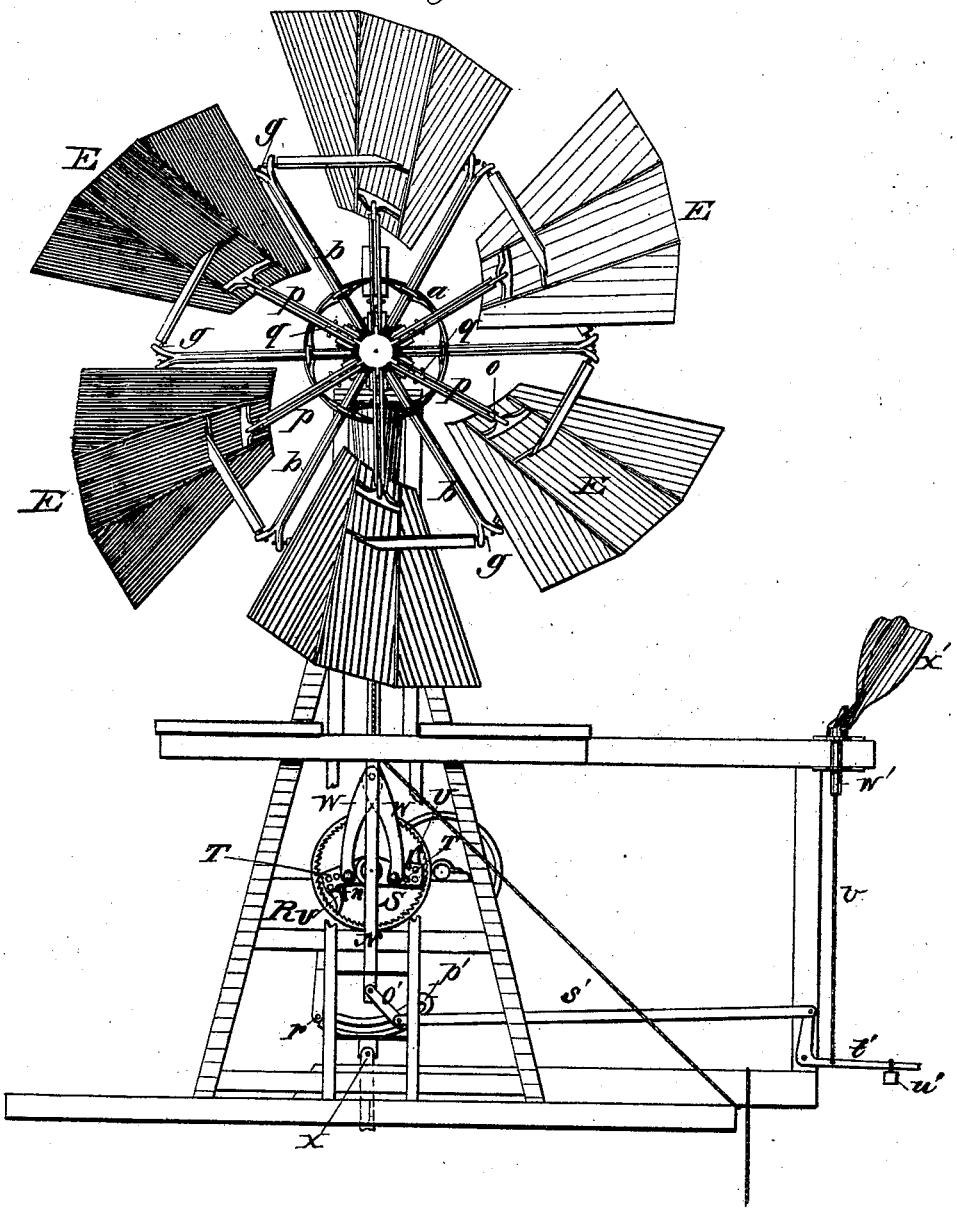
3 Sheets—Sheet 1.

H. M. UNDERWOOD.

WIND MILL.

No. 180,678. Patented Aug. 1, 1876.

Fig. 1.



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H. M. UNDERWOOD.

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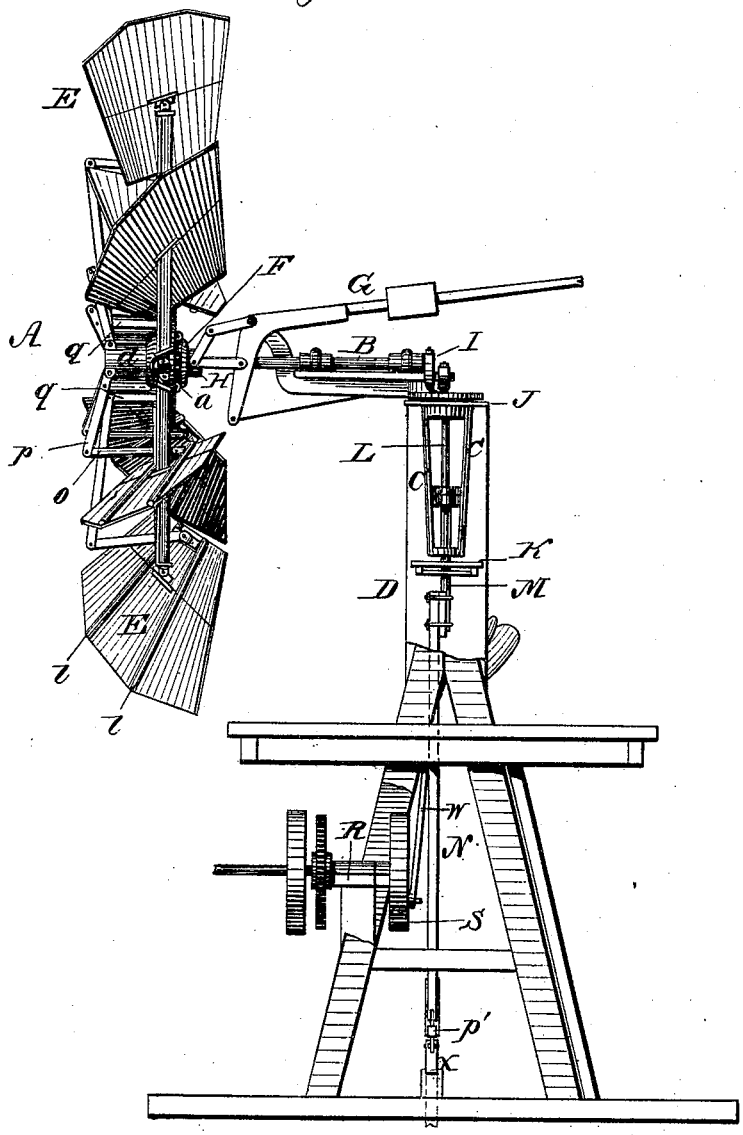
Fig. 2.



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3 Sheets—Sheet 3.

H. M. UNDERWOOD.

WIND MILL.

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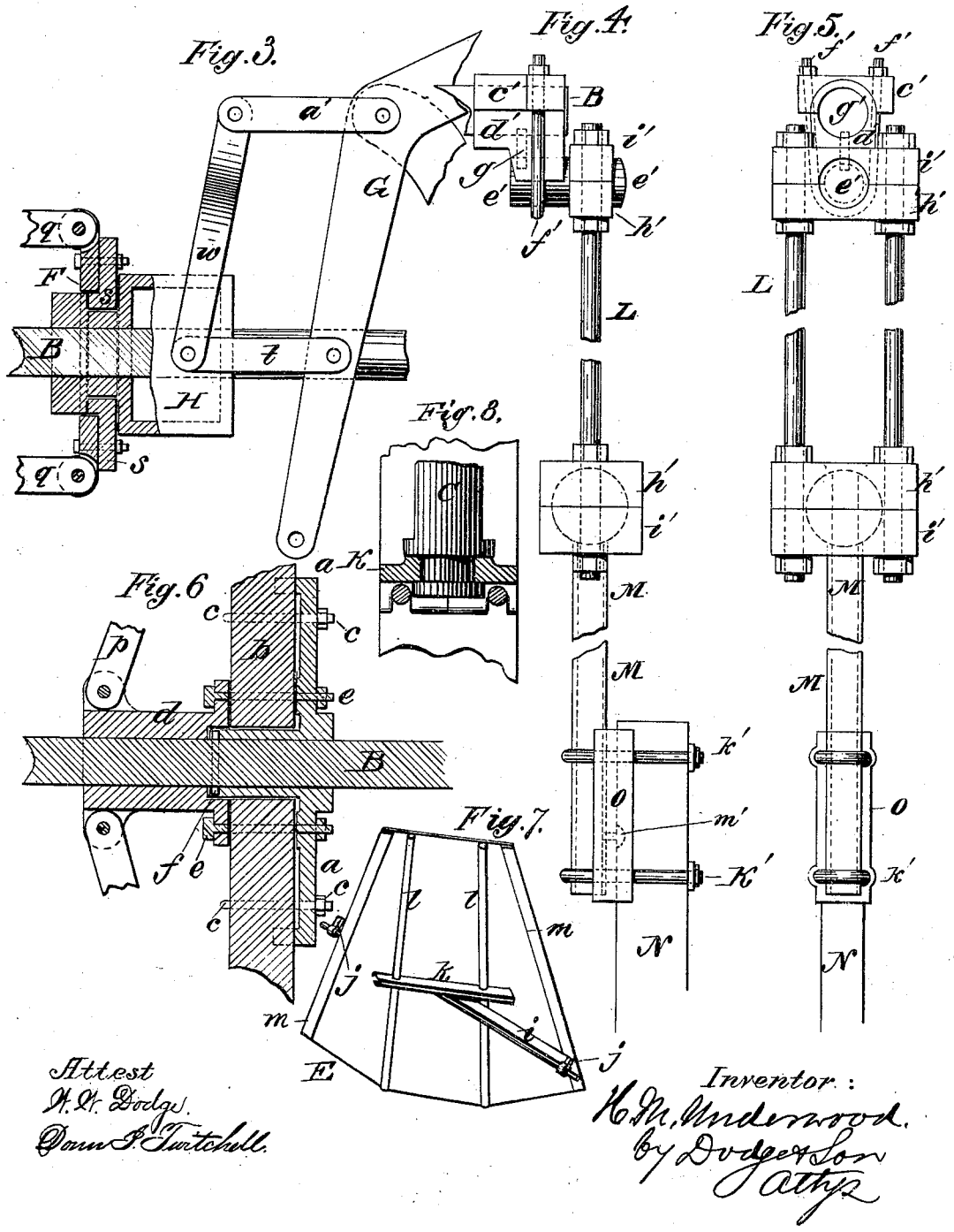

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Donn P. Twitchell.

Inventor:
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by Dodger & Son
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UNITED STATES PATENT OFFICE.

HENRY M. UNDERWOOD, OF KENOSHA, WISCONSIN, ASSIGNOR OF ONE-HALF HIS RIGHT TO ENOCH VAN WIE, OF SAME PLACE.

IMPROVEMENT IN WIND-WHEELS.

Specification forming part of Letters Patent No. **180,678**, dated August 1, 1876; application filed April 4, 1876.

To all whom it may concern:

Be it known that I, HENRY M. UNDERWOOD, of Kenosha, in the county of Kenosha and State of Wisconsin, have invented certain Improvements in Wind-Wheels, of which the following is a specification:

My invention consists in various improvements in the construction of what are known as "rosette" wheels; in the combination, with a wind-wheel, of a peculiar arrangement of devices for transmitting motion from its crank to a rotary shaft below; and in a novel combination of devices whereby the stroke of a pump-rod, driven by the wheel, is automatically lengthened and shortened, according to the speed of the wheel.

Figure 1 represents a face view of my wheel with its frame and connections; Fig. 2, an edge view of the same. Figs. 3, 4, 5, 6, 7, and 8, various details.

A represents the wheel proper; B, the horizontal shaft on which the wheel is secured; C, the turn-post, having a horizontal arm on which the shaft-bearings are secured, and D the stationary main frame or mast in which the turn-post is sustained. The central portion of the wheel consists of a circular skeleton plate or spider, *a*, provided in its face with recesses, to receive the radial wheel-arms *b*, which are secured thereto by hook-bolts *c* at the periphery, and a hub or collar, *d*, at the center, as shown in Figs. 1, 2, and 6, the hook-bolts clasping around the arms and extending through the plate *a*, while the hub *d* is held in place against the ends of the arms by bolts *e* passing through the central part of the plate. The plate *a* is mounted on the main shaft B, and is prevented from turning thereon by a pin, *f*, passing transversely through the shaft, and bearing at its ends in notches formed in the end of a hub or sleeve on the plate *a*, as shown in Fig. 6. The hub *d* and the plate *a*, being drawn together by the bolts *e*, embrace the pin *f* between them, as shown, so that it cannot escape from the notches in plate *a*, and at the same time the hub *d* is enlarged, as shown, so as to fit over the ends of the pin and prevent its escape endwise. The outer ends of the wheel-arms *b* are split or forked, and are connected with each other by rods *g*, on which the tipping sails or blades are mounted.

Each sail E consists, as shown in Fig. 6, of a wooden bar, *i*, having metal caps *j* on its ends, to receive the pivot-rod, and having secured rigidly across its middle an oblique bar, *k*, through the ends of which two round wooden bars or rods, *l*, are passed, to sustain the body of the sail, which is made of a single sheet of wood, and secured firmly to the round bars. Each sail is bound or re-enforced along the edges by strips *m*, to prevent them from splitting, and give them increased strength and stiffness.

As the outer ends of the sails travel at a higher velocity than the inner, it is desirable, in order to attain the best and most economical results, to present the different portions of the surface of each sail at different angles to the wind, according to the velocity at the different points, for which purpose I give each sail a twist or curvature from the inner to the outer end, in such manner that its surface has an increasing divergence from the course of the wind toward its outer end.

By thus twisting the sails and giving the different points of their surfaces an obliquity corresponding to their velocities, I obtain much better results than with the usual blades having flat faces, and the same pitch or inclination at all points.

The governing of the sails is effected by means of links *o* pivoted to blocks on their inner ends, and connecting with the outer ends of radial arms *p*, which latter are pivoted at their inner ends to the central hub *d*, and connected at their middle to rods *q*, which extend through the wheel to a sliding and rotating collar, F, mounted on the main shaft in front of the wheel, and connected, in the manner hereinafter described, with a weighted elbow-lever, G, which tends to push the collar backward, and thereby, through the intermediate parts, to hold the sails facing the wind. The outer ends of the sails are given more surface than the inner, so that when the force of the wind increases materially, its pressure overcomes the resistance of the weight, and

tips the sail backward, whereby an increase in the speed of the wheel is prevented. The tipping or feathering action of the blades or sails is also facilitated by hanging them a little forward of the center, so that when the wheel is in motion the centrifugal force tends to tip them over backward.

The construction and arrangement of the collar F are clearly shown in Fig. 3, in which H represents a sliding non-rotating casting mounted on the main shaft, and having at one end a round grooved neck or hub, on which the collar is mounted.

The collar consists of a front plate or ring, having ears to which the rods *q* are connected, and of two segmental back plates, *s*, seated in the groove around the neck or hub, and secured firmly to the front plate or ring, as shown, so that, although the block H and the collar must slide together on the shaft, the collar can rotate freely while the block remains at rest. The segments *s* have around the inner edge a side flange, over which the front plate or ring fits, as shown, the plate holding the two segments together around the shaft, and also covering the joint in such manner as to exclude dust and dirt from the wearing-surfaces.

In order to insure a thorough and constant lubrication of the shaft, I make the block H hollow, and fill it with cotton-waste or similar absorbent material charged with oil, a hole being made in the top of the block to permit the introduction of the oil.

The depending end of the weighted lever is provided with an opening through which the shaft passes, as shown in Fig. 8, and is connected with the sliding block H by two links, *t*, one on each side of the shaft, by which arrangement I avoid side draft on the block, and the consequent danger of its binding or cramping on the shaft.

The block H is held from rotating by a bail or stirrup, *w*, pivoted to its sides, and connected by a link, *a'*, to the arm on which the weighted lever is mounted. This arrangement, while preventing the rotation of the block, admits of its sliding freely forward and backward, and overcomes the evils incident to the use of the sliding devices ordinarily employed, which are frequently disabled by the accumulation of ice, snow, &c., upon them.

The turn-post or pivot C, which is made in the form of an inverted hollow cone, with a horizontal arm at its upper end to sustain the shaft-bearings, is supported at its upper and lower ends in two metal bearings, J and K, the latter consisting of two plates, shoved into grooves from opposite sides of the frame, in such manner as to encircle the lower end of the post and fit within a groove therein, as shown in Fig. 8, so as to hold the post down in its place. The two parts of the bearing K are held in place, as shown in Figs. 2 and 8, by transverse bolts passing through the frame and notches in the plates.

The crank of the main shaft consists, as shown in Figs. 4 and 5, of two castings, *c'* and *d'*, which inclose the end of the shaft between them. The wrist-pin *e'* is seated in a notch in the outer end of the block *d'*, and is held by a yoke-bolt, *f'*, passing around the wrist and through the parts *c'* and *d'*, and secured at its ends by nuts, keys, or equivalent fastenings. A pin, *g'*, passes through the block *d'*, and enters both the shaft B and the wrist-pin *e'*, as shown, so that when the parts are all drawn together by the bolt the pin holds them securely in their places.

To the crank there is connected a pitman, L, having jointed to its lower end a vertical tube, M, which passes down through the lower end of the post C, and has its lower end united to a vertical rod, N, which is mounted in guides or bearings, so as to have a true vertical motion. The pitman L consists, as shown in Figs. 4 and 5, of two parallel rods, with heads, composed each of two blocks, *h'* and *i'*, clamped together by nuts, applied to the ends of the rods, which are threaded, and passed through the blocks, as shown. The head at the lower end of the pitman has a vertical hole made through it, and is provided in its interior with a large spherical cavity, to receive a globular head on the tube M, as shown, this connection permitting the pitman to vibrate with the crank, while the tube is guided vertically by the post C. The lower end of the tube M rests in the side of a pillow-block, O, the back of which is recessed to admit the end of the vertical rod N, and the three parts are secured together by yoke-bolts K', passing around the tube, through the edges of the block, past the sides of the rod, and through plates on the back thereof, and secured by nuts on their ends, as shown. A pin, *m'*, is applied, as shown, with one end seated in the block, and the other seated in the tube, to keep the parts from working endwise in relation to each other, as shown in Fig. 4.

In order to transmit motion from the wind-wheel to a rotary shaft below, without the use of the ordinary objectionable devices, and to give such shaft a steady motion, notwithstanding the swinging of the wheel, as the course of the wind varies, a result which cannot be attained by the usual arrangements, I employ the combination of devices represented in Figs. 1 and 2. At any suitable height in the frame or structure by which the wheel is sustained I mount the shaft R, which is to be driven in a horizontal position, and provide it at one end with a wheel or disk, S, having an overhanging peripheral flange or rim, the inside face of which is provided with ratchet-teeth, as shown. Loosely on the end of the shaft I mount two arms, T, extending in opposite directions nearly to such rim; and to the end of each of these arms I attach a pivoted pawl, U, and a spring, *n'*, to force the same against the rim, one pawl extending upward and the other downward, as shown.

To a single pivot on the rod N I attach two links or rods, W, and pivot the lower ends of the same, one to each of the arms T, as shown. The rod N, being mounted in guides and reciprocated in a vertical direction, causes the links W to move the arms T up and down, thereby causing the pawls to act alternately, and give the wheel S and its shaft a continuous rotation in one direction. By properly proportioning the length of the crank, the size of the flanged wheel, and the length of movement of the pawls, a practically-uniform speed is imparted to the shaft, notwithstanding the variable speed which the sliding bar receives from the crank and pitman during different portions of each stroke. The one great advantage, however, of my arrangement is, that the changing position of the wheel as it follows the course or direction of the wind does not cause any irregularity in the speed of the shaft R, whereas the arrangements now in use cause an increase or decrease in the speed of the shaft every time the wheel changes its position. Instead of employing the ratchet-teeth and pawls, friction clamps or dogs may be arranged on the ends of the arms to engage with the wheel, the construction and arrangement of these parts being immaterial, provided the arms serve to turn the wheel steadily in one direction.

In order that the wheel, when applied to pumping, may be caused to work with more or less leverage or advantage upon the pump-rod automatically, according to the force of the wind and speed of the wheel, I adopt the arrangement shown in Figs. 1 and 2.

The pump-rod proper X is located directly below the vertically-reciprocating rod N, and connected therewith by a swinging link, o', and slotted yoke p'. The yoke p' is pivoted at its middle to the rod X, and is hung at one end to a link, r', while the link o' is pivoted at its upper end to the rod N, and provided at its lower end with a pin passing through the slot in the yoke, as shown in Fig. 1, so that the rise and fall of the rod N causes the link o' to operate the yoke, and thereby the rod X.

By swinging the lower end of the link o' to and from the fulcrum of the yoke, the length of movement of the latter and of the rod X may be increased or diminished, while the stroke of the rod N remains unchanged. The proper movement of the link o' is effected by pivoting to its lower end a bar, s', which is connected to an elbow-lever, t', which latter is mounted on one side of the main frame, and provided with a weight, u', and a cord, v', the latter extending up through a tubular rotating post, w', and being attached to a vane or blade, x', pivoted thereon.

The weight tends to tip the lever forward, and draw the link o' toward the outer end of the yoke p', so as to shorten the stroke of the pump, while the wind, urging the vane over backward, tends, through the cord and lever, to move the link o' toward the fulcrum of the yoke, and thereby increase the stroke of the pump.

By properly proportioning and arranging the weight w' and the vane x' the stroke of the pump is nicely proportioned to the force of the wind and the consequent power of the wheel.

Having thus described my invention, what I claim is—

1. The combination of the plate a, having the arms b seated in notches therein, and secured by the hook-bolts c, hub d, and bolts e, as shown.

2. In combination with the shaft B, provided with the pin f, the plate a, notched to receive the ends of the pin, and the hub or collar d, holding the pin in place, as shown and described.

3. The sails E, each consisting of the bars i and k, rods l, and the wooden sheet or surface applied thereto, as shown.

4. A wind-wheel sail, E, twisted or curled from its inner to its outer end, as described and shown, so as to have an increasing divergence from the wind toward its outer end.

5. The collar F, consisting of the front plate or ring, provided with ears, and the segmental plates s, secured thereto, in combination with the sliding block H, provided with the grooved neck or journal, as shown.

6. In combination with the wind-wheel shaft B, the hollow sliding block H, mounted thereon, as shown, and serving both as a lubricator for the shaft and as a connection between the sail-controlling arms and the counter-weight.

7. In combination with the sliding block H, as and for the purpose described, the lever G, encircling the shaft B, and provided with two links, t, connected to opposite sides of the block, as shown.

8. In combination with the sliding block H, the yoke or stirrup w, and the link a', connected to a fixed support, as shown, whereby the block is prevented from rotating.

9. The crank, consisting of the blocks c' and d', wrist-pin e', and yoke-bolt f', as shown.

10. In combination with the shaft B, block d', and wrist-pin e', the pin g', as and for the purpose shown.

11. The pitman L, consisting of the parallel rods having the blocks h' and i' applied to their ends, and secured in the manner shown.

12. In combination with the pitman L, having its lower head constructed as shown, the tube M, having a spherical head connected to the pitman, as shown.

13. The combination of the tube M, rod N, block O, and pin m, with the bolts K', as shown.

14. The turn-post C, having a grooved neck, in combination with the bearing K, consisting of the two parts inserted in grooves in the frame, so as to encircle said neck and enter the groove therein, as shown and described.

15. A wind-wheel provided with a crank, I, and pitman L, in combination with a vertically-reciprocating rod, N, links W, arms T, pawls U, and wheel S, as shown and described.

16. The combination of the reciprocating rod N, rod X, yoke p', and link o', with the weighted lever t' and vane or sail x', said parts being connected and arranged to operate substantially as shown and described.

HENRY M. UNDERWOOD.

Witnesses:

H. W. GREETHAM,

LEWIS BAIN.