(No Model.) 2 Sheets—Sheet 1.

# P. P. MAST & H. CROFT, Jr.

## WINDMILL.

No. 408,422. Patented Aug. 6, 1889.

Fig. 1.

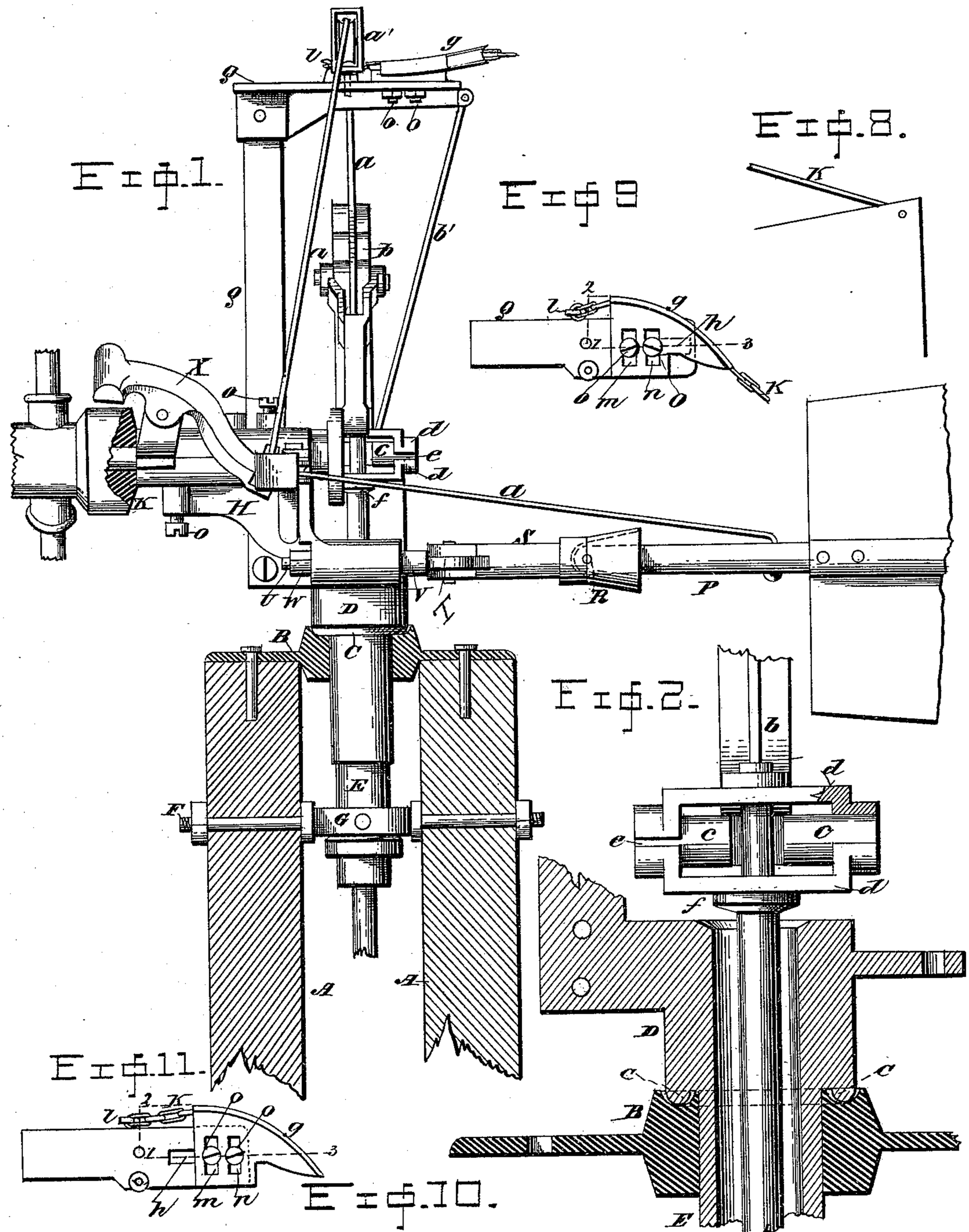



Fig. 8.




Fig. 3.



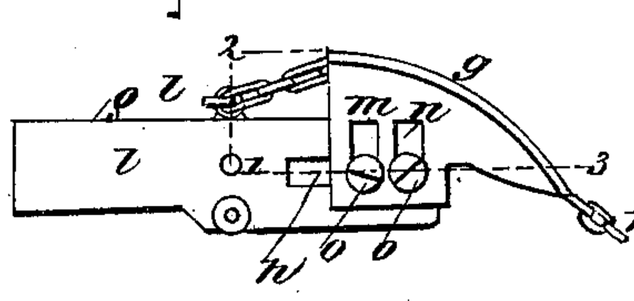

Fig. 2.




Fig. 11.




Fig. 10.




WITNESSES

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Fig. 3.

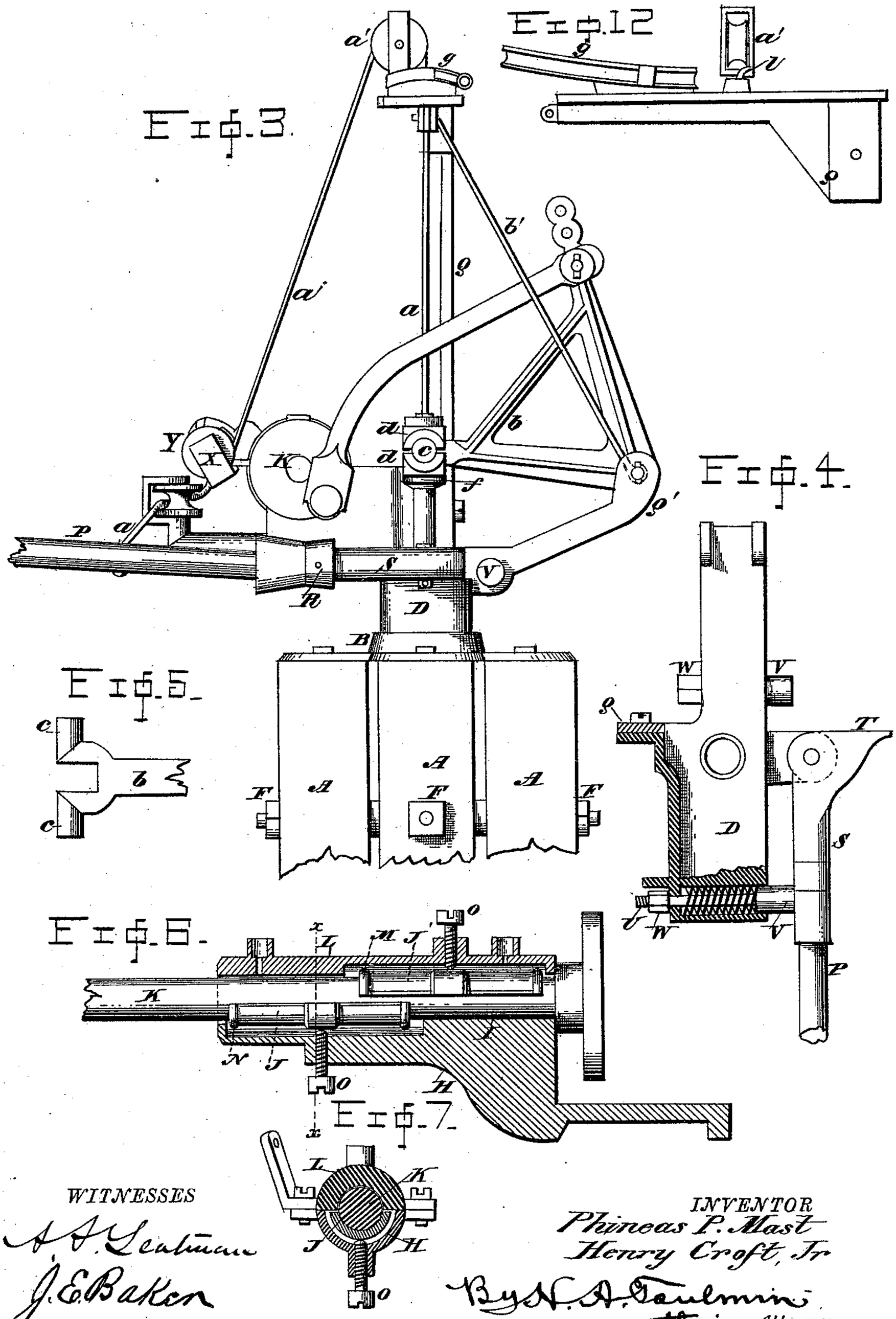


Fig. 12.




Fig. 4.



Fig. 5.




Fig. 6.



Fig. 7.




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# UNITED STATES PATENT OFFICE.

PHINEAS P. MAST AND HENRY CROFT, JR., OF SPRINGFIELD, OHIO, ASSIGNORS TO THE MAST, FOOS & COMPANY, OF SAME PLACE.

## WINDMILL.

SPECIFICATION forming part of Letters Patent No. 408,422, dated August 6, 1889.

Application filed June 4, 1887. Serial No. 240,238. (No model.)

*To all whom it may concern:*

Be it known that we, PHINEAS P. MAST and HENRY CROFT, Jr., citizens of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Windmills, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to improvements in windmills, and in particular to that class in which the wheel-shaft is mounted to one side of the vertical axis of the turn-table, and the tail-vane is used, by its weight, to hold the wheel to the wind normally and to return it to the wind after an unusual increase thereof has subsided to the general normal force.

It is also designed as an improvement in some several particulars over Letters Patent granted August 20, 1878, No. 207,189, for wind-wheels, and September 30, 1879, No. 220,083, for windmills.

In the accompanying drawings, forming a part of this specification, and in which like reference-letters indicate corresponding parts, Figure 1 represents a partial side elevation and partial sectional view of our improved windmill; Fig. 2, a like view of the actuating-rod and crank, and of the head or turn-table and its bearing, the parts being enlarged; Fig. 3, a rear view of the parts shown in Fig. 1, save that the vane is removed and the vane-bar turned to one side to expose one of the bumpers; Fig. 4, a partial plan and horizontal sectional view of the vane-bar and head or turn-table; Fig. 5, a plan view of a portion of the crank; Fig. 6, a side elevation of the wheel-shaft and a vertical section of its bearing in the head or turn-table; Fig. 7, a cross-section thereof on the line $x x$; Fig. 8, a detached view of a portion of the tail-vane and supporting-rod; Fig. 9, a plan view of the turn-table standard and the cam-arm, showing the latter in one position; Fig. 10, a like view showing the cam-arm in another position, and one which will enable the tail-vane to exercise a greater control over the wheel and maintain it against the wind when blowing more than usually hard; Fig. 11, also a like view, showing the cam-arm in the same position as in Fig. 9, so far as concerns the leverage for holding the wheel normally in the wind; but in the position shown in Fig. 10, so far as concerns the leverage for returning the wheel to normal position, the said three figures showing several positions in which the cam-arm may be adjusted; and Fig. 12, a side enlarged view of the upper portion of the standard and of the cam-arm entire, showing the inclined position of the latter.

The letter A refers to the tower-beams, of which there are usually four, and upon which is mounted the bearing or head-support B, the upper face whereof is annularly grooved to receive a narrower head C on the head or turn-table D. A place is thus formed where oil may be applied for lubricating purposes, the weight of the structure above said bearing requiring a lubricant, and the groove holding the oil from dripping or running off. The column E, which extends downward from the head D, is fitted to a collar G, and the collar is held to the tower-beams by the radial bolts F, and thus the head or turn-table is mounted in the tower.

The turn-table has an extension or bracket H, hollowed out on its upper face to form a bearing-surface I, and to receive an adjustable bearing plate or box J, held up against the lower outer portion of that part of the wheel-shaft K which is within the length of the said bracket. Fitted to the said bracket H, as seen in Figs. 6 and 7, is a cap L, the under face whereof is hollowed out like the upper face of the bracket, as just described, save that the bearing-surface in the cap is at the outer end thereof and the bearing plate or box J′ at the inner or rear end. In other words, the lower bearing-plate is nearest the wheel and the upper bearing-plate farthest from it. The cap and bracket are secured together by screws and lugs, as seen in Fig. 7, or otherwise.

It will be observed that the weight of the wheel will constantly tend to lift in the inner end of the wheel-shaft, causing its upper side to wear the upper part of the bearing away much more rapidly than the lower side wears the lower part of the bearing; and hence

arises the necessity of being able to adjust the upper inner end of the bearing toward the shaft to take up the wear, and it will also be observed that the weight of the wheel will likewise more rapidly wear away the lower outer part of the bearing by pressing the shaft heavily upon said part, and hence also arises the necessity of being able to adjust the lower outer part. These adjustments we accomplish by means of the separate bearing plates or boxes J and J', which are fitted within the cap and bracket, as seen in Figs. 6 and 7, and which are held to the wheel-shaft by the screws O. The screws engage the plates near their middle, and the plates are free to tilt on them as a center, whereby they can accommodate themselves to the shaft and to any inequalities in wear. When worn they can be easily and cheaply removed and replaced by new ones. The position of the bracket is such on the head as to bring the wheel-shaft the proper distance to one side of the vertical axis of the head or turn-table, as seen in Fig. 3. The van-bar P is pivoted to a lug extending from the head, and is about in line with said axis, while the standard Q is slightly to the other side of the axis; this latter position, however, is not material, as the cam-arm, hereinafter appearing, controls the feature of eccentricity in this respect.

The vane-bar is jointed at R, the form of the joint being such as to allow the vane to move up and down, as disclosed in the patent of September 30, 1879, already alluded to, and the forward member S of the bar has a laterally-extending foot T, which normally stands against one of the bumpers, so that the said foot is never suddenly resisted, no matter from what cause the vane is swung violently in that direction. Another such bumper is located on the other side of the vane-bar for a like purpose. These bumpers consist of threaded rods U, having heads V and nuts W, and are fitted in holes in the turn-table, as seen in Fig. 4, with a spiral spring interposed between the head V and the wall at the end of the hole.

We will now refer to the brake. This consists of a lever X, pivoted to a lug extending from the cap, or from some other suitable part, having one end thereof formed to constitute a shoe, which engages with the hub of the wheel, while the other end carries a sheave Y. The rope *a*, which is used to draw the vane into and against the wind to cause it to partially rotate the head or turn-table, and thereby bring the edge of the wheel into the wind and deprive it of active influence over the wheel, is run through the sheave Y, so that in actuating that cord or rope for the above purpose the brake is by the same act put upon the wheel and its momentum checked as its motive force is deprived of influence over it. The said cord or rope is otherwise arranged as set forth in the last-named patent, save that in the present instance it is secured at one end to the vane-bar and passed through a sheave on the head instead of being secured to the head and passed through a sheave on the bar, as in the patent referred to, and save that the pulley *a'* is above the standard projection; the operation, however, is the same.

The letter *b* designates the crank which transmits the motion from the wheel-shaft to the actuating-rod, (this rod is hollow,) the lower end of which crank is divided into two trunnions *c*. Upon them are fitted two coupling-plates *d*, fashioned with approximately semicircular ends which partially encircle the trunnions, the intervening space *e* (see Fig. 2) allowing for wear. These plates are also provided with holes for the actuating-rod, and the rod is shouldered at *f* and screw-threaded above the shoulder, where a nut is applied.

It is found in practice that wear takes place between the screws and the collar (used to connect the rod with the crank or angular lever in the last-mentioned patent) in a longitudinal direction with the rod, and that the tightening of the screws does not cure the lost motion.

In the present case the wear occurs between the trunnions and the plates and the latter and the shoulder and nut; but this wear is all taken up and the lost motion entirely corrected by the one adjustment—namely, by turning the nut farther on the rod.

This device is of appreciable value in practice, as the joint here alluded to performs much severe work in the practical operation of windmills.

The upper end or horizontal portion of the standard Q is provided with a slot *h*, by which the cam-arm *g* is connected to it in an adjustable manner, the said arm being itself provided with slots *m* and *n*, and screws or bolts *o o* being employed to secure the arm in any set position. It will be noticed that the slot *h* and the slots *m* and *n* are at an angle to each other. The object of this is to allow of the cam-arm being adjusted laterally and rearwardly (or vice versa) or to be adjusted laterally alone or rearwardly alone; and the object of the double adjustment (the first named) is to change the leverage which the weight of the tail-vane has in holding the wheel in the wind and the leverage which it has in returning the wheel into the wind at the same time and in corresponding ratio, and the object of the single adjustment is to change the leverage for either of these purposes without changing it for the other.

It will be understood that the vane is connected with the cam-arm by the rod and chain *k*, the end of the chain being secured to the hook *l* on the standard Q. The vane having an up-and-down movement, as already suggested, is supported in the rear of its pivotal joint by the said rod and chain, and the cam-arm being eccentrically placed to the axial line of the turn-table, it results that the weight of the vane maintains the wheel against the wind. When the wind becomes excessive,

and as a consequence the table turns, the wheel swings round more or less in one direction and the cam-arm in the other, this movement of the arm giving the vane more leverage and enabling the weight of the vane to throw the wheel back into the wind. The reason of the increased leverage is that the distance from one to two, (1 to 2,) being the radial distance from the axis of the turn-table to the periphery of the cam-arm, is less than the distance from one to three, (1 to 3,) the radial distance from the said axis to the rear portion of the cam-arm, which is the portion that presses against the chain when the arm swings round, as above stated. We have shown the two slots in the cam-arm and the one slot in the standard; but it is obvious they may be vice versa. As seen in Fig. 12, the cam-arm is curved upward somewhat, the object being to have it follow the rise of the chain as the vane is lifted by the shortening thereof in being wound round the cam-arm during the change of position between the vane and cam-arm. A rod *b'* connects with the projection of the standard Q and with a portion Q' of the turn-table, and thereby serves to brace the said projection against the strains brought upon it by the action of the vane upon the cam-arm.

We do not wish to be understood as laying claim to the motion-transmitting crank constructed with trunnions and the co-operating coupling-plates fashioned to fit upon the trunnions and having each of them a hole, and an actuating-rod fitted to said holes and having devices to adjust the plates, as the same will form the subject of an application now about to be filed by us.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a windmill, the combination, with the turn-table and a standard extending therefrom, of a cam-arm connected to said standard by a laterally and longitudinally adjustable connection, the tail-vane, and the rod or chain connecting the vane and cam-arm together, for the purpose set forth.

2. In a windmill, the combination, with the turn-table, the tail-vane pivotally connected thereto, and a standard extending upwardly from the table and having a slotted rearwardly-projecting portion at its upper end, of a cam-arm having one end curved and grooved and having two slots at an angle to the slot in the standard, fastening-screws in said slots, and a rod-and-chain connection between the vane and the cam-arm, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

PHINEAS P. MAST.
HENRY CROFT, JR.

Witnesses:
S. J. PENFIELD,
W. T. RABBETTS.