(Model.)

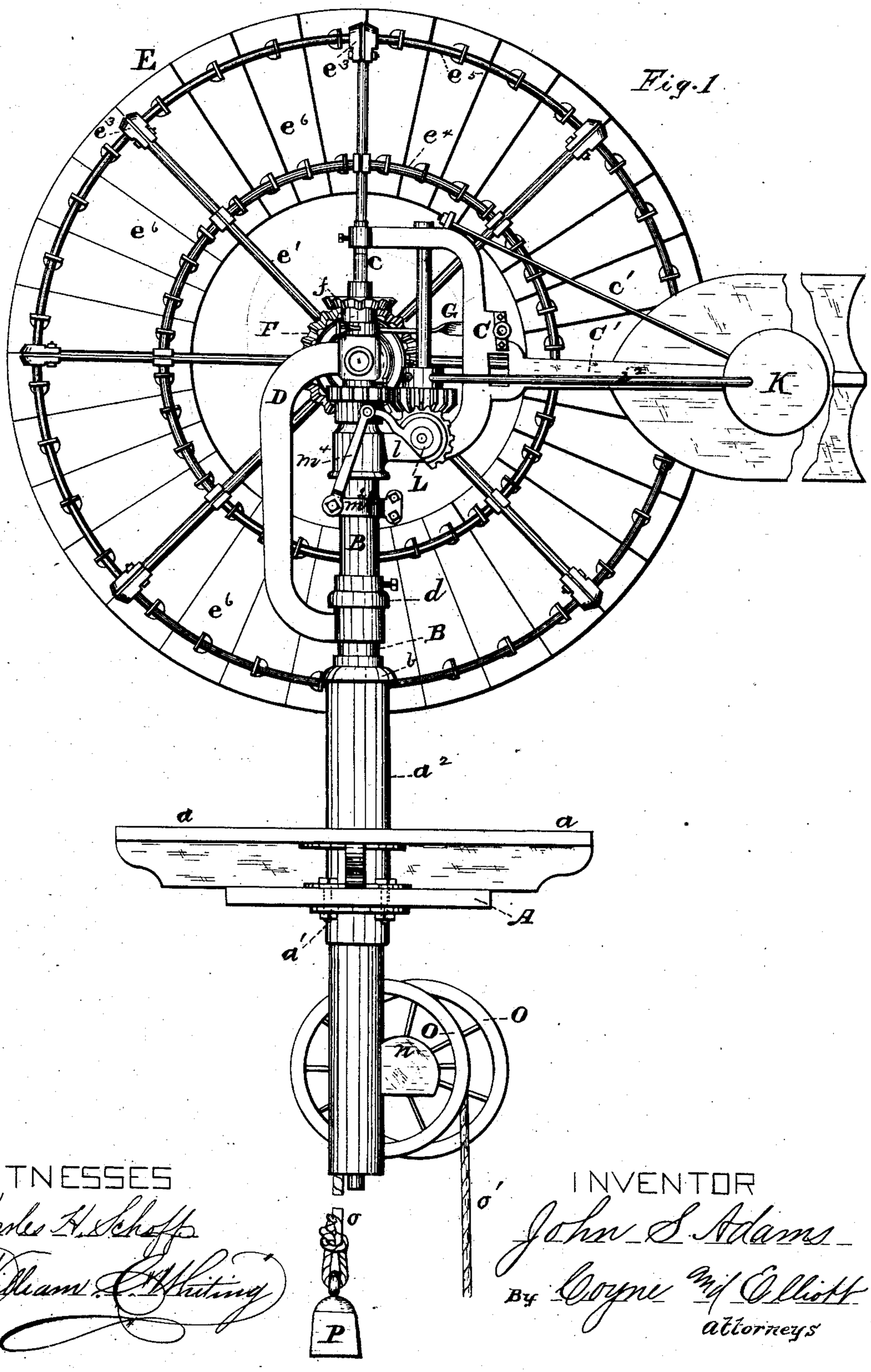
3 Sheets—Sheet 1.

J. S. ADAMS.

WINDMILL.

No. 244,968. Patented Aug. 2, 1881.

Fig. 1



WITNESSES

Charles H. Schoff

William C. Whiting

INVENTOR

John S. Adams

By Coyne and Elliott

attorneys

(Model.) 3 Sheets—Sheet 2.

J. S. ADAMS.

WINDMILL.

No. 244,968. Patented Aug. 2, 1881.

Fig. 2.

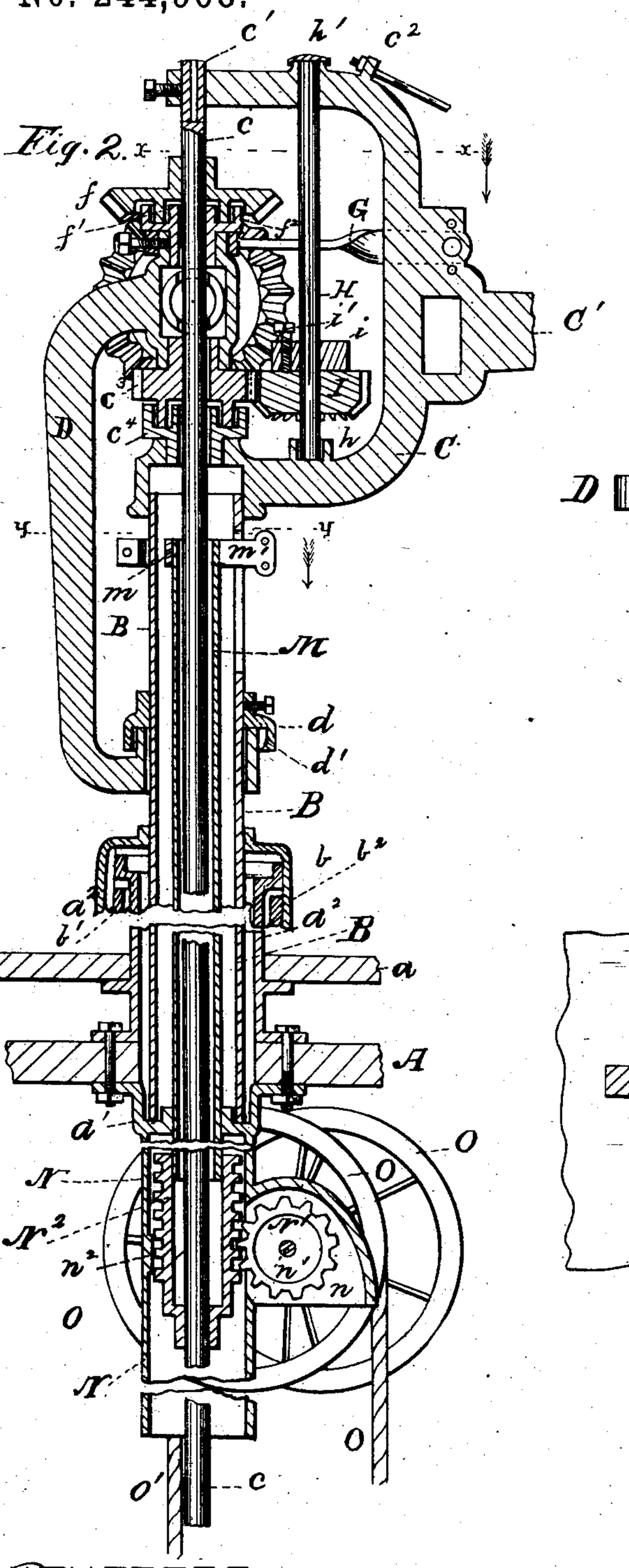


Fig. 3

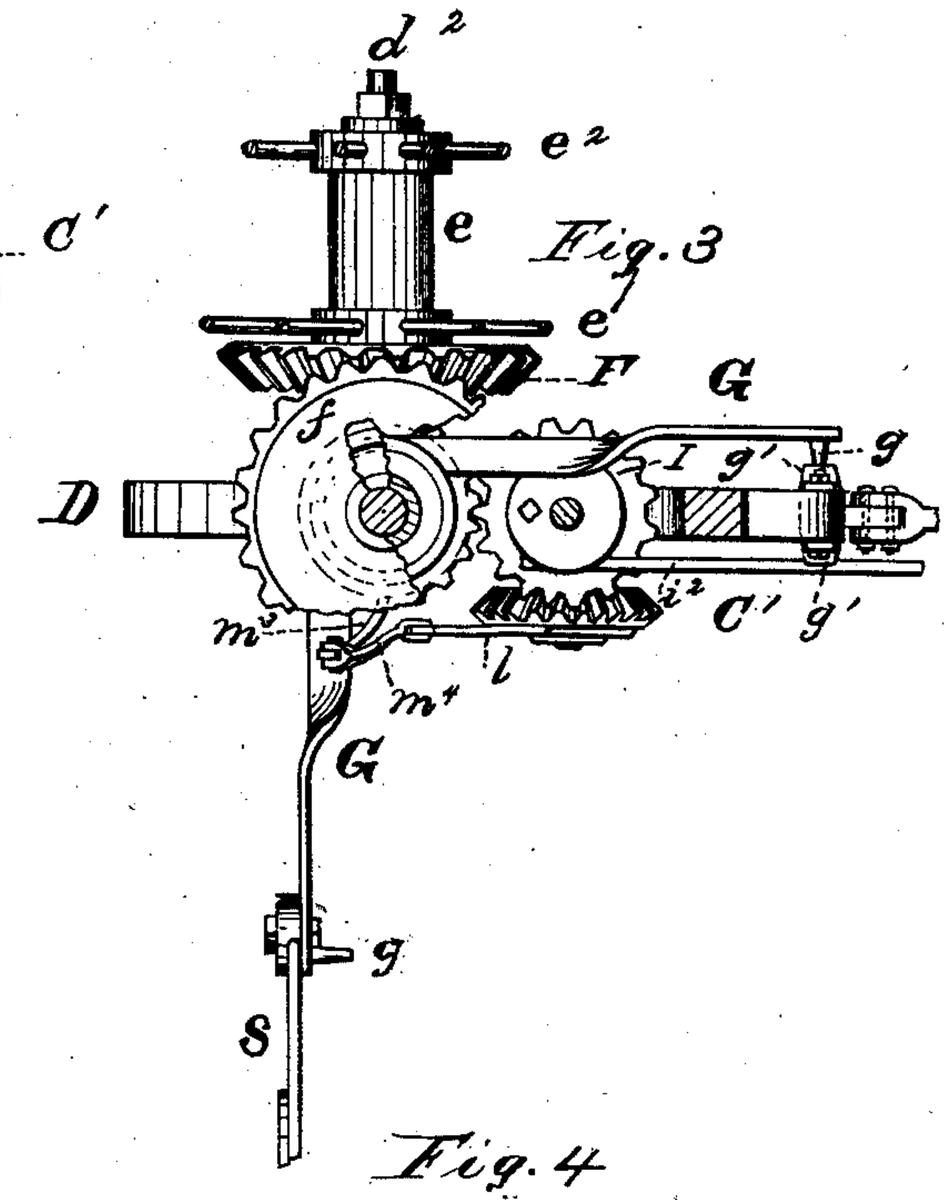
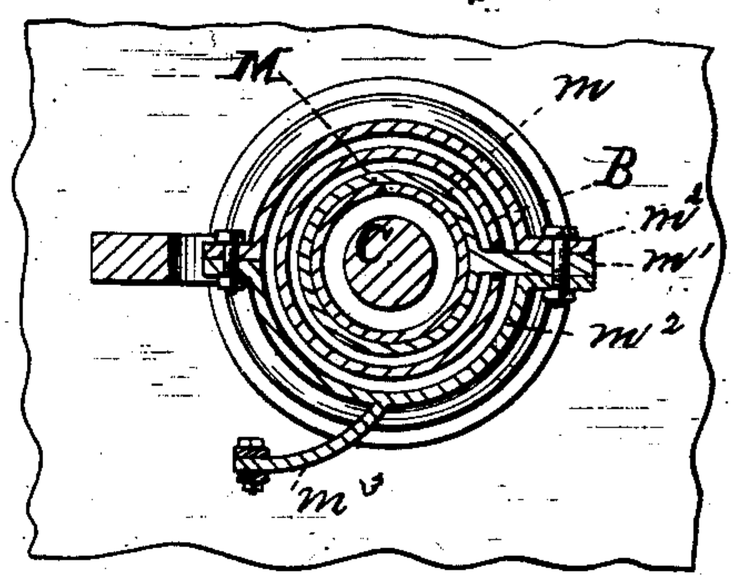


Fig. 4



WITNESSES

James K. Coyne.

W. C. Whitney.

INVENTOR

John S. Adams

By Coyne and Elliott

attorneys

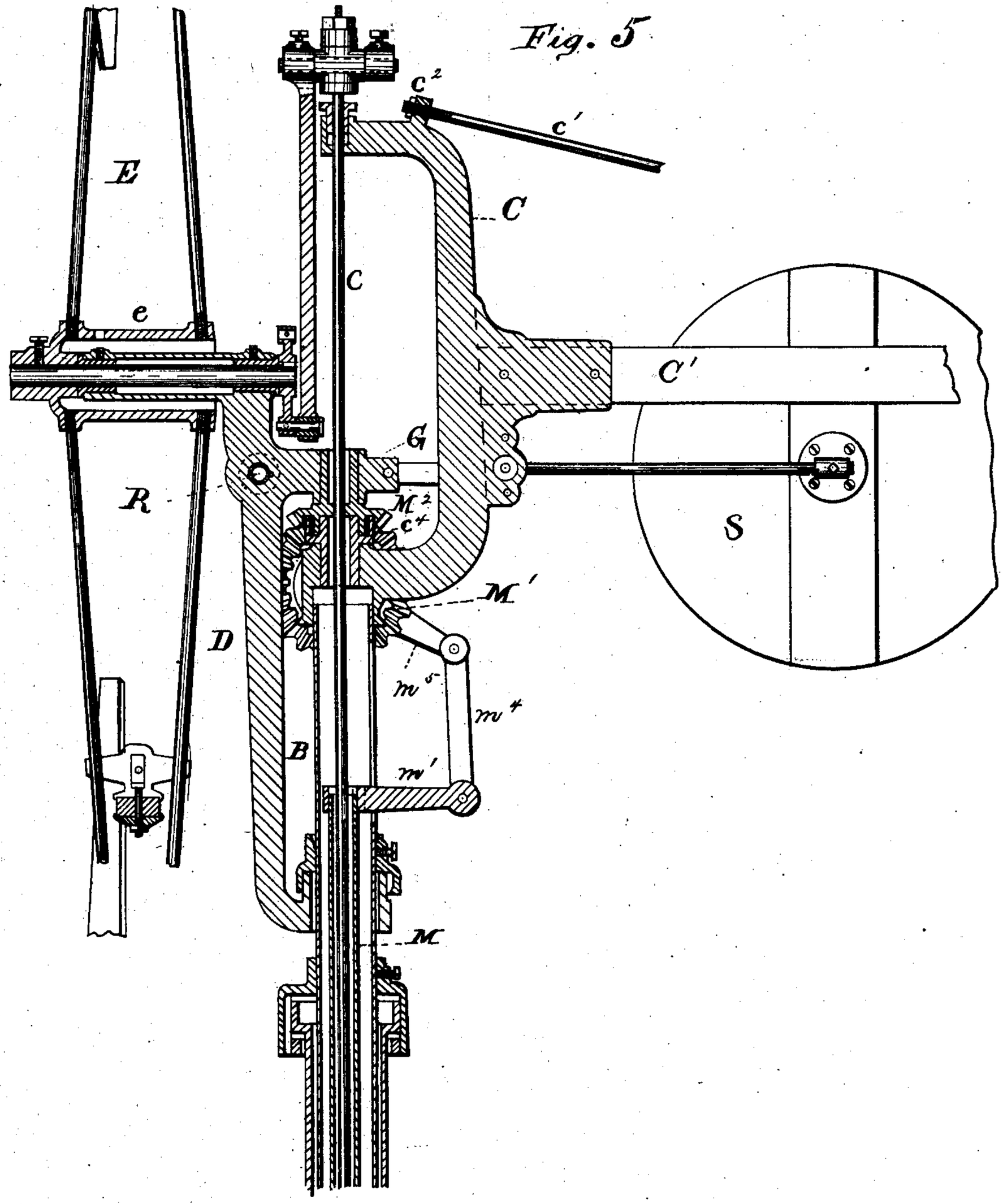
(Model.) 3 Sheets—Sheet 3.

J. S. ADAMS.

WINDMILL.

No. 244,968. Patented Aug. 2, 1881.

Fig. 5



WITNESSES

James F. Coyne

Wm. C. Whitney

INVENTOR

John S. Adams

By Coyne and Elliott

attorneys

UNITED STATES PATENT OFFICE.

JOHN S. ADAMS, OF ELGIN, ILLINOIS.

WINDMILL.

SPECIFICATION forming part of Letters Patent No. 244,968, dated August 2, 1881.

Application filed November 3, 1880. (Model.)

To all whom it may concern:

Be it known that I, JOHN S. ADAMS, a citizen of the United States, residing in Elgin, in the county of Kane and State of Illinois, have invented a certain new and useful Windmill, of which the following is a specification.

My invention relates to improvements in windmills in which the wind-wheel has a horizontal axis and is journaled in or upon an arm of the swinging bracket, the axis of which bracket is at a right angle to the axis of the wind-wheel; and the objects of my invention are, first, to provide an improved method of pivoting the swinging bracket, by which the wind-wheel and tail-vane may swing independently or simultaneously with each other upon the same vertical axis; second, to prevent an upthrust of the tubular turn-table, the swinging bracket, and the vertical shaft; third, to prevent a lateral motion of the vertical tubular turn-table, and to provide bearings for the tubular turn-table, the swinging bracket, and the gear of the vertical shaft, which bearings are in themselves oil cups or reservoirs; fourth, to provide improved mechanism adapted for either geared or pumping windmills, or both, by which mechanism the position of the wind-wheel with reference to the tail-vane or other steering mechanism may be positively controlled from the ground or from any point below the upper platform of the tower, either manually or automatically, by means of a ball-governor, tank-float, or any other suitable governing device for the purpose of swinging the wind-wheel into or out of the wind, or automatically maintaining it at such an angle to the wind that said wind-wheel will not be revolved faster than a desired maximum velocity; fifth, to provide an improved wind-pressure-governing mechanism acting as an auxiliary to or independently of the above-mentioned controlling mechanism, and adapted for either geared or pumping windmills, or both, by which mechanism the position of the wind-wheel with reference to the tail-vane or other steering mechanism may be automatically controlled by wind-pressure acting upon a storm-vane so arranged as to partially or fully equalize the forces acting upon the steering mechanism, and to relieve the wind-wheel from excessive pressure in case of sudden violent gusts of wind; sixth, to provide means by which to automatically ease the action of the wind-wheel when swung around by a strong wind, so as to prevent violent contact of the stops and cushion, and also to prevent the wind-wheel from remaining automatically swung out of the wind and stopped during severe storms—in other words, a mechanism to maintain the normal action of the wind-wheel during storms in which other windmills of this class would be automatically stopped; and, seventh, to provide stops and an elastic cushion for receiving said stops, to limit the lateral-swinging movement of the wind-wheel, and to cause an easy reaction against the striking force of the wind-wheel when it is swung violently to its limit in either direction. I attain these objects by mechanism illustrated in the accompanying drawings, in which—

Figure 1 represents a rear-side elevation of a windmill embodying my invention; Fig. 2, a vertical longitudinal section of the shafting and supports for the same; Fig. 3, a detail plan view, partly in section, and taken on the line *x x* of Fig. 2; Fig. 4, a horizontal section taken on the line *y y* of Fig. 2; and Fig. 5 is a vertical section of a pumping-windmill with my improved manual and automatic regulator for the wind-wheel attached.

Similar letters of reference indicate the same parts in the several figures of the drawings.

A represents the centrally-perforated cap of an ordinary windmill-tower, above which is supported the flooring *a* in the usual manner. Upon the under face of this cap is an annular cup-shaped bearing, *a'*, and upon its upper face is a tubular mast, a^2, having an inner diameter corresponding with that of the outer walls of the bearing and with the perforated cap, forming, substantially, a continuation of the outer rim of the bearing, said mast and bearing being secured to the cap by bolts passing through their flanges and through the cap, as shown. The mast a^2 extends through and some distance above the floor *a*, and forms an outer shell inclosing the vertical tubular turn-table B, which is stepped at its lower end in the bearing *a'*, and has rigidly secured to it a cap or inverted cup-flange, *b*, overlapping the en-

larged upper end of the mast. The cap *b* serves to exclude matter, sleet, dirt, &c., from the turn-table, and by overlapping the enlarged end of the mast prevents a lateral motion of the turn-table, in which latter function it is an auxiliary to the cup-bearing *a'*. A recess, *b'*, is formed in the side of the cup *b*, for the reception of oiled wicking or other material for lubricating this upper lateral bearing of the tubular turn-table. A ring, segment, or nut, b^2, secured to the inside of the cap *b*, and extending under the enlarged portion of the upper end of the mast, serves to prevent vertical displacement of the tubular turn-table B by whirlwinds or other similar causes.

Rigidly secured by its lower arm to the upper end of the tubular turn-table is a vertical C-shaped bracket, C, the upper arm of which affords a bearing for the vertical main shaft *c* passing through the lower arm and down through the center of the tubular turn-table, the tower-cap, and the bearing *a'*, to operate the pump or other machinery.

To the bracket C is secured, at a right angle to the turn-table, the arm of the tail-vane C', which arm is suspended by an obliquely-extending rod, *c'*, attached at one end to and toward the free end of the arm, and at its other end to a lug, c^2, upon the upper arm of the bracket, where it may be tightened by means of a nut working upon the screw-threaded end of the rod.

D represents a C-shaped bracket having its lower arm sleeved upon the turn-table and bearing against the inner walls of the cap *d*, which cap is firmly secured to the tubular turn-table some distance below the rigid bracket C, which bracket D has its upper arm pivoted upon the lower arm of the rigid bracket by means of the annular flange of the pinion c^3, sleeved within the annular cup-shaped bearing c^4, seated in the lower arm of the rigid bracket. The external diameter of the annular recess in this bearing is greater than that of the annular flange of the pinion c^3, so that while the internal diameters of the flange and recess correspond and are fitted together so as to form the upper lateral bearing of the swinging bracket, the greater external diameter of the recess provides an oil cup or reservoir for lubricating this bearing, which bearing also sustains the entire weight of the swinging bracket and wind-wheel.

The cap *d*, secured to the tubular turn-table and fitting over the sleeve of the lower arm of the swinging bracket, not only forms the lower lateral bearing of the swinging bracket, but also excludes rain, sleet, ice, &c., from the bearing and acts as a stop to prevent vertical displacement of the bracket and the mechanism it supports. A recess, *d'*, is formed in the side of cap *d*, for the reception of oiled wicking or other packing for lubricating this bearing. The upper end of the joints between caps *b* and *d* and the tubular turn-table, if not absolutely tight, should be calked to prevent the entrance of matter. The forms, dimensions, and positions of the vertical and lateral bearings of this swinging bracket combine great strength of structure and ease of action.

Journaled upon a horizontal arm or axle, d^2, rigidly secured to the swinging bracket is a wind-wheel, E, which consists of a hub, *e*, a series of radial arms or rods, *e'* e^2, (see Fig. 3,) respectively secured near the inner and outer ends of the hub, and having their outer ends and centers of length connected by clamping-plates e^3, respectively, to curved, tubular, or cylindrical rim-sections e^1 e^5, to which are secured by clips the sails e^6 e^6. Hub *e* has upon its inner end a bevel-wheel, F, engaging with a bevel-pinion, *f*, firmly secured upon the vertical shaft *c*. The bevel-pinion *f* is provided upon its under face with an annular flange, *f'*, which flange has its lateral and vertical bearings in the cup-shaped bearing f^2, sleeved upon the vertical shaft and seated in the upper arm of the swinging bracket D. The bevel-pinion *f* and the vertical shaft *c* are secured against vertical displacement by means of the stop-bearing *c'*, secured in the upper arm of the fixed bracket, which stop may be so adjusted as to rest upon the upper end of the vertical shaft, and thus prevent all end-play of said shaft and pinion.

The cup shape given the bearings *a'*, c^4, and f^2 not only serves to prevent a lateral motion of the several parts supported by and journaled in them, but also affords capacious receptacles or reservoirs for oil or other lubricator. These receptacles retain the lubricator so that it cannot escape and run down over the machinery. They also exclude dust, snow, sleet, or other foreign substances which would retard or stop, and consequently strain, the machinery.

Rigidly secured upon the upper arm of the swinging bracket in a horizontal plane, and at substantially a right angle to each other, are arms or bars G G, which terminate at their free outer ends in lugs *g g*, and afford stops for limiting the lateral movement of the wind-wheel and tail-vane with reference to each other—that is to say, while the wind-wheel and tail-vane may be swung simultaneously or independently toward each other upon one side of the tale-vane, so as to stand parallel with each other, and the wheel be out of the wind, they cannot be swung farther toward the opposite side of the tale-vane than will cause them to stand at a right angle to each other and the wheel be full in the wind.

Upon each side of the rigid or tail-vane bracket are secured perforated caps containing a cushion or spring of rubber, *g'*, or other elastic material, with which the lugs *g g* engage when the wind-wheel is swung to the limit of its lateral movement in either direction. The elastic cushion or spring *g'* causes a reaction against and takes up a portion of the striking force of the tail-vane or wind-wheel when they come in contact with each

other, in which function the arms or bars G G may be made an auxiliary to the elastic cushion by constructing them of spring metal.

Having described the construction for supporting and enabling the wind-wheel and tail-vane to swing horizontally upon a vertical axis, I shall now proceed to describe the mechanism for both manually and automatically regulating such lateral movement.

Resting in a cup-bearing, *h*, the lower arm of the rigid bracket is a vertical shaft, H, the upper end of which passes through the upper arm of the bracket and is provided with a cup or covering, *h*. Upon and near the lower end of this shaft is secured a pinion, I, meshing with the pinion c^3 on the swinging bracket and supporting a head or lug, *i*, which is secured to the shaft by means of a set-screw, *i'*, as shown in Fig. 2. The lug or head *i* is perforated to receive a rod or bar, i^2, carrying upon its outer end a circular vane, K, which I term a "storm-vane," because it operates in a heavy wind, by reason of its connecting devices, to shift the wind-wheel out of the wind, as will presently be understood. When the wind-wheel is full in the wind and its face at a right angle to the tail-vane the face of the storm-vane is parallel with and outside of the periphery of the wind-wheel and at a right angle to the tail-vane. The area of the storm-vane is such that a sudden or steadily increasing wind having sufficient force to cause the wind-wheel to revolve faster than a desired maximum velocity will swing the storm-vane toward the tail-vane, and in doing so the pinion I will revolve the pinion c^3 in the opposite direction and move the wind-wheel with and at an angle to the wind corresponding with that of the angle assumed by the storm-vane.

In order to make the storm-vane automatically return the wind-wheel to a wind decreasing in force, some means other than the above-described must be provided for this purpose. While a rope connected with the arm of the storm-vane and passing over a pulley upon the swinging bracket with a weight upon its end might answer, I prefer a construction which may be operated in a more positive manner and both automatically and manually from the ground. I have therefore provided the pinion I with beveled teeth to engage with a toothed segment, L, pivoted upon the rigid bracket and provided with an arm, *l*, as shown in Fig. 1.

Sleeved within the tubular turn-table, and extending some distance below and having a lateral bearing against the inner walls of the annular cup-shaped bearing *a'*, is a reciprocating tube, M, to the upper end of which is secured a collar, *m*, having a horizontal arm, *m'*, extending through a vertical elongated slot in and near the top of the tubular turn-table and between the lower arms of the rigid and the swinging brackets, as shown in Fig. 2.

Bolted or otherwise secured to the arm *m'* is a collar, m^2, which encircles the outside of, but does not come in contact with the tubular turn-table, and is provided with a curved arm, m^3, about a quarter around the collar from the point at which it is connected with the arm *m'*. The vertical slot in the tubular turn-table is formed on the leeward side, so as to prevent the entrance of rain or snow through the slot. The curved arm m^3 is connected to the lever *l* of the segment by a pitman, m^4, pivoted at its ends to said arm, as shown in Fig. 1, so that as the tube M is raised the lever L will be elevated and the segment be revolved outwardly from the turn-table, and vice versa when the tube M is lowered.

Cast with or otherwise secured to the cup-shaped bearing *a'* is a tube, N, slotted upon one side and provided with a hood, *n*, in which is journaled the shaft *n'* of a pinion, N', the teeth of which enter the tube through the slot and engage with a tubular rack, N^2, sleeved upon the main shaft and rigidly secured to the end of the reciprocating tube M. Tube N is also provided with an annular flange or bead, n^2, which affords a bearing for and to decrease the the friction of the tubular rack. The end of the shaft *n'* projects beyond the hood, and has secured upon it eccentric pulleys O O, oppositely arranged upon the shaft.

Respectively secured to that portion of the circumference of the eccentric pulleys nearest their axes are cords or chains *o o'*, one of which, *o*, has secured to its end a weight, P, so that when the reciprocating tube is elevated and the wind-wheel and storm-vane are out of the wind, as shown in Fig. 1, the weight P will cause the pulley O to revolve, the tube to descend, and the wind-wheel and storm-vane to come into the wind when the power is released from the cord *o'*.

The weight P may be so adjusted, as to weight, that it will be a counter-balance to swing the storm-vane and wind-wheel in a heavy but decreasing wind, or, in other words, it will in a strong increasing wind so gradually permit the swinging of the wind-wheel out of or decrease its angle to the wind that a maximum velocity of the wind-wheel may be maintained until the force of the wind becomes so strong against the wind-wheel and storm-vane that they will overcome the power of the weight and swing entirely out of the wind.

It will thus be seen that the horizontal movement of the wind-wheel upon its vertical axis may be regulated automatically, as well as manually, from the ground by substantially the same mechanism; but it is to be understood that I do not limit myself to the specific construction described, for instead of the segment I may use a sliding rack-bar or any other mechanism which will insure a positive lateral-swinging motion of the pivoted bracket.

Owing to the position of the weight P and the friction of the parts intermediate it and the swinging bracket, the wind-wheel is eased when struck by a gale or hurricane and prevented from being jerked violently out of the wind, to the injury of it and the mechanism which it operates.

The form and arrangement of the pulleys O O, with the connecting mechanism, are for the purpose of giving the weight P increasing resistance to counteract the increasing power of the wind to turn the wind-wheel upon its pivot as the wheel is swung toward the tail-vane.

Having thus described a portion of the governing mechanism of the windmill and its action in a gale, I shall now describe the construction and action of the balance-vane S, Fig. 5, the use of which is designed to obviate the great objection which has been urged against the use of solid-wheel windmills—viz., that in a severe storm they will swing entirely out of the wind and stop.

The great point to be gained in the construction of windmills of this class is to so proportion the varying resistance of the counterpoise as to keep the wind-wheel from being swung entirely out of the wind, however severe it may be, and to maintain the wind-wheel at such an angle to the wind as to keep it in constant operation at the desired rate of speed. For this purpose various systems of mechanism have been devised to increase and decrease automatically the power of the counterpoise; but none of them have perfectly secured the desired result, for the reason that in the counterpoise of weight or spring there is a constant force increasing or decreasing in a fixed proportion, while in the wind which acts upon the wind-wheel and storm-vane there is a fluctuating force acting in ever-varying combinations upon the several parts of the mill. The balance-vane, on the contrary, is a counterpoise, which is acted upon by a varying force of substantially the same proportions as that acting upon the wind-wheel. In other words, I counterpoise a varying force with a varying resistance acting at the same time and with the same power.

The balance-vane S, as shown in the drawings, consists of a circular disk secured to a rod or arm, which is fastened by means of a set-screw in a socket formed in the arm or bar G. The rod or arm which supports the balance-vane may be secured to the swinging bracket or turn-table to which the wind-wheel is attached at any other desirable point, or by any other suitable means, to secure the simultaneous swinging of the wind-wheel and balance-vane.

When the wind-wheel stands full in the wind the balance-vane stands edge to the wind and nearly in line with the tail-vane; but as the wheel is swung out of the wind on one side of the vertical axis the balance-vane swings into the wind on the opposite side and opposes increasing resistance to the swinging of the wheel, as the pivoting-power of the wheel increases by its change of position. The area of the balance-vane should be such that with its leverage its pivoting-power will equal or nearly equal that of the wind-wheel when standing edge to the wind, the two members being thus wind-balanced. The wind-wheel may be easily held into the wind by means of the weight P. It will be seen that by the use of this balance-vane the use of mechanism for giving the weight P increasing and decreasing power is rendered unnecessary. Consequently concentric pulleys may be used in the place of the eccentric pulleys O O.

My regulating mechanism is equally applicable to pumping-windmills, as shown in Fig. 5 of the drawings, in which case I connect the arm m' of the reciprocating tube by means of a crank-arm, m^5, with a bevel-cog wheel, M′, upon the rigid bracket, and gear this cog-wheel with a similar cog-wheel, M^2, seated in the cup-bearing c^4 and secured upon the swinging bracket. The storm-vane may then be geared by means of its pinion I with the cog-wheel M^2; but I prefer, in a pumping-windmill, to attach the storm-vane to the swinging bracket, as indicated at R, and the balance-vane S to the same bracket at a right angle to the storm-vane.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In windmills, the combination, hereinbefore set forth, of a horizontally-swinging wind-wheel, a turn-table supporting the same above the cap of the tower, and a horizontally-swinging tail-vane rigidly secured to said turn-table, said wind-wheel and vane swinging simultaneously with or independently of each other, as described and shown.

2. The combination, with the swinging bracket carrying the wind-wheel and with the tubular turn-table, of a rigid bracket secured upon the turn-table and extending above the swinging bracket and forming an end bearing for and adapted to prevent an upthrust of the main shaft, said rigid bracket carrying the tail-vane.

3. The combination, with the swinging bracket and with the wind-wheel, of a tubular turn-table, a tail-vane bracket rigidly secured to the same, and a vertical shaft journaled in a bearing upon the swinging bracket and connected with the wind-wheel, substantially as described and shown.

4. The combination, with the swinging bracket, the rigid bracket, and a tubular turn-table supported in a cup-shaped bearing below the tower-cap, of a cup-bearing secured upon the rigid bracket and supporting the swinging bracket.

5. The combination, with the tubular turn-table and its cup-shaped bearing a', of the tubular mast and the cap b, secured to the turn-table and overlapping said mast.

6. The combination, with the swinging bracket carrying the wind-wheel and the flanged pinion c^3 and cup-bearing c^4, of the turn-table, the cup-bearing a', and cup d, substantially as described and shown.

7. The combination, with the turn-table B, brackets C D, flanged pinion c^3, and annular bearings c^4 f', of the main shaft c and operating mechanism.

8. The combination, with the swinging

bracket, the arms G G, and stops *g g*, carried by said arms, of the rigid bracket C, and cushion *g'*, secured to said bracket, adapted to engage with the stops.

9. The combination, with the swinging bracket and with the storm-vane, of a reciprocating tube and mechanism for operating the same to either manually or automatically swing the wind-wheel in or out of the wind.

10. The combination, with the swinging bracket and with the storm-vane, of the reciprocating tube, the tubular rack, and the pinion for operating the same.

11. The combination, with the storm-vane, the reciprocating tube, the tubular rack, and its pinion, of the pulleys and means for automatically and manually operating the same.

12. In a windmill, the combination, with the wind-wheel, and the tail and storm vanes, of the tubular turn-table, the main shaft, the reciprocating tube sleeved upon the main shaft within the turn-table, and mechanism for operating the same.

13. In a solid-wheel windmill, the combination, with the wind-wheel, of a balance-vane swinging horizontally and with said wheel, and adapted to prevent the automatic stopping of the wind-wheel by wind-pressure.

JOHN S. ADAMS.

Witnesses:
JNO. G. ELLIOTT,
WM. C. WHITING.