(No Model.)

3 Sheets—Sheet 1.

LA VERNE W. NOYES.

WINDMILL.

No. 523,843. Patented July 31, 1894.

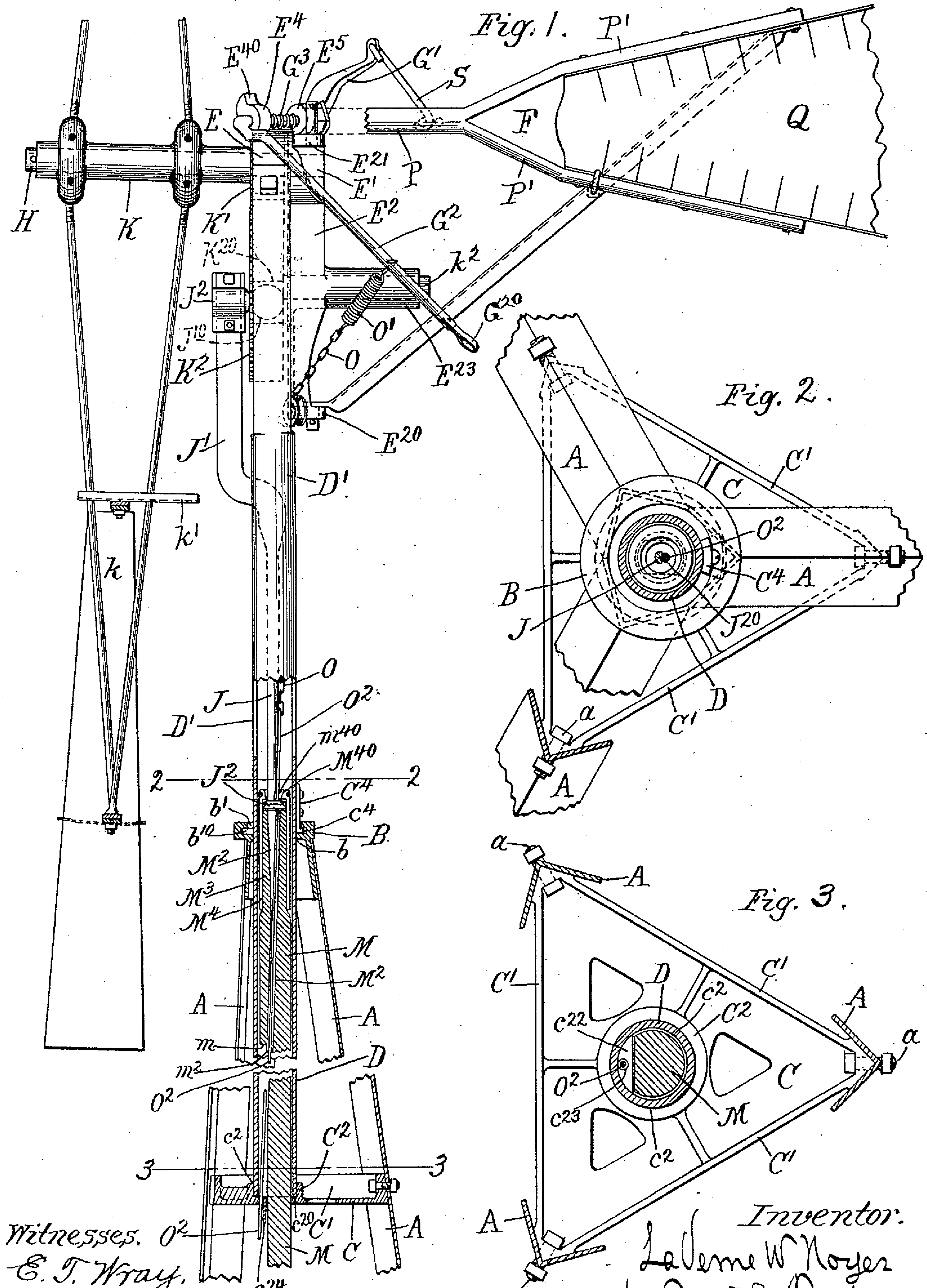

Fig. 1.

Fig. 2.

Fig. 3.

Witnesses.
E. T. Wray.
Jean Elliott

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La Verne W. Noyes
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his attys

(No Model.)

3 Sheets—Sheet 2.

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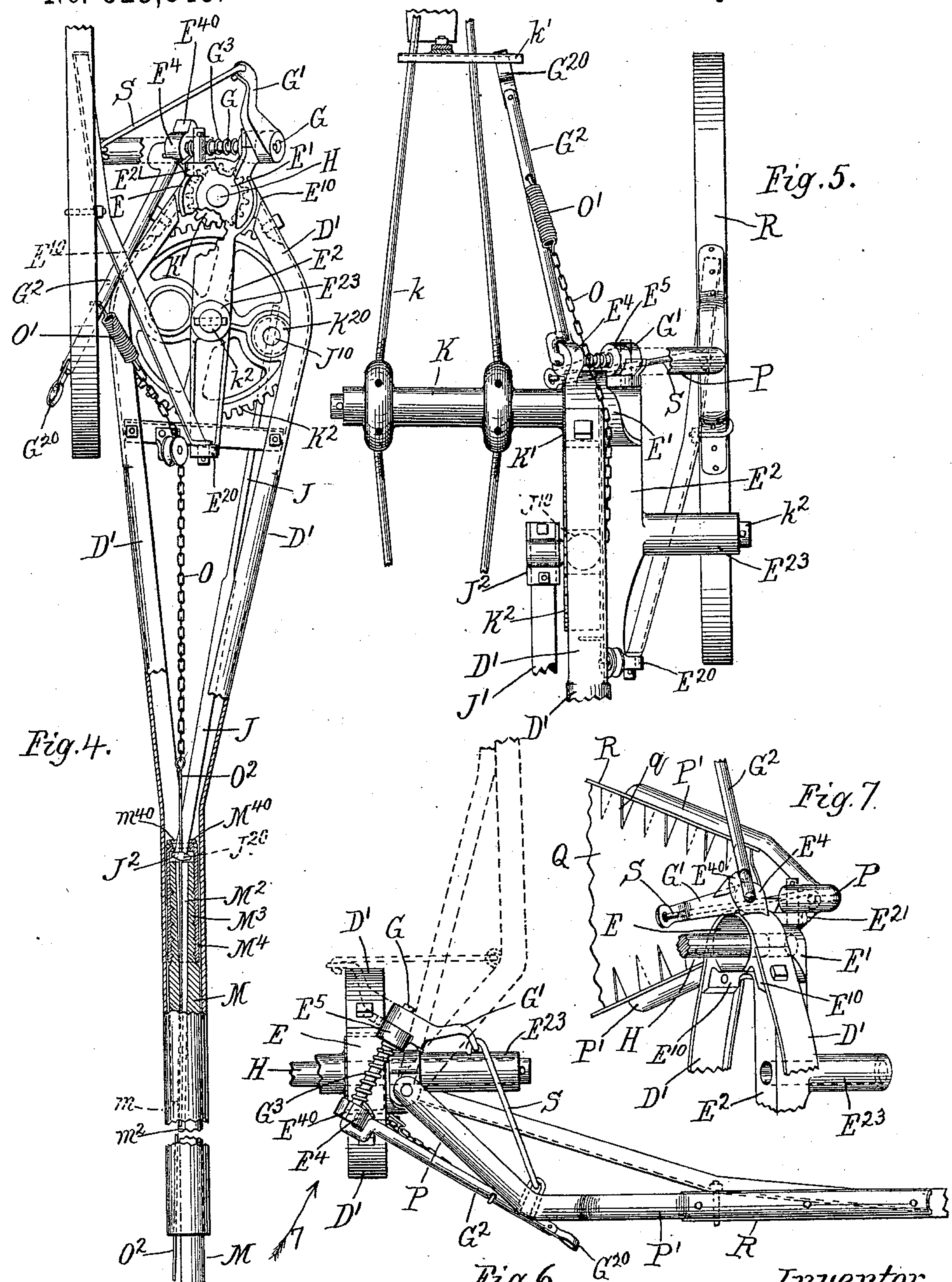

Fig. 4. Fig. 5. Fig. 6. Fig. 7.

Witnesses.

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(No Model.) 3 Sheets—Sheet 3.

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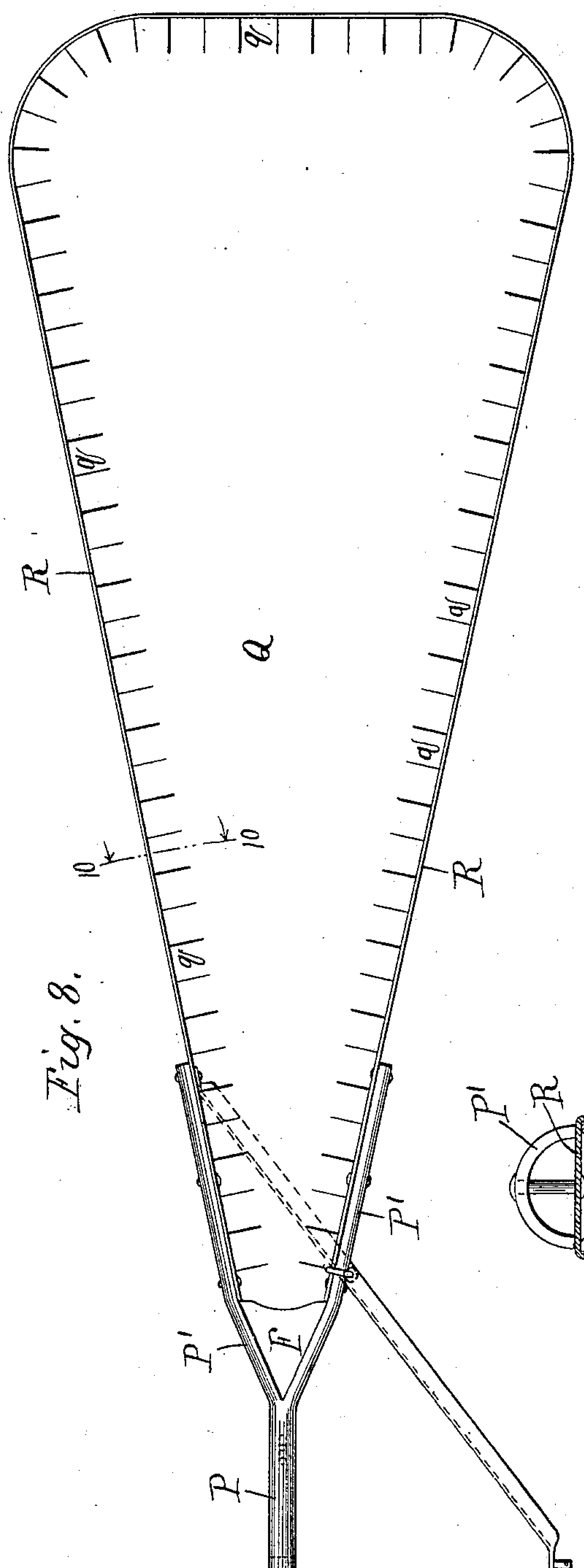

Fig. 8.

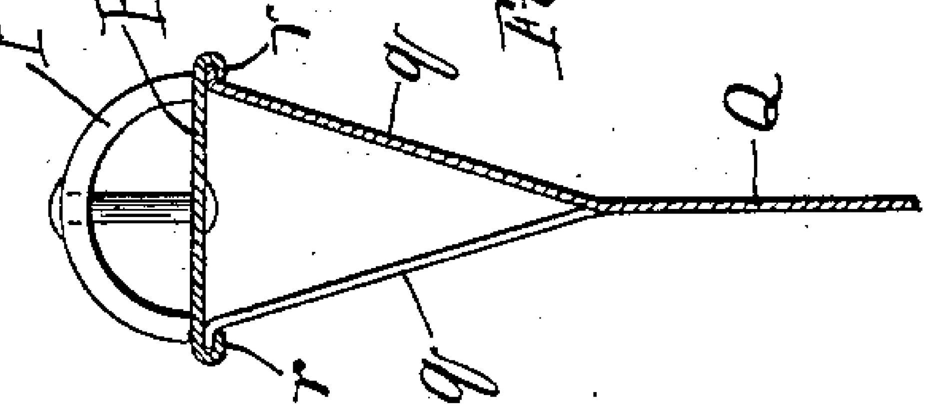

Fig. 10.

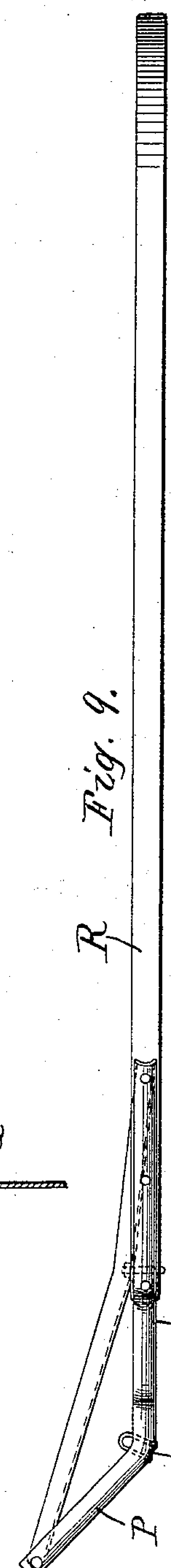

Fig. 9.

Witnesses.
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Jean Elliott

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UNITED STATES PATENT OFFICE.

LA VERNE W. NOYES, OF CHICAGO, ILLINOIS.

WINDMILL.

SPECIFICATION forming part of Letters Patent No. 523,843, dated July 31, 1894.

Application filed February 16, 1894. Serial No. 500,235. (No model.)

To all whom it may concern:

Be it known that I, LA VERNE W. NOYES, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Windmills, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

This invention is designed to provide an improved support for a windmill which operates a vertically reciprocating rod, as a pump rod, as a means of transmitting the power from the wheel downward to mechanism below.

The improvement consists, in general, in locating all the bearings of the mechanism on the turntable, substantially in the vertical line in which the pump rod reciprocates, which is, of necessity, substantially the axis of the turntable, and in connecting the pitman of the pump rod to the operating crank or crank-wheel, also in the same line, so that the strains which the operation of the mechanism puts upon the turntable, is all in one line, amount to a direct tensile or compressing strain upon the turntable. A lighter frame is required to withstand strain so applied than to withstand bending or torsional strain, which results from connecting the pitman or pump rod out of line with the bearings, since such out-of-line connection virtually affords a leverage to multiply the strain tending to bend or break the frame or turntable. In connection with this general feature of construction, I have embodied certain details which are set forth in the claims, and a novel form of tail or steering vane which I have contrived with the same general purpose of lightening and stiffening the whole structure.

In the drawings,—Figure 1 is a sectional elevation of a portion of a turntable and mill embodying my invention, the turntable being in position to show the wheel edgewise, and the mill being shown facing the wind. The upper portion of the tower and lower portion of the turntable therein are shown in axial section. Fig. 2 is a horizontal detail section at the line 2—2 on Fig. 1. Fig. 3 is a similar section at the line 3—3 on Fig. 1. Fig. 4 is a partly sectional elevation of the turntable and mechanism thereon, the position of the parts being the same as that shown in Fig. 1, the tail or steering vane being shown in end edge view, and the upper part of the turn table stem being shown in axial section. Fig. 5 is a detail elevation from the same point of view as Fig. 1, but showing the position of the parts when the wheel is out of the wind. Fig. 6 is a detail plan of the turntable and tail-bone, the relative position of the parts corresponding to Fig. 1. Fig. 7 is an elevation of the parts shown in Fig. 6, looking in the direction of the arrow "7," but showing the parts in relative position corresponding to Fig. 5. Fig. 8 is a detail elevation of my improved steering vane or tail. Fig. 9 is a plan or upper edge view of the same. Fig. 10 is a section at the line 10—10 on Fig. 8.

I will first describe the tower in connection with which this invention is illustrated. It is a three-cornered tower, the corner posts being of angle-iron A A A. It may be braced in any suitable manner at the lower portion. The upper portion only is illustrated in the drawings, showing the connection of the turntable thereto. Three-corner posts A A A are connected at the apex by means of the thimble B, about which they are fitted and which has a circular opening b through its top horizontal web to admit the stem of the turntable. At a distance below the apex, the three corner posts are further rigidly connected by a triangular casting C, rendered horizontally rigid by the wide marginal flanges C′ C′ C′ on the three sides, which, merging and being slightly expanded or thickened at the corners, form the seats for the inner faces of the angle or corner posts A A A, and give good thickness for bolts a a a which bind the posts to the casting at the angles. From the horizontal web of this casting there springs at the center a circular boss or hub C^2, having the aperture c^2 coaxial with the aperture in the top web of the thimble B, and equal, except as to a segment which is filled up at one side, to the axial aperture through the stem of the turntable, which, as hereinafter described, is tubular. This aperture is rabbeted from the upper side to enlarge it above the shoulder c^{20} thus formed to the outer diameter of the turntable stem, so that said stem entering said enlarged aperture from above may seat upon the shoulder c^{20}, as seen in Fig. 1. The aperture b in the cap B is further enlarged at the upper part at b', and an annular recess b^{10} is formed in the periphery of the enlarged aperture and serves to receive the lip c^4 of the key C^4, which is first inserted in the position shown in Fig. 1, and then made fast to the turntable stem afterward inserted in the seat described, whereby said stem is retained against vertical displacement while permitted to rotate in its seat, the stem of the key C^4 being accommodated during such rotation in the last enlargement mentioned of the upper part of the central aperture in the hub, which is seen at b'. The aperture c^2 in the casting C is rendered segmental in form by the continuation of the web of the casting over the portion c^{22}, through which, however, there is formed the small aperture c^{23}; and from the lower end of the hub there is extended the flat wing or lug c^{24}, whose face toward the center is in the vertical plane of the chord of the segment c^{22}, the aperture c^{23} being at the outer side of said wing. The purpose of this wing and of the segmental form given the aperture c^2 and of the aperture c^{23} will hereinafter appear.

The turntable comprises the stem D which is tubular, being made of gas pipe about two or three inches in diameter, which is diametrically split at the upper portion, and the two members D' D' spread apart and bent toward each other at the upper end, as seen distinctly in Fig. 4. Between the spread members of this split tubular stem there is secured at the upper ends where the said members are again bent toward each other, the bracket or frame E, which has the bearings for the wind-wheel and gearing. The form of this wheel-bearing frame or bracket is simple in outline comprising at the upper end the substantially circular boss E', having lugs or wings E^{10} E^{10}, projecting divergingly downward from opposite sides, and shaped to afford seats for the inwardly converging upper ends of the split arms D' D' of the stem, said arms being bolted to the lugs E^{10} E^{10}, as seen in Fig. 4. From the rear end or side of this circular boss E', there is extended forward the arm E^2, at the lower end of which there is formed the horizontally projecting lug E^{20}, which affords one pivot for the tail F, the other pivot being afforded by the horizontal lug E^{21} at the upper end of said vertical arm. A little below the middle of the vertical length of this arm E^2, there is formed upon it the long horizontal boss E^{23}, which affords bearing for the shaft of a gear wheel hereinafter mentioned by which the power of the windwheel is transmitted. At the top of the bracket or frame E are formed two lugs E^4 E^5, which afford bearings for the rock-shaft G, which is concerned in the operation of swinging the tail to throw the windwheel into and out of wind, as hereinafter more specifically explained.

H is the axle of the windwheel k, which is made rigid in the boss E' extending horizontally from the center of that boss.

K is the hub of the wheel, the further details of whose construction need not be here described, as they form no part of the present invention. Rigid with this hub K, is the pinion K', which is located in the vertical plane of the spread arms D' D' of the stem.

The gear wheel K^2, whose shaft k^2 is journaled in the long horizontal boss E^{23}, meshes with and is driven by the pinion K', and like that pinion is in the vertical plane of the spread arms D' D' of the turntable stem. The main vertical stem and bosses of the bracket E being just back of the plane of said gear wheels and partly between the arms D' which embrace them. As to the gear wheel K^2, the arms D' shield its teeth from the weather, and the bracket E constitutes a housing for the pinion in which it is also perfectly shielded.

J is the pitman. It extends down between the arms D' and into the stem D, as hereinafter more partiuclarly explained but is offset at the upper portion J' to cause it to extend alongside the face of the gear wheel K^2, and has secured to it at the upper end the wrist J^2, which is rigid with the pitman, jutting off from it toward and into the gear-wheel K^2, which is provided with a socket to receive it. In order that the main purpose of this invention may be subserved at this point, and that the strain transmitted through the pitman back to the train may be exerted as nearly as possible in line with the bearings of the gear-wheels in the bracket E of the turntable, the wrist J^2 terminates in a spherical knob for which there is provided a box K^{20} in the gear wheel K^2, making a ball and socket joint at the connection of the pitman to the gear-wheel, from which it results that the strain transmitted from the pitman operates always virtually as if it were applied at the center of the spherical knob J^{10} or center of the ball and socket joint described, which center is in the vertical plane which contains the axis, and in which the arms of the turntable stem are spread; and said center travels in that plane as the gear-wheel revolves.

M is the pump rod or vertically reciprocating rod by which power is transmitted downward to the mechanism to be operated. At its lower part, this pump rod is a segment of a cylinder conformed substantially to the segmental opening c^2 in the casting C, adapted to play easily through said opening, but not to turn therein. At the upper part, however, it is circular, fitting loosely within the tubular stem D of the turntable, the shoulder m marking the end of the segmental portion and the commencement of the full circular portion.

The upper cylindrical portion of the pump rod has the aperture M^2, which emerges at the flat face of the segmental portion at the lower end of the cylindrical portion, and forms a groove m^2 in that segmental face, diminishing in depth until it runs out toward the lower end of the rod. This aperture M^2 is enlarged toward the upper part for a purpose which will hereinafter appear. At the upper end the pump rod is reduced in size at M^3, and reinforced by a metal ferrule M^4, which has the head M^{40} overhanging the end of the pump rod, and provided with an aperture m^{40} less in diameter than that upper end, but widening outwardly as seen in Fig. 1.

The lower end of the pitman J is provided with a knob or button J^2, thickest at the middle and tapering at the edges all around and adapted to occupy the space between the end of the pump rod and the overhanging annular shoulder around the aperture M^{40}, and constitute means of connection of the pitman to the pump rod of the nature of a ball-and-socket or swivel joint, but quite loose and free in its action. The lower portion of the pitman, is flattened by being cut away at one side nearly to the center, and leaves uncovered an aperture J^{20} through the button J^2.

The rock shaft G has two lever arms G′ and G^2, the first being connected by the link S to the tail F, and the second having connected to it the furling chain O, said chain having at the upper end, and constituting the immediate attachment to said lever arm G^2, the extensible spring O′, and having connected at its lower end and constituting its continuation down from the turn-table, the furling wire or rod O^2, which passes through the aperture J^{20} in the center of the knob or button J^2, and extends down thence through the aperture M^2 in the pump rod M, lying in the groove m^2 at the lower segmental portion of that rod, and finally passing through the aperture C^{23} in the casting C outside of the wing C^{24}.

A spring G^3 coiled upon the shaft G, and reacting between the shaft and the bearings, tends to rock that shaft into position to hold the tail parallel to the wheel to keep the wheel idle, and the tension of this spring must therefore be overcome in turning the vane toward a position at right angles to the wheel to hold the wheel in wind.

The tail is made of split and forked pipe P, between whose fork arms P′ P′ the tail vane is secured edgewise, as hereinafter explained in detail. The tail is bent at *p*, whereby, without having its pivot remote from the wheel, the tail is set off from the plane of the wheel when it stands parallel to the latter, as is desirable in order that it may not be in danger of becoming entangled with the wheel. This detail of construction is in pursuance of the main intention,—to locate the bearings to which the strains are directed as nearly as possible in one line, so that the strength required in the turn-table shall be minimum.

The vane Q is made of sheet metal, which, in lieu of ribs and beads, or stiffening cross-bars, which are usually employed, is slit from the edge inward at short intervals all around the periphery, the slits being four or five inches long and the metal tongues between the slits being bent alternately in opposite directions from the plane of the vane, as shown in Fig. 10, so that they diverge about sixty degrees more or less, and a flat metal band R, three or four inches in width, is extended around the periphery resting on the ends of the spread tongues and secured in any suitable manner. I have usually secured the band by folding its lateral edges inward, forming lips *r r*, which clasp the ends of the tongues *q q*, and are clinched down upon them as seen in Fig. 10. This has the same effect in stiffening the vane as the formation all around the periphery of a triangular bead having in cross-section the dimensions of the triangle bounded by two consecutive lips and the band which spans their spread ends,—that is to say, about four inches by four inches by three inches, more or less. The weight of the vane is increased very slightly by the addition of the band, and ribs or corrugations extending across the vanes are rendered unnecessary.

When the wheel is out of wind, the tail being parallel with the wheel, the lever arm G′ and link S are in the relative positions shown in Fig. 7, the link having been swung down past the line of the axis of the rock-shaft G, so that any pressure tending to move the tail toward a position at right angles to the wheel is ineffectual, because the link in that position being pulled by the tail, only tends to turn the rockshaft farther in the same direction in which it was rocked to turn the wheel out of wind; and such further movement is prevented by the arm G^2, which, at the position in question, is stopped against the shoulder E^{40} on the bearing lug E^4. The wheel is thus locked out of wind until the furling rod is operated to swing the arms G^2 down away from said stop shoulder.

When the furling rod is released to permit the lever arm G^2 to swing up to allow the wheel to swing out of wind, its free extremity passes up to the position shown in Fig. 5, where the spring G^{20}, with which that arm is provided, stands in the path of cross-bars of the wheel, of which one is shown at *k′*; and as the wheel continues to revolve from its acquired momentum, these arms collide, one after the other, with the spring terminal of the lever arm G^2, said terminal yielding to allow the cross-bars of the wheel to pass, until, by such repeated collisions, the momentum of the wheel is overcome and finally a cross-bar comes against the spring terminal without enough momentum to bend the latter aside, and the wheel comes to rest with the cross-bar against the spring terminal of the lever, which thus operates as a break or check and finally as a lock for the wheel.

I claim—

1. In a windmill, a turntable comprising a tubular stem split and spread at the upper part, and a bracket secured between the spread arms having bearings for the wind-wheel and gearing train: substantially as set forth.

2. In combination with a turntable comprising the tubular stem split and spread at the upper part, and the gearing bracket secured between the spread arms, and having bearings for the windwheel train, the pitman driver constituting the last element in said train located and rotating in the plane of said arms between the same; the pitman having a wrist set off rigidly from it and making a ball-and-socket joint with the pitman driver, the pitman being set off, at a distance below the wrist, into the vertical plane of the center of said ball and socket joint, and the pump rod connected to the lower end of the pitman and reciprocating within the tubular stem: substantially as set forth.

3. In a windmill, in combination with a pitman driver having its center located substantially in the line of the vertical axis of the turntable, the pitman having its lower end reciprocating also substantially in the same line and its upper end connected with the driver by a ball and socket joint whose center rotates with the driver in a vertical plane through the same line: substantially as set forth.

4. In combination with the tower, the turntable having a tubular stem vertically journaled in the tower; the plate C having a step-bearing for the lower end of the stem, said bearing having a vertical aperture corresponding to the tubular opening of the stem except as to a segment c^{22} at one side; the pump rod occupying the central aperture in the turn-table stem and flattened at one side to adapt it to pass through the segmentally reduced aperture in the plate C, whereby said pump rod is prevented from rotating with the turntable: substantially as set forth.

5. In combination with the tower, the turntable having a tubular stem vertically journaled in the tower; the plate C rigid with the tower having an aperture corresponding to that of the tubular turn-table except as to the segmental web c^{22} which occupies a portion of the cross-area of such aperture; the pump rod occupying the cavity of the tubular stem and flattened at one side to adapt it to pass through the segmentally reduced aperture in the plate C, and having a longitudinal aperture extending from the upper end to the surface at a point below the end and above the plate C, and the furling rod extending through the segmental web c^{22} and through said longitudinal aperture of the pump rod: substantially as set forth.

6. In combination with the tower having the plate C rigid with the same below the top, the turntable having a tubular stem vertically journaled in the tower; the pump-rod located within the stem and made non-circular in cross-section for a portion of its length which reciprocates past the plane of the plate C, said plate having an aperture corresponding to the non-circular cross-section of the pump rod through which the latter reciprocates, whereby the plate prevents the rod from rotating; said rod having a longitudinal aperture from its upper end to a point on its surface below the end and above the plate C; the furling rod or wire extending through said longitudinal aperture and through a suitable aperture provided for it in the plate C: substantially as set forth.

7. In combination with the tower, the turntable having a tubular stem vertically journaled in the tower; the plate C rigid with the tower at a distance below the top and having a step bearing for the turntable stem; the pump rod located in the tubular stem and made non-circular at a portion which reciprocates past the plane of the plate C, said plate having an aperture within the circle of the step-bearing of the stem corresponding to the non-circular cross-section of the pump rod, whereby the pump rod is prevented from rotating with respect to the tower, the pump rod having a longitudinal aperture extending from its upper end and emerging at the surface at a point above the plate C, the web of said plate within the step-bearing and aside from the aperture made for the pump rod having a further aperture, and the furling rod or wire extending through the longitudinal aperture in the pump rod and through said further aperture in the web of the plate C: substantially as set forth.

8. In combination with the turntable having the bearings for the windwheel and train actuated thereby; the tail pivoted to said turntable; a rock-shaft journaled on said turntable and crossing the vertical plane of the axis of the windwheel obliquely thereto; lever arms on said rock-shaft, one of said lever arms being linked to the steering tail and the other connected to the furling rod: substantially as set forth.

9. In combination with the turntable, the windwheel journaled thereon and having projections extending back toward the tower, the tail pivoted to the turntable; the rock-shaft G and connections therefrom by which it operates the tail, the lever arm G^2 of said rock-shaft having its end when the tail is parallel standing in the plane of said projections, said arm having a spring whereby it is adapted yieldingly to resist the rotation of the wheel when the projections collide therewith: substantially as set forth.

10. In combination with the tower and the turntable vertically journaled therein, the windwheel journaled on the turntable; the tail pivoted to the turntable near to the turntable axis and to the vertical plane of the wheel's rotation, and bent at an oblique angle at a short distance from its pivot, whereby the strain of furling and holding the wheel in wind is brought to bear upon the turntable near the line of the axis and the tail is set off from the plane of the wheel when the latter is out of wind: substantially as set forth.

11. In combination with the turntable, the tail pivoted thereto, the rock-shaft G having the lever arm G' and the link S connecting

it to the tail; the arm G^2 by which the rock-shaft is operated, said lever arm and link being so related and connected to the tail that the pivotal connection of the link and arm moves past the plane which contains the axis of the rock-shaft and the pivotal connection of the link to the tail when the wheel is furled; the bearing of the rock-shaft having the stop shoulder which prevents further rocking of the shaft in that direction, whereby the wheel is automatically locked out of wind: substantially as set forth.

12. In a windmill, the steering tail having the tail bone bent aside a short distance from the pivot and forked vertically beyond the bend, and a brace extending obliquely across the plane of the fork and fastened to each branch and thence extending directly to a pivot which is substantially in a vertical line below the pivot of the tail-bone, whereby the tail is braced against torsion: substantially as set forth.

13. In a windmill, a steering tail having its vane consisting of a metal sheet slit inward from the edges to form tongues between the slits; alternate tongues being bent divergent from the remaining tongues, and a band encompassing the periphery of the vane secured in position spanning the angle of divergence between the two sets of tongues; substantially as set forth.

14. In a windmill, a steering tail having its vane consisting of a metal sheet slit inward from the edges to form tongues between the slits, alternate tongues being divergent from the remaining tongues, and a band encompassing the periphery of the vane secured in position spanning the angle of divergence between the two sets of tongues: and the tail-bone forked to embrace the vane edgewise and secured to the band at the edges: substantially as set forth.

15. In a windmill, the steering tail having the vane made of sheet metal slit inward from the edges at short intervals throughout the periphery and the tongues bent alternately in opposite directions from the plane of the vane combined with a metal band encompassing the vane thus slit and secured seated upon the ends of the tongues and spanning their angle of divergence: substantially as set forth.

16. In combination, substantially as set forth, the sheet metal body of the vane slit inward from its edges and having the tongues between such slits bent alternately in opposite directions from the plane of the vane, and the band encompassing the edges thus slit and bent, said band having its lateral edges introverted to form lips, the ends of the tongues of the vane being engaged under such lips: substantially as set forth.

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