G. R. COMSTOCK.

WINDMILL.

No. 189,302. Patented April 10, 1877.

Fig. 1.

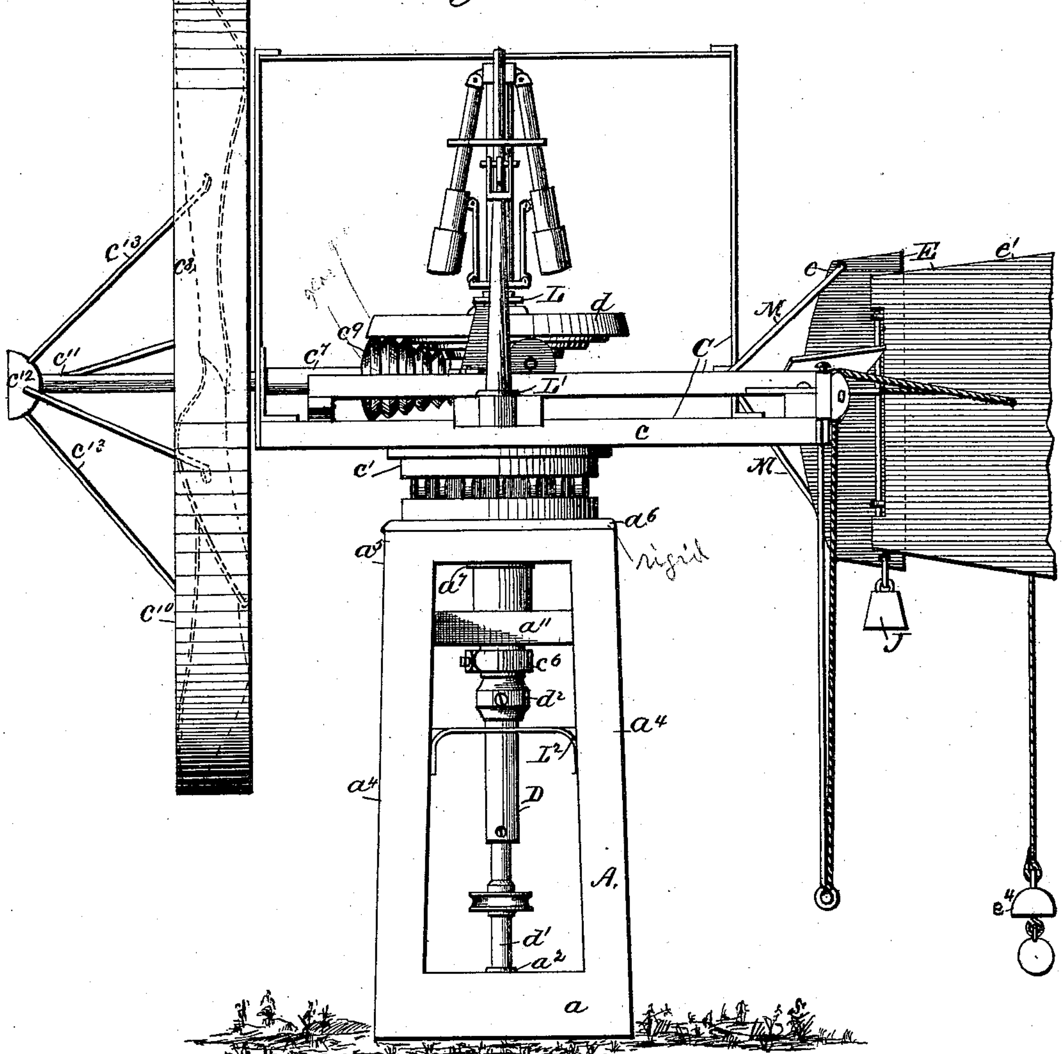

Fig. 2.

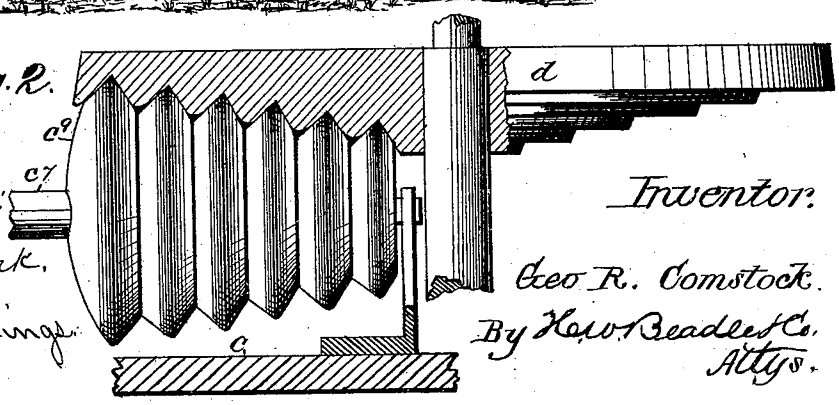

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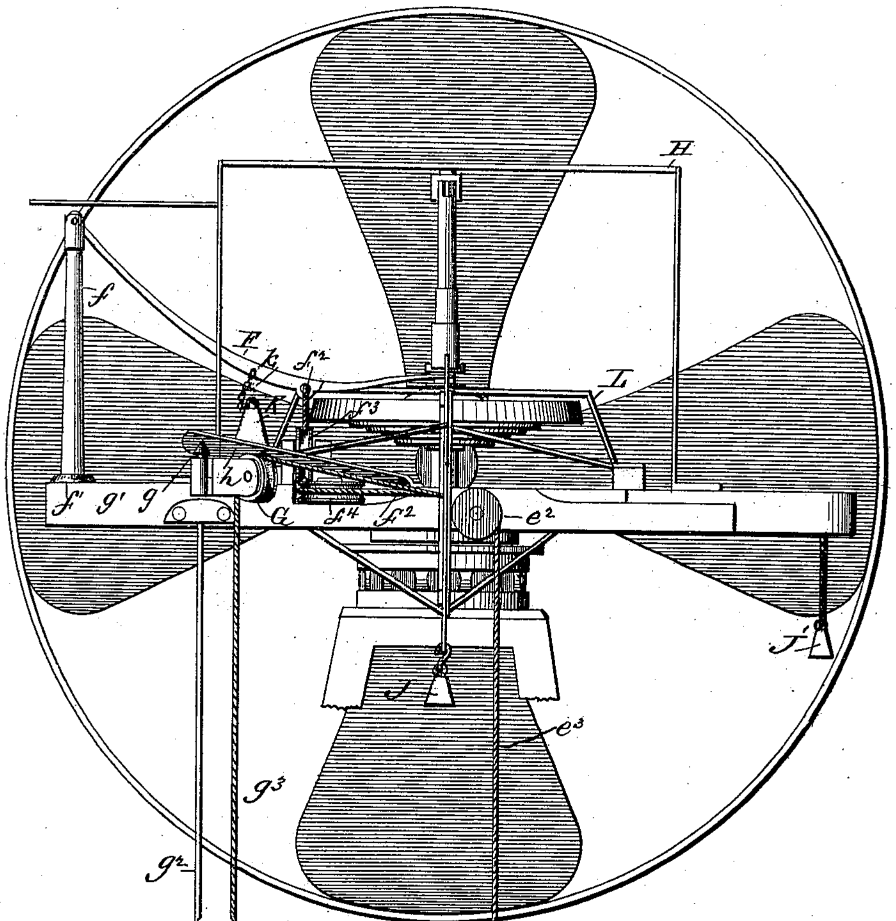
Fig 3



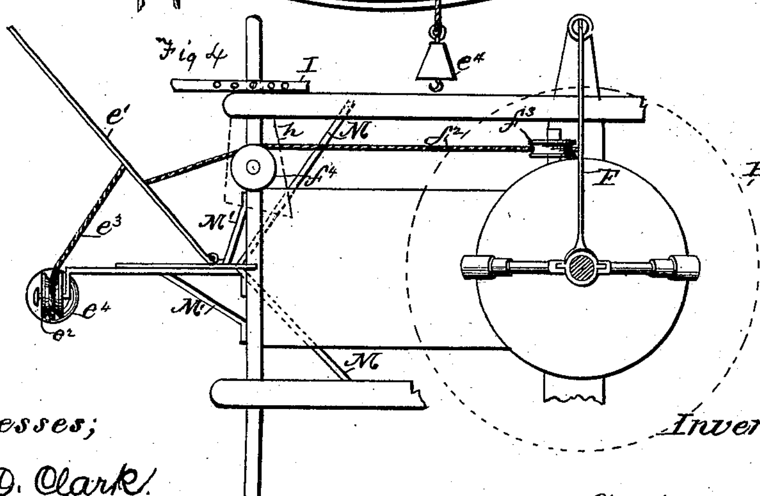


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Fig 5

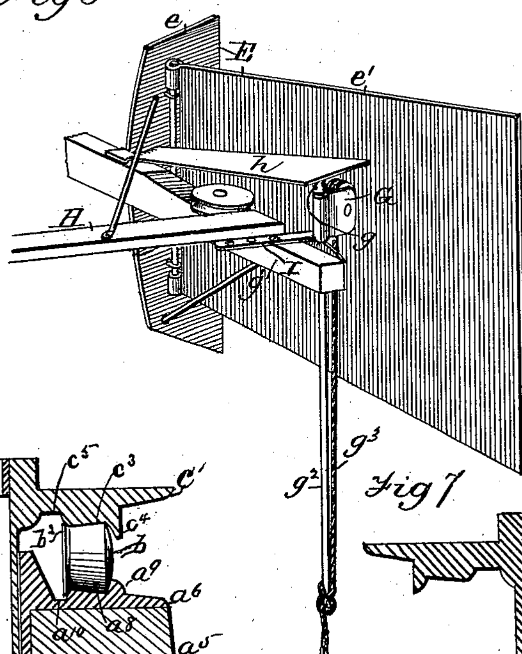


Fig 6

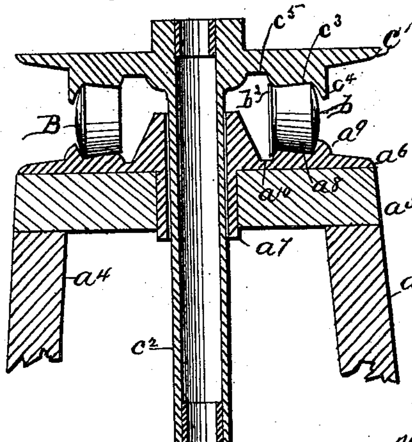


Fig 7

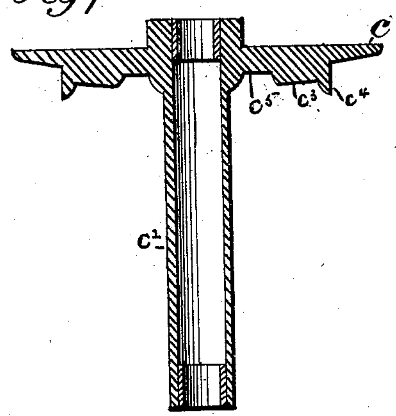
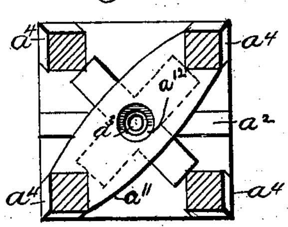


Fig 8



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UNITED STATES PATENT OFFICE.

GEORGE R. COMSTOCK, OF MANKATO, MINNESOTA.

IMPROVEMENT IN WINDMILLS.

Specification forming part of Letters Patent No. 189,302, dated April 10, 1877; application filed August 1, 1876.

To all whom it may concern:

Be it known that I, GEORGE R. COMSTOCK, of Mankato, county of Blue Earth, and State of Minnesota, have invented a new and useful Improvement in Windmills; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

This invention consists mainly, first, in the employment of certain novel anti-friction devices between the stationary or base part of the mill, and the upper portion revolving upon it; second, in the employment of certain novel friction bearing-wheels for communicating the motion of the wind-wheel shaft to the main vertical shaft; third, in the employment of certain novel devices for governing the speed of the windmill; and, fourth, in the employment of certain novel means for holding the wheel out of the wind when it is desired to stop the mill.

It further consists in certain details of construction, which, in connection with the foregoing, will be fully described hereinafter.

In the drawings, Figure 1 represents a side elevation of my improved windmill; Fig. 2, an enlarged view of the devices for connecting the movement of the wind-wheel shaft to the main vertical shaft; Fig. 3, a rear elevation of the upper part of the windmill; Fig. 4, a plan view; Fig. 5, a perspective view, illustrating the manner of holding the wheel out of the wind; Fig. 6, a partial sectional elevation of the friction devices between the base portion and upper portion of the mill; Fig. 7, a sectional elevation of the bearing-plate c^1 detached, and Fig. 8 a transverse sectional elevation of the base or tower.

To enable others skilled in the art to make and use my invention, I will now proceed to describe fully its construction and manner of operation.

A, Fig. 1, represents the foundation structure of the mill, which may consist, generally, of any suitable frame-work rising from a proper base, but is here represented with a base, a, having a transverse bar or beam, a^2, Fig. 8, with central bearing-opening a^3, and also corner beams or pillars a^4, rising therefrom a proper distance, and united at the top by a platform, a^5, as shown.

a^6, Figs. 1 and 6, represents a circular casting or plate adapted to rest upon the platform a^5, and be rigidly secured thereto, which is provided with a dependent sleeve, a^7, adapted to extend through a central opening in the platform, and upon its upper face with an inclined bearing-surface, a^8, a guiding-flange, a^9, and an annular recess, a^{10}, as shown.

a^{11}, Figs. 1 and 8, represents a beam diagonally held between two pillars near their upper ends, which has a central opening provided with an anti-friction sleeve or bushing, a^{12}, as shown.

B, Fig. 6, represents one of a series of anti-friction rollers, adapted to rest upon the inclined bearing-surface of the foundation-plate, which consists, essentially, of a suitable piece of metal, corresponding in form with the frustum of a cone. b represents one of a series of rollers, which is identical with the roller B in construction, with the exception that its smaller end is extended somewhat in length beyond the end of roller B, and is provided with an annular flange, b^2, as shown. These rollers are located upon the inclined bearing-surface a^8, and alternate with each other, so that each flanged roller rests between two plain rollers, and each plain roller between two flanged ones, as shown.

C, Fig. 1, represents the superstructure, adapted to revolve upon the fixed foundation, which consists, mainly, of a base-plate or beam, c, adapted to sustain the other parts attached thereto.

c^1, Figs. 1, 6, and 7, represents a circular bearing-plate, rigidly secured to the lower side of the beam c near one end, which is provided with a central tube or sleeve, c^2, having anti-friction bearings or bushings at its ends, and also with an inclined bearing-surface, c^3, flange c^4, and recess c^5, identical in construction with the corresponding parts of the foundation-plate a^6.

This bearing-plate c^1 is supported by the anti-friction rollers, which rest upon the foundation-plate a^6, the parts being accurately held in place by the tube c^2, which extends through the central opening in the foundation-plate, and also through the sleeve a^{12} of the beam a^{11}. c^6, Fig. 1, represents a stop-collar, by means of which the tube c^2 is held against vertical movement. c^7 represents the wind-wheel shaft, supported in proper bearings at one end of the beam c, which is provided at one end with the wind-wheel c^8, having fixed vanes of any proper construction, and at the other with the conical gear-wheel c^9, having annular V-shaped grooves, as shown. c^{10} represents a circular band or tire, inclosing the ends of the wheel, which is preferably sufficiently broad to extend from edge to edge of the vanes, set at an angle, and protect them from the force of the wind when the mill is stopped. c^{11} represents an extension of the wind-wheel shaft, which projects outward beyond the wind-wheel a proper distance, and is provided at its outer end with a cup or disk, c^{12}, as shown. c^{13} c^{13} represent any suitable number of brace-rods extending from the disk c^{12} to the vanes, as shown, by means of which great strength is given to the wheel without increasing materially its weight.

D represents the main vertical shaft, to which power from the wind-wheel shaft is communicated, and from it transferred to any desired point. This is provided at its lower end with a coupling-socket and a transverse pin-opening, or with other suitable coupling devices, and at its upper end with a centrifugal governor of the usual well-known construction. d represents a conical plate or crown-wheel, rigidly attached to the shaft below the governor, which is provided with a lower bearing-surface of conical form, having annular V-shaped grooves, as shown. This plate or disk is, in fact, a friction gear-wheel, and rests upon and is supported by the conical gear-wheel c^9, as shown.

The V-shaped projections and corresponding recesses of the gear-wheels are so formed relatively to each other, as shown in Fig. 2, that the points of the projections do not touch or bear upon the bottom of the recesses, and consequently the weight of one part resting upon the other has a tendency to wedge the two parts together, and cause them to interlock so firmly that slipping is impossible. At the same time it will be understood that movement is communicated from one part to the other by a rolling contact, so that the friction and wear is reduced to a minimum, a positive connection being obtained without the usual grinding or rubbing of one part upon another.

The main vertical shaft extends through the tube c^2, and is united at its lower end by any proper coupling device, as before stated, to a pulley-shaft, d^1, held at its lower end by the transverse beam a^2. If desired, other suitable means may be employed for conveying the power to any desired point.

d^2 represents a stop-collar, by means of which the shaft D is held against vertical movement.

E, Figs. 1 and 5, represents the vane, consisting of a fixed part, e, rigidly attached to the rear end of the beam c, and a movable part, e^1, hinged to the fixed part in any suitable manner.

e^2, Figs. 3 and 4, represents a grooved pulley, supported in rear of the movable part of the vane by any suitable rod or beam extending from the rear end of beam c, as shown.

e^3 represents a cord or rope of proper length, which is attached at one end, in any proper manner, to the movable part of the vane, and provided at the other with one or more weights, e^4, an intermediate portion passing over the pulley e^2, as shown. The movable part of the vane, it will be observed, is so hinged to the fixed part as to swing in one direction only, its movement being limited by the fixed part of the vane, against which it shuts. The tendency of the rope and weight just described is to hold the vane in its normal position—that is, at right angles to the wind-wheel.

F, Fig. 3, represents a lever, pivoted at one end to the upper end of the vertical standard f, rising from the transverse beam f^1, and provided at the other with fingers, adapted to rest in the groove of the governor-sleeve. f^2, Fig. 4, represents a cord or rope of suitable length, which passes under the vertical pulley f^3, about the horizontal pulley f^4, and is secured at one end to the lever F, and at the other to the movable vane, as shown.

G, Figs. 1, 3, and 5, represents a vertical pulley, the block of which is pivoted to a vertical standard, g, rising from the transverse beam g^1, as shown. g^2 represents a hanging beam or rod, depending from the end of beam g^1, which is provided at its lower end with an eye or other proper fastening device. g^3 represents a rope attached at one end to the movable part of the vane, which, after passing over pulley G, hangs down within convenient reach from the ground, or suitable platform upon the tower.

H represents a cover of suitable construction, supported upon proper standards, which is adapted to protect the central portion of the mill; and h, a cover adapted to protect the pulley f^4, G.

I, Figs. 4 and 5, represents an adjustable stop-bar, adapted, by means of a series of holes and a proper fastening-screw, to be secured in any desired position upon the bar g^1. By means of this bar the hinged vane may be fastened in any desired position, for the purpose of limiting the speed or partially stopping the mill, as will be described hereinafter.

J J′ represent weights, located at the rear end of the turn-table frame, which are employed to counterbalance the wind-wheel at the other end of the frame. The latter weight, J′, is also located upon the side opposite to that against which the free end of the vane swings in closing, so that it serves also as a counter-balance to the vane when the mill is stopped, and when it swings away from its normal center line.

K represents an auxiliary weight, attached, by an intermediate slack chain or rope, k, to the governor-lever, as near as possible to its moving end. This weight, which should exceed the governor-balls in weight, does not act in the usual movements of the mill, but remains dormant until an excess of speed over that desired raises the governor sufficiently to take up the slack, when it acts by its weight to prevent further excess of movement. This weight, also, may be attached directly to the governor-lever, when the mill is laid to, for the purpose of preventing an excess of movement in a high wind or gale, the proper lay-to speed, however, being permitted, as described.

L represents boxing adapted to support the vertical shaft between the governor and the crown-wheel.

L^1 represents boxing located on the turn-table frame, and L^2 boxing near the lower end of the shaft. These or any part of them may be employed, if desired, instead of the boxing within the sleeve c^2.

M M M′ M′ represent a system of braces, by means of which the fixed portion e of the vane is strongly held.

The operation is substantially as follows:

The general operation of this mill is similar to others of its class—that is, the wind-wheel is held in the wind by the vane, and it is moved out of the wind by devices actuating the hinged vane.

The operation of the peculiar features of construction described is as follows:

The superstructure revolves freely upon the foundation portion, the friction being greatly reduced by the anti-friction rollers employed between the fixed and moving parts. The action of these rollers is peculiar.

Being conical in form, and resting upon a bearing-surface having the proper incline, it follows that each portion of their peripheries will revolve at its proper speed, the inner portions, which have a smaller circle to traverse, revolving, of course, more slowly than the outer. To make the movement of the rollers certain, however, and to prevent cutting or grinding by the irregular action of any part, the intermediate flanged rollers are employed, which, being themselves accurately guided by the annular recesses a^{10} c^5, serve, also, to guide accurately the plain rollers between them, so that the entire series move in harmony, and enable the superstructure to revolve with a minimum amount of friction.

The wind-wheel, having fixed vanes, is revolved by the direct action of the wind, the power thus obtained being transferred to the main vertical shaft by the intermediate friction-gearing described. The whole weight of the vertical shaft and its attachments, it will be observed, rests, by means of the disk, upon the gearing of the wind-wheel shaft, and hence these parts, in consequence of the peculiar V-shaped recesses and projections, are wedged together, so that slipping is impossible. This wedging action is insured by constructing the projections and recesses of such form that the points of the former cannot bear upon the bottoms of the latter, and hence the inclined sides are necessarily wedged together, as described, and thus prevent slipping. It will be understood, also, that the power is conveyed from one to the other by a rolling contact, and hence that there is no grinding or cutting between the parts, but, on the contrary, great smoothness and freedom of action, the mill, in consequence, being operated by a very small amount of wind.

The speed of the windmill is determined by the action of the centrifugal governor.

This may be properly adjusted to allow the mill to run at any speed from the slowest movement up to the most rapid within the limits of safety.

When this limit is reached, the governor-sleeve, being raised by the action of the rapidly-revolving balls, actuates the lever, and, by means of the intermediate rope, swings the hinged portion of the guiding-vane out of its normal position. The position of the vane being changed, the mill is consequently revolved, and the wheel moved out of the wind, the distance of its movement, of course, depending upon the movement of the vane.

This vane, it will be understood, is drawn out of its normal position by the operation of the governor against the action of the weights e^4, and, consequently, when the governor-balls fall under the reduced speed, the weights draw back the vane to place, and the wheel is again thrown into the wind.

The speed of the wheel is thus regulated so that it cannot exceed the limits of safety, no matter how violently the wind may blow.

For some purposes the wheel may run at a comparatively low rate of speed, and thus do its necessary work without the wear and tear incidental to a higher rate.

This result may be accomplished by lessening the amount of weight employed to draw the hinged vane to place. For instance, if a single weight be employed, the governor-balls, having less to overcome, will consequently be thrown out at a lower rate of speed than if more weights were employed.

By employing additional weights, on the other hand, the speed of the mill will be increased, because the balls, having more resistance to overcome, cannot act unless the shaft revolves more rapidly. By the addition or removal of weights the speed of the mill may be readily and accurately regulated.

When it is desired to stop the mill entirely, the vane is drawn by means of the rope into the position shown in Fig. 5, where it lies, as will be observed, in a plane parallel to the plane of the windmill, and consequently the latter is held out of the wind. The rope may be secured in any proper manner to the rod, as shown.

The better practice, however, it is believed, is not to stop the mill entirely under any circumstances, but to allow it, when laid to, to run at a low rate of speed, for the purpose of relieving the wheel and tower from strain.

The vane may be readily adjusted for accomplishing this object by the employment of the adjustable stop-bar I, the precise position occupied by the vane depending somewhat, of course, upon circumstances.

By means of the stop-bar, also, the vane may be held at the proper angle to run the mill at a low rate of speed, for avoiding wear and tear, as before described, without the possibility of its slamming or banging against any of its parts.

The auxiliary weight may be used for some purposes without a regulating-vane; but it is especially designed as a safe-guard against excessive speed in gales, or in case of the breakage of any of the controlling parts.

It need not be employed under ordinary circumstances, but be attached when a gale threatens, or when the mill is laid to, for the purpose of guarding against excessive speed.

Some of the advantages of the described construction are as follows:

By the employment of the anti-friction devices between the foundation and superstructure of the mill the moving part is enabled to turn with great readiness, and the wear of the frictional surfaces is reduced to a minimum.

By the employment of the friction gear-wheels power is transferred from the wind-wheel shaft to the main shaft without slip, and without a rubbing or grinding action between the bearing parts.

By the employment of governing devices described the speed of the wheel may be regulated with great readiness and accuracy.

By the employment of a lay-to stop-bar the mill may be run at a low rate of speed when desired to, and thus relieve the wheel and tower from strain.

By means of this adjustable stop-bar, also, the hinged vane may be rigidly secured in such manner as to cause the mill to run at the lowest rate of lay-to speed, so that injury from violent movements of the vane is entirely prevented.

The devices, also, for stopping the mill are simple and easily used. The mill as a whole is simple in its construction, not liable to get out of order, easily regulated, and yet very effective in its action.

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

1. In combination with the foundation portion and the revolving superstructure of windmill, having inclined bearing-surfaces a^8 c^3, the conical loose rollers B, substantially as described.

2. In combination with a foundation portion and revolving superstructure of a windmill, a series of loose plain rollers, and a series of loose flanged rollers, the members of which alternate with each other, substantially as and for the purpose described.

3. In combination with the foundation-plate of a windmill, having an inclined bearing, a^8, and annular recess a^{10}, the corresponding plate above, and the intermediate loose rollers, substantially as described.

4. In combination with the vertical shaft of a windmill-shaft and the wind-wheel, the intermediate friction-gearing described, consisting of the wheels d, resembling in form the frustum of a cone, and wheel c^9, of corresponding form, the two being united by a series of V-shaped projections and recesses, substantially as described.

5. The vertical shaft D, having the disk d, with annular V-shaped projections and recesses, in combination with the wind-wheel shaft c^7, having the conical gearing c^9, with annular V-shaped projections and recesses, the projections being less in length than the recesses, so that the two are united to communicate movement by the weight of the upper, substantially as described.

6. The combination of the centrifugal governor, the lever, the intermediate rope, and the hinged vane, substantially as described.

7. The combination of the governor, lever, rope, and hinged vane with the retracting-weight, substantially as described.

8. In combination with the hinged vane e^1, and a fixed pulley, e^2, a cord, e^3, extending from the vane, over the pulley, to a point within reach, and provided at its lower end with a weight, e^4, having means for holding other weights, as and for the purpose described.

9. In combination with a governor and a hinged vane united by intermediate connecting devices, substantially as described, a retracting-weight, made adjustable, substantially as and for the purpose set forth.

10. In combination with the hinged vane, the stop-rope, adjustable pulley, and dependent beam g^2, as described.

11. The combination of a shaft having a crown-wheel provided with annular V-shaped projections and recesses, as described, with a shaft having corresponding projections and recesses, and supporting the former, as described.

12. A turn-table movement, having a series of intermediate loose flanged and plain rollers, alternated, located as described.

13. In combination with the hinged vane, the adjustable stop-bar I, substantially as and for the purpose described.

14. In combination with the governor-lever and the regulating-vane, the removable auxiliary weight, as described.

This specification signed and witnessed this 22d day of July, 1876.

GEORGE R. COMSTOCK.

Witnesses:
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