(No Model.) 2 Sheets—Sheet 1.

E. P. WHEELER.

WINDMILL.

No. 263,447. Patented Aug. 29, 1882.

Fig. 1.

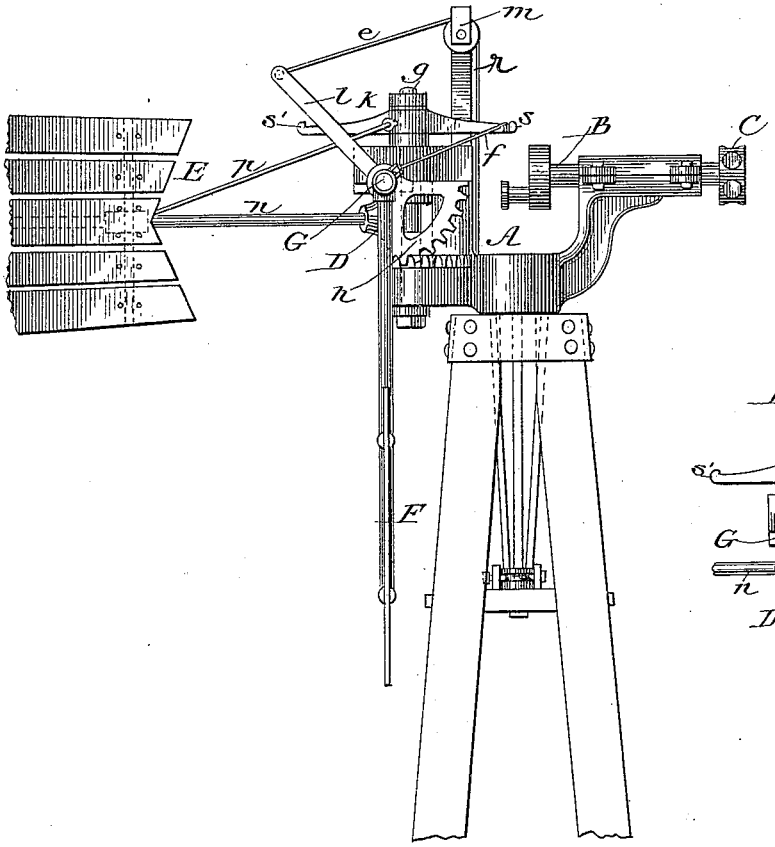
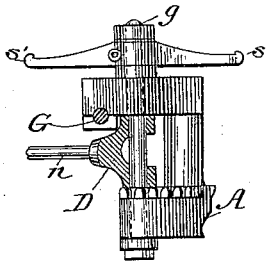


Fig. 5.



Witnesses:

Frank S. Blanchard

Jacob Lorum.

Inventor

Edward P. Wheeler

By Charles F. White

Attorney.

(No Model.) 2 Sheets—Sheet 2.

E. P. WHEELER.

WINDMILL.

No. 263,447. Patented Aug. 29, 1882.

Fig. 2

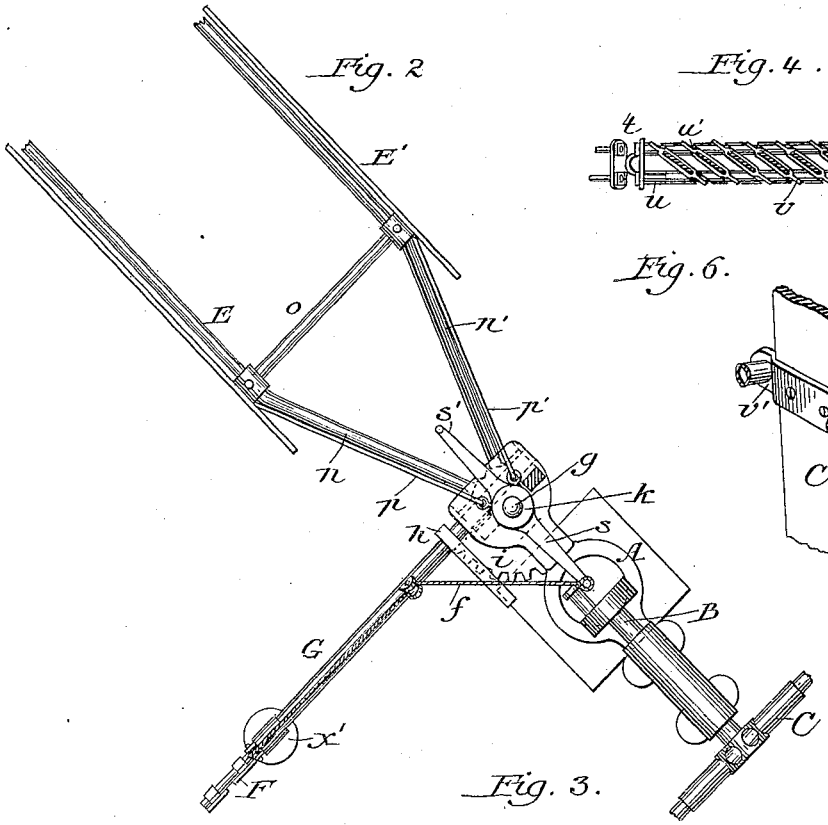


Fig. 4.

Fig. 6.

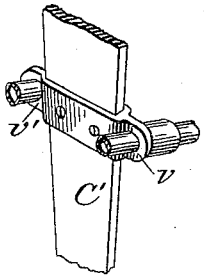
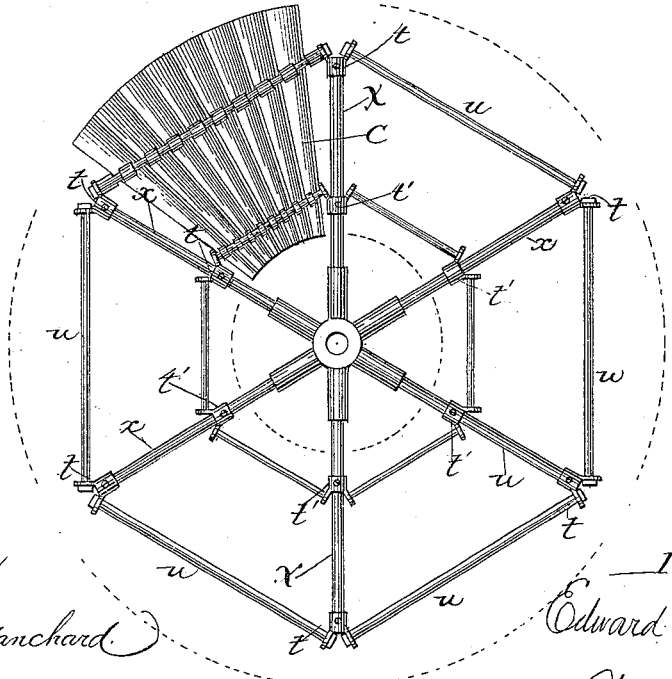


Fig. 3.



Witnesses
Frank L. Blanchard.
Jacob Lorum.

Inventor:
Edward P. Wheeler
By Charles F. White
Attorneys.

UNITED STATES PATENT OFFICE.

EDWARD P. WHEELER, OF BELOIT, WISCONSIN.

WINDMILL.

SPECIFICATION forming part of Letters Patent No. 263,447, dated August 29, 1882.

Application filed March 18, 1882. (No model.)

To all whom it may concern:

Be it known that I, EDWARD P. WHEELER, of Beloit, in the county of Rock and State of Wisconsin, have invented certain new and useful Improvements in Windmills, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

Figure 1 is a side elevation of my windmill. Fig. 2 is a plan or top view with some of the parts omitted. Fig. 3 is a front view of the wind-wheel. Fig. 4 is a plan view of a section of the wind-wheel, showing devices for holding the fans therein. Fig. 5 is a view of a detached portion of my mill, in which is illustrated the method of hinging the tail-vanes to the turn-table; and Fig. 6 is a view of a detached part of one of the fans of the wind-wheel, illustrating the method of securing the fans in the wheel.

My invention has relation to that class of windmills which are automatic in their action and self-regulating; and it consists, first, in a windmill having two main tail or rudder vanes standing substantially parallel with each other and separated by an intervening space, so as to present their inner surfaces to the action of the air-currents passing through the central opening of the wind-wheel and their outer surfaces to the action of the currents of air passing the outer edges of the wind-wheel, said vanes being rigidly connected together and hinged to and adapted to turn laterally upon the turn-table of the mill; and it consists, secondly, in a windmill having two main tail or rudder vanes standing substantially parallel with each other and separated by an intervening space, so as to present their inner surfaces to the action of the air-currents passing through the central opening of the wind-wheel and their outer surfaces to the action of the currents of air passing the outer edges of the wind-wheel, said vanes being rigidly connected together and hinged to and adapted to turn laterally upon the turn-table, and a pendent regulating-vane connected with a rocking-shaft for turning the tail or rudder vanes laterally, the pendent vane acting normally by the gravitation of its own weight to keep the tail or rudder vanes substantially parallel with the line of the working-shaft of the mill, in which position the rudder-vanes will operate to steer and hold the wheel to the wind; but when the wind increases in force sufficient to overcome the weight of the pendent vane it will be carried forward and upward, rocking said shaft and through the medium of segment-gears or other suitable means will deflect or turn the rudder-vanes at an angle from their normal position toward the wind-wheel, when they will operate to steer the wheel out of the wind; and it consists, thirdly, in a windmill having two main tail or rudder vanes standing substantially parallel with each other and separated by an intervening space, so as to present their inner surfaces to the action of the air-currents passing through the central opening of the wind-wheel and their outer surfaces to the action of the currents of air passing the outer edges of the wind-wheel, said vanes being rigidly connected together and hinged to and adapted to turn laterally upon the turn-table, in combination with a pendent regulating-vane attached to a rocking-shaft for turning the tail or rudder vanes laterally, and a wind-wheel mounted and adapted to turn laterally with the turn-table out of the wind; and it consists, fourthly, in a windmill, of the pendent regulating-vane provided with an adjustable weight, said vane being attached to a rocking-shaft turning in bearings upon the turn-table, and having a segment-gear or other suitable mechanism for turning the rudder or tail vane or vanes of the mill laterally, and acting normally and automatically by the gravitation of its own and the adjusted weight to keep said tail or rudder vane or vanes substantially parallel with the line of the working-shaft of the mill and the wind-wheel steered to the wind; and it consists, fifthly, in a wind-mill having a pendent regulating-vane and rocking-shaft, the arrangement of a sliding weight on the bar of the pendent vane, connected by means of a chain or cord to a swivel-bar made to turn laterally with the tail-vanes upon the turn-table, and for the purpose of automatically regulating the motion of the wind-wheel by providing a constantly-varying resisting force, greater or less, as desired, to the movement of the mill out of the wind; and it consists, sixthly, of a wind-wheel composed of individual slot-fans placed in and secured to suitable castings, and connected together and held at

suitable angles in the wheel by means of parallel rods secured to collars fastened to radial arms extending out from the hub of the wheel; and it further consists, seventhly, in the wind-wheel, also hereinafter particularly described.

In the drawings, A is the turn-table of the mill, upon which, on one side, is mounted the driving-shaft B, to one end of which shaft the wind-wheel C is attached. Said turn-table, on its lower side, has the usual pivotal bearings, and is secured to the mill-tower in the usual manner.

D is a casting provided with suitable bearings, and hinged to and adapted to turn laterally upon the turn-table A.

n n' are bars or shafts, preferably made of tubular iron gas-pipe, rigidly attached to said casting D by screw-threads or other suitable means. Said bars are further secured and held in position by a cross or brace bar, O, and are made to support the two tail or rudder vanes E E'. Said tail or rudder vanes may be placed parallel with each other, or set slightly deflected outward from a parallel position, and should be far enough apart to be acted upon by the currents of air passing the outer edges of the wind-wheel. The advantages which I claim for my double tail-vane over the single tail-vane in windmills as heretofore constructed and in general use are, first, that the two tail-vanes, when rigidly connected and separated by an intervening space, so as to present their inner surfaces to the action of the air-currents passing through the central opening of the wind-wheel and their outer surfaces to the action of the currents of air passing the outer edges of the wind-wheel, as specified, will hold the wind-wheel more steadily in the wind than a single tail-vane, thus giving increased power to the mill.

A serious defect in all windmills as heretofore constructed having but a single tail-vane has been that owing to the obstruction of the wheel the force of the wind is broken and its direction changed before reaching the tail-vane, and the vane is left to swing, as it were, in a vacuum, without sufficient and constant force to steady the wheel in the wind. The result is that the tail-vane has to seek its steadying force by swinging laterally to one side and the other until it reaches the currents of air which blow by the outer edges of the fans. This gives an unsteady lateral oscillation to the turn-table and mill, throwing the wind off the wheel and materially diminishing its power. This lateral oscillation in mills having a single tail-vane is well known as the "flop" of the tail, and becomes so serious a defect that it has been found impracticable to construct mills of that character having a wind-wheel of over twenty-five feet diameter. By the use of two tail-vanes in my mill, braced over against each other and placed far enough apart to be constantly and uniformly acted upon by the air-currents, both on their inner and outer surface, I am enabled to overcome in a great measure this defect of unsteady lateral oscillation, and at the same time to make said vanes in large mills shorter and less unwieldy than is possible in the case of the single tail-vane in mills as ordinarily constructed.

G is a rocking shaft, secured to and made free to turn in suitable bearings upon the turn-table A.

F is a pendent vane, rigidly attached to said rocking shaft, and hanging with its plane parallel or in line with said shaft.

x' is an adjustable weight, made to slide on the bar of the pendent vane. Said weight may be provided with a set-screw or other suitable means for securing it fixedly at any desired position on said bar; or it may be connected with a cord or chain working over a pulley attached to the rocking shaft above the bar, and adjusted by means of said cord or chain in the following manner: When it is desired to set the weight at a fixed position on the bar, by securing the cord or chain, as the case may be, to any convenient part of the turn-table. When, however, it is desired to make said weight a weight of varying resistance on the pendent vane and a more perfect automatic regulator, the cord or chain may be fastened to the one or the other of the arms of the swivel-bar *k*, according as a greater or less weight is desired on said pendent vane, after the force of the wind has become sufficient to initiate the movement of said vane and rock its shaft far enough to deflect the tail or rudder vanes from their normal position. As said vanes are turned laterally upon the turn-table, said swivel-bar *k* is also, by means of the brace-rods *p p'*, carried around laterally with them, the vertical bolt *g* forming the common axis of oscillation. By this lateral movement the point *s* of said swivel-bar constantly approaches nearer to the rocking shaft and pendent vane, which allows the weight, in case its cord is attached to said arm, to slide down the bar, thus increasing the weight on the pendent vane and offering greater resistance to the movement of the mill out of the wind. On the other hand, as the lateral movement of the tail or rudder vanes continues the distance of the point *s'* of said swivel-bar from the rocking shaft and pendent vane constantly increases, which operates, in case the weight-cord is attached to that arm, to draw the weight up the bar, and thus diminish the resistance offered by the pendent vane to the movement of the mill out of the wind.

h is a segment-gear rigidly attached to the rocking shaft G, and made to engage with the corresponding segment-gear, *i*, upon the casting D.

l is an arm extending up from said rocking shaft, to which the chain or cord *e* is fastened. Said chain or cord *e* is made to pass over a pulley, *m*, on the standard *r* of the turn-table, and thence connect with a rod passing down through the vertical axis of the mill. The de-

sign and purpose of said arm, pulley, chain, and rod are to enable the operator, by turning the rocking shaft, to steer and secure the mill out of the wind.

C is the wind-wheel, the arms *x x* of which are preferably made of tubular wrought-iron gas-pipe, screwed into sockets in the shafts of the spider or hub of the wheel. Attached to each of said arms are two adjustable collars, *t t'*, adapted to slide upon said arms, and which are provided with set-screws or other suitable means for securing them at any desired position thereon. Said collars on either side have two perforated ears made to receive the parallel rods *u u'*, connecting the several arms. The different sections of the wheel are made up of individual fans *c' c'*, which fans are made to fit into small castings *v v'*, and are secured therein by screws or other suitable means. These castings *v v'* are perforated or provided with ears on either end to receive the rods *u u'*, and are made so as to secure respectively the desired relative angle of the fans to each other in the wheel. The rods *u u'* are passed through the ears on either side of the fans, thus connecting them together in a continuous section. The ends of said rods are provided with screw-threads, and are secured to the collars *t' t'* by means of check-nuts. Between the interspaces of the fans are placed thimbles, made to slide over the rods *u u'*, and hold the fans at a proper distance apart. In addition to supporting the fans in the wheel, the rods *u u'*, with their check-nuts, furnish a means of adjusting the angle of the fans, and also of "tarving" or twisting them as they approach the outer edge of the wheel.

The operation of my mill is as follows: Under ordinary circumstances and in an average wind the two tail or rudder vanes stand parallel with or at a slight angle to the line of the working-shaft of the mill and to each other. In this position the pendent vane F hangs vertically downward, presenting its full surface to the wind, and the wind-wheel C is held squarely and steadily to the wind. When the force of the wind acting on the surface of the pendent vane becomes sufficient to swing or carry it out of its vertical toward a horizontal position the rocking shaft G is turned in its bearings, carrying with it the segment-gear *h*, which, engaging with the gear *i*, swings the tail or rudder vanes E E' laterally toward the wind-wheel, which in turn guides the wheel out of the wind. This lateral movement of the wind-wheel out of the wind, it will be observed, is not effected by the direct action of the wind on the pendent vane, as in the case of mills having a single flexible tail and a rigid side vane where the movement of the wheel is caused by the direct action of the wind on the side vane. The sole office or function of said pendent vane, as respects said movement, is to change the relative position of the tail or rudder vanes to the wind-wheel. Until this relative position of said vanes to the wind-wheel is changed the wheel remains fully to the wind; but as soon as said relative position becomes changed the tail-vanes, acting as a rudder, steer the wheel out of the wind. As soon as the force of the wind abates the pendent vane, by the gravitation of its own and the added adjustable weight, returns to its vertical position, rocking the shaft backward, and by means of the segment-gears swings the rudder-vanes around again to their normal position.

I am aware that windmills have heretofore been constructed having two tail or steering vanes loosely held apart by springs or coupled by toggle-joints, so as to approach each other when acted upon by the force of the wind, and I am also aware that windmills have heretofore been constructed in which the tail-vane is double and diverges each way from the central shaft, constituting what is known as the "feathered tail-vane." I do not therefore claim, broadly, a windmill having two tail or steering vanes; but

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. A windmill having two tail or rudder vanes standing substantially parallel with or set at a slight angle to each other and separated by an intervening space, so as to present their inner surfaces to the action of the air-currents passing through the central opening of the wind-wheel and their outer surfaces to the action of the currents of air passing the outer edges of the wind-wheel, said vanes being rigidly connected together and hinged to and adapted to turn laterally upon the turn-table of the mill.

2. A windmill having two tail or rudder vanes standing substantially parallel with or set at a slight angle to each other and separated by an intervening space, so as to present their inner surfaces to the action of the air-currents passing through the central opening of the wind-wheel and their outer surfaces to the action of the currents of air passing the outer edges of the wind-wheel, said vanes being rigidly connected together and hinged to and adapted to turn laterally upon the turn-table, and a pendent regulating-vane connected with a rocking shaft for turning the tail or rudder vanes laterally, the pendent vane acting normally, by the gravitation of its own weight, to keep the tail or rudder vanes substantially parallel to the line of the working-shaft of the mill and the wind-wheel steered to the wind.

3. A windmill having two tail or rudder vanes standing substantially parallel with each other and separated by an intervening space, so as to present their inner surfaces to the action of the air-currents passing through the central opening of the wind-wheel and their outer surfaces to the action of the currents of air passing the outer edges of the wind-wheel, said vanes being rigidly connected together and hinged to and adapted to turn laterally upon the turn-table, in combination with a

pendent regulating-vane attached to a rocking shaft for turning the tail or rudder vanes laterally, and a wind-wheel mounted upon and adapted to turn laterally with the turn-table out of the wind.

4. In a windmill, the pendent regulating-vane provided with an adjustable weight, said vane being attached to a rocking shaft turning in bearings upon the turn-table and having a segment-gear for turning the tail or rudder vanes of the mill laterally, and acting normally and automatically, by the gravitation of its own and the adjusted weight, to keep said tail or rudder vanes substantially parallel with the line of the working-shaft of the mill and the wind-wheel steered to the wind.

5. In a windmill, the combination of the sliding weight x', the pendent vane F, rocking shaft G, swivel-bar k, and cord f, for the purpose specified.

6. In a windmill having a pendent regulating-vane, the arrangement of an adjustable weight on said vane, substantially as described, and for the purpose specified.

7. The foregoing-described wind-wheel C, composed of individual slat-fans placed in and secured to the castings $v\ v'$, and connected together and held at suitable angles in the wind-wheel by means of the parallel rods $u\ u'$, secured to the collars $t\ t'$, fastened to the radial arms $x\ x'$, extending out from the hub of the wheel, substantially as described.

EDWARD P. WHEELER.

Witnesses:

CHARLES F. WHITE,

MARTIN L. WHEELER.