(No Model.)

R. H. AVERY & L. B. BERRIEN.

WINDMILL.

No. 371,120. Patented Oct. 4, 1887.

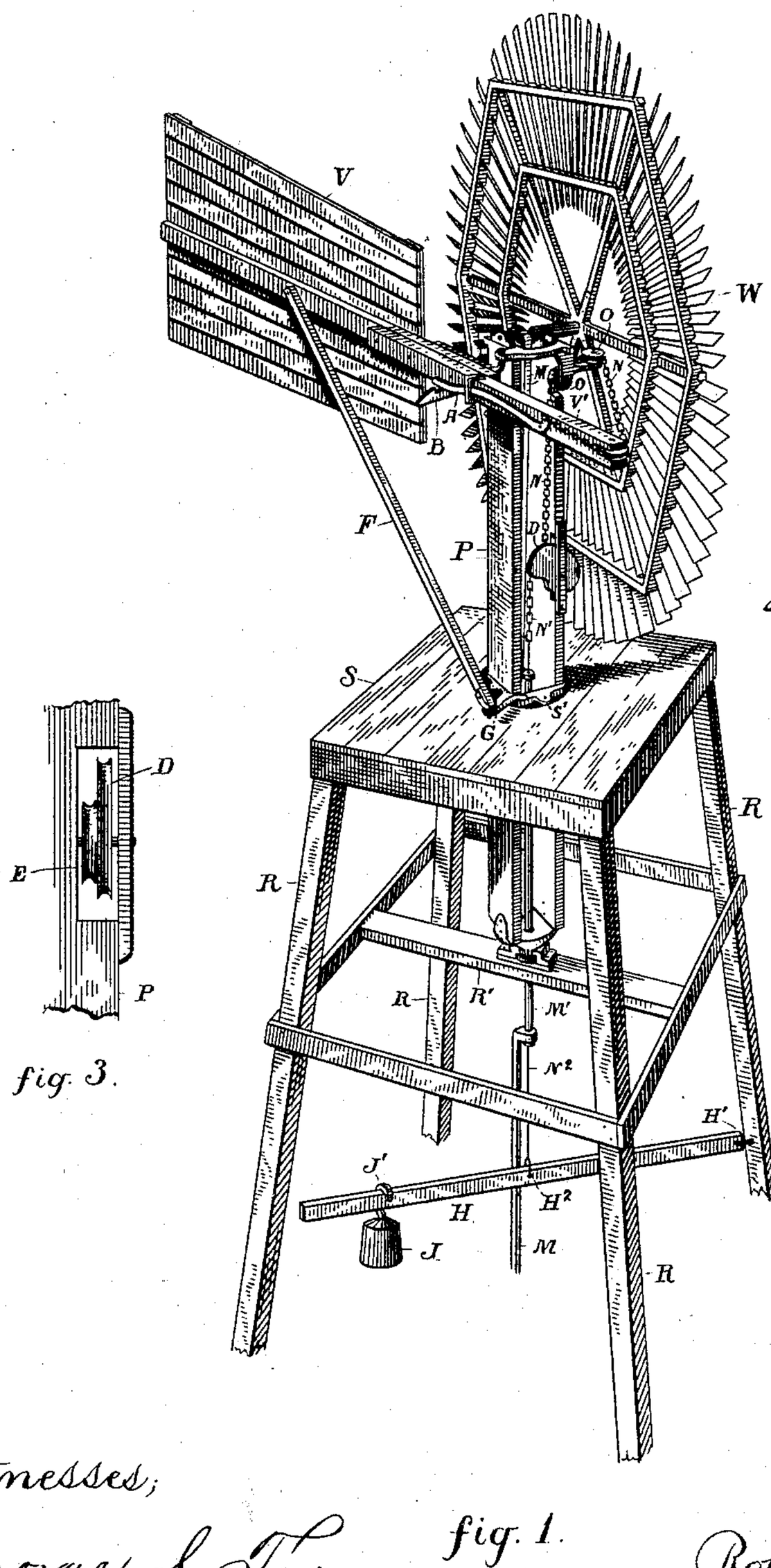

fig. 1.

fig. 3.

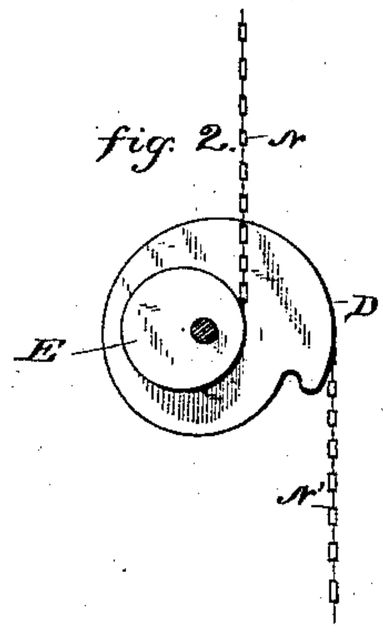

fig. 2.

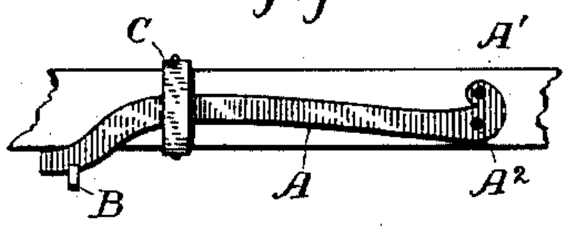

fig. 4

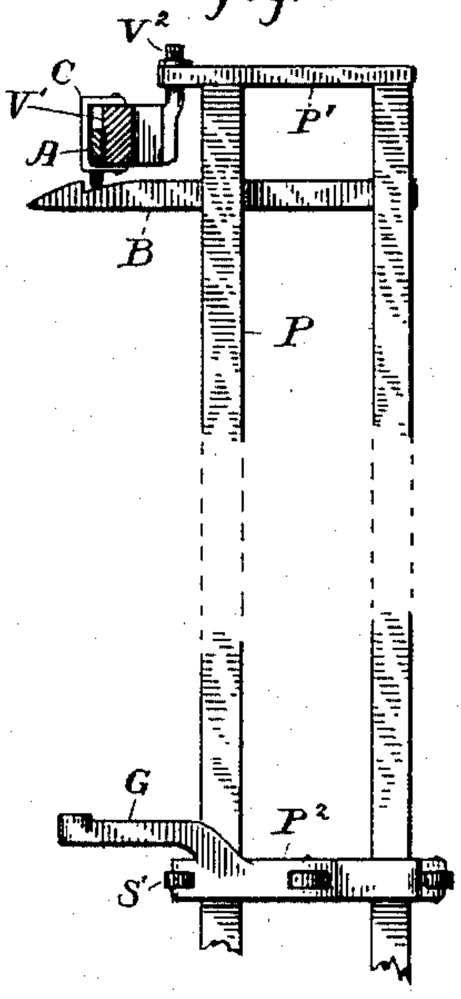

fig. 5.

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UNITED STATES PATENT OFFICE.

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WINDMILL.

SPECIFICATION forming part of Letters Patent No. 371,120, dated October 4, 1887.

Application filed September 8, 1886. Serial No. 212,975. (No model.)

To all whom it may concern:

Be it known that we, ROBERT H. AVERY and LEONARD B. BERRIEN, both of Peoria, in the county of Peoria, in the State of Illinois, have invented an Improved Windmill; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the annexed drawings, making a part of this specification, in which like letters of reference refer to like parts, and in which—

Figure 1 represents a perspective view of the entire mill; Fig. 2, a face view of the double pulley D E; Fig. 3, an edge view of same; Fig. 4, a side elevation of the latch A and arm V′; Fig. 5, an elevation of the turn-post of the mill and certain of its attachments, especially the catch B and the upper and lower pivotal bearings of the vane.

The invention is fully described, explained, and claimed in this specification, and illustrated in the views above mentioned, in which—

R R are the posts of an ordinary windmill-tower.

S is a platform resting on and rigidly fastened to the tops of the posts, and P is an open or hollow vertical turn-post passing through a preferably central opening in the platform S and supported by a cross-bar, R′, beneath the platform. The lower end of the turn-post is stepped in a suitable socket resting on the cross-bar, and its middle, which lies in the horizontal plane of the platform S, is encircled by castings P^2, in which are journaled anti-friction rollers S′, resting against the wall of the circular opening in the platform, and thereby holding the turn-post in position and insuring its free rotation.

To the top of the turn-post is fastened a plate, P′, provided with a suitable bearing in which is journaled an approximately-horizontal wind-wheel shaft, bent to form a crank at a point slightly at one side of the axis of rotation of the turn-post, or vertical axis of the mill. On the outer end of the wind-wheel shaft is rigidly mounted a wind-wheel of any desired construction, and on the crank, at its inner end, is suspended the upper section of a pump-rod, M, extending downward to a point just above the platform, where its lower end is fastened to the upper end of a second rod, M′, which is hollow from end to end, and is preferably coincident with the vertical axis of the mill. This hollow rod M′ extends downward through the cross-bar R′, and its lower end is swiveled to the upper end of the lower section of the pump-rod M, which, like the upper section, is set slightly at one side of the vertical axis of the mill. The three sections M M′ M together form a single pump-rod; but the swiveled connection of the rod M′ and the lower section M permits the free rotation of the turn-post, and the offset of the sections M M from the hollow section M′ leaves the latter open for the passage of a regulating-rod, as is hereinafter set forth.

On the rear edge of the top plate, P′, is a projection in which is formed a suitable bearing for a pivot or gudgeon, and on the rear edge of one of the castings P^2 is formed a projection, G, in which is formed a second bearing similar to the first. The upper bearing is slightly at one side of the vertical plane of the wind-wheel shaft, and the lower bearing is on the same side of said plane, but farther from it than the upper, and at the same time is considerably farther from the vertical plane of the wind-wheel than the upper bearing, as is clearly shown in Fig. 5. The line joining the two bearings is the axis of oscillation of a vane, V, having the ordinary mid-rib and provided with a gudgeon, V^2, Fig. 5, which enters the upper bearing, and a brace, F, whose lower end enters the lower bearing. The obliquity of the pivot or axis of oscillation of the vane causes its weight (when not counterbalanced in any way) to swing the vane into a position approximately parallel to the vertical plane of the wind-wheel and to resist any effort to bring the vane out of said position. When the vane is in this position, which is the one illustrated in Fig. 1, the mill is said to be out of the wind, since the vane and wind-wheel are both held approximately parallel to the line of the wind, and the force of the wind has no tendency to rotate the wheel. We are aware that it has heretofore been proposed to pivot a vane obliquely to the turn-post or turn-table of a windmill; but so far as we

know the mill shown and described herein is the first in which the obliquity of the pivot has been such as to cause the weight of the vane to carry it from its normal working position, approximately at right angles to the plane of the wind-wheel, into a position parallel to the plane of the wind-wheel.

In order to prevent slight oscillation of the vane with reference to the wind-wheel when the mill is out of the wind, we have provided it with a latch, A, pivoted at A^2, Fig. 4, to an arm, V′, which is fastened rigidly to the mid-rib of the vane and is really an extension thereof. The latch has a vertical oscillation, limited in extent by a guard, *c*, attached to the arm V′, and engages, when the mill is fully out of the wind, with a catch, B, Figs. 1, 4, 5, fastened to the turn-post. The end A′ of the latch opposite the catch B is directly above the pivot A^2, and a chain, N, is fastened to the latch at this point, and passes thence about a horizontal pulley journaled in the end of the arm V′, a horizontal pulley, O, journaled in the plate P′, and a vertical pulley, O, also journaled in said plate, and extends downward from the last-named pulley to the periphery of a pulley, E, journaled in the turn-post, the lower end of the chain being fastened to said pulley E. A larger pulley, D, is fastened to or formed integral with the pulley E, and the upper end of a second chain, N′, is secured to the periphery of this second pulley, the lower end of said chain N′ being fastened to the upper end of a rod, N″, which extends downward through the hollow section M′ of the pump-rod and is hooked to a lever, H, one of whose ends is pivoted to the tower of the mill, while the opposite end supports, when desired, a weight, J.

It is evident that when the weight J is placed on the free end of the lever H the first effect of the consequent downward motion of the lever is to throw the end of the latch A out of engagement with the catch B, and that the farther downward motion of the lever must draw the free end of the arm V′ toward the horizontal pulley O, and thus swing the vane into its normal working position approximately at right angles to the plane of the wind-wheel. In other words, the weighted lever furnishes a means of overcoming the effect of the obliquity of the vane-pivot, and serves to hold the mill in the wind with a force varying in accordance with the mass of the weight and its position on the lever.

It is evident that if the pulley D E be omitted from the structure, or if both its parts D E be centrally-pivoted circles, the force exerted by the weight upon the vane will be the same in all positions of the vane with reference to the wheel; but as it is desirable to have the weight exert a varying force on the vane—that is, a force which is least when the mill is fully in the wind and greatest when the mill is fully out of the wind—we have mounted both of said parts eccentrically, the point of greatest eccentricity of the part D being directly opposite the corresponding point on the part E. We have also given the chains N N′ such lengths, respectively, that when the mill is fully out of the wind, as shown in Fig. 1, the chain N is tangent to the pulley E at its point of least eccentricity, and consequently the chain N′ is tangent to the pulley D at its point of greatest eccentricity. The evident result of this construction is that when the mill is fully out of the wind the weight has the advantage of the greatest leverage of the pulley D, while the force of resistance of the vane is applied at the extremity of the shortest lever on the pulley E. As the free end of the arm V′ swings toward the horizontal pulley O, however, the rotation of the pulley causes a gradual decrease of the leverage of the weight on the pulley D and a corresponding increase of the leverage of the vane-resistance on the pulley E, so that as the mill swings into the wind the power of the weight gradually decreases.

It is evident that one of the pulleys D E may be centrally and the other eccentrically pivoted, or that either or both of them may be irregular cams, instead of regular eccentrics. As a cam is an irregular eccentric, we shall use the word "eccentric" in the claims as a generic term covering either the regular or irregular form, or both.

The position of the vane-pivot has already been fully described; but we wish further to call attention to the fact that both the elements of its oblique position (namely, its obliquity with reference to the plane of the wind-wheel and its obliquity with reference to the vertical plane of the wind-wheel shaft) are material and important, and that either of said elements is in itself sufficient to swing the vane into a plane parallel to the wind-wheel. If the vane-pivot, however, while retaining its obliquity with reference to the plane of the wind-wheel, were in a plane parallel to the vertical plane of the wind-wheel shaft, the vane would be at its "dead-center" when the mill was fully in the wind, and would have no tendency to leave its position until started by some external force; and, on the other hand, if the pivot, while retaining its obliquity with reference to the vertical plane of the wind-wheel shaft, were in a plane parallel to the plane of the wind-wheel, the vane would have no stability of position when the mill was fully out of the wind. The double obliquity of the pivot removes both these difficulties and causes the vane (if not restrained by a counterbalancing force) to start quickly from its position when the mill is in the wind and to hold its position firmly when the mill is out of the wind.

The operation of the mill as a whole is evident, from the foregoing description, to any person familiar with the art. The position of the horizontal pulley O, or of some interposed stop on the plate P′, is preferably such that the arm V′ and vane V cannot reach a position exactly at right angles to the wind-wheel;

but the weight J, acting through the chains N N', holds the arm ordinarily in contact with said pulley or stop, the weight being such as to preserve this position of the parts during a wind of any usual velocity. Any increase of the wind above the velocity calculated on swings the wheel toward the vane and correspondingly raises the weight. Owing to the arrangement of the pulleys D E, however, the resistance of the weight increases as the wheel swings toward the vane, and at the same time the force of the wind on the wheel decreases, so that unless the wind is extremely violent the two forces balance each other before the mill is fully out of the wind. Of course when the force of the wind decreases the mill again comes into the wind. When it is desirable to stop the operation of the mill, the weight J is removed, the vane swings into a position parallel to the wheel, and the latch A engages the catch B and locks the parts together.

Having now described our invention and explained its operation, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the rotating turn-post of a windmill and a wind-wheel mounted thereon, of a vane pivoted to the turn-post, as described, on a line of such obliquity that the weight of the vane tends to carry it from its normal working position to one parallel to the plane of the wind-wheel.

2. The combination, with the rotating turn-post and the wind-wheel mounted thereon, of a vane whose upper pivot is nearer than its lower to the plane of the wind-wheel, as described, the obliquity of the pivots being such that the weight of the vane tends to carry it from its normal working position into a plane parallel to that of the wind-wheel.

3. The combination, with the rotating turn-post of a windmill, a wind-wheel shaft journaled therein, and a wind-wheel mounted on the shaft, of a vane pivoted, substantially as described, so that its weight tends to hold it in a position parallel to the wind-wheel, a regulating-cord adapted to draw the vane into a position at right angles to the wind-wheel, and a weight connected with the cord and sufficient to overcome the resistance of the weight of the vane and to hold it normally at right angles to the wind-wheel.

4. The combination, with the turn-post of a windmill, a wind-wheel shaft journaled therein, and a wind-wheel mounted on the shaft, of a vane pivoted to the turn-post and provided with an arm extending from the vane beyond the pivot, a catch on the turn-post, and a latch pivoted to said vane-arm and adapted to engage said catch when the mill is out of the wind, and a regulating-cord attached to said latch and passing thence about the end of the vane-arm and over suitable pulleys mounted in the turn-post, and from said pulleys downward to the foot of the tower of the mill, a downward pull on said cord being adapted to release said latch from the catch, and then to draw the end of the vane-arm toward the pulley mounted in the turn-post, substantially as and for the purpose set forth.

5. The combination, with the turn-post of a windmill, the wind-wheel shaft journaled therein, and the wind-wheel mounted on the shaft, of a vane pivoted, substantially as described, so that its weight tends to hold it in a position parallel to the wind-wheel, a regulating-cord attached to the vane and passing thence over suitable attachments of the turn-post and downward toward the foot of the tower of the mill, whereby the vane may be drawn from its position parallel to the wind-wheel, a weight connected with the cord, and means, substantially as shown and described, for varying the leverage of the weight and of the vane-resistance, substantially as and for the purpose set forth.

6. The combination, with the turn-post and the vane hinged thereto, substantially as set forth, of the chains N N', the rigidly-connected eccentric pulleys D E, interposed between said chains, and the weight connected with and operating said chains, substantially as and for the purpose set forth.

In testimony that we claim the foregoing invention we have hereunto set our hands this 1st day of June, 1886.

ROBERT H. AVERY.
LEONARD B. BERRIEN.

Witnesses:
A. B. UPHAM,
EDWARD M. AMES.