts adapted to receive and retain the headed ends of the brace-rods, and the bolts D^4 d^4 clamping the brace-clamp and their slot-openings against the posts, substantially as herein set forth.

THOMAS O. PERRY.

Witnesses:
MARY K. PERKINS,
FRANK S. BLANCHARD.