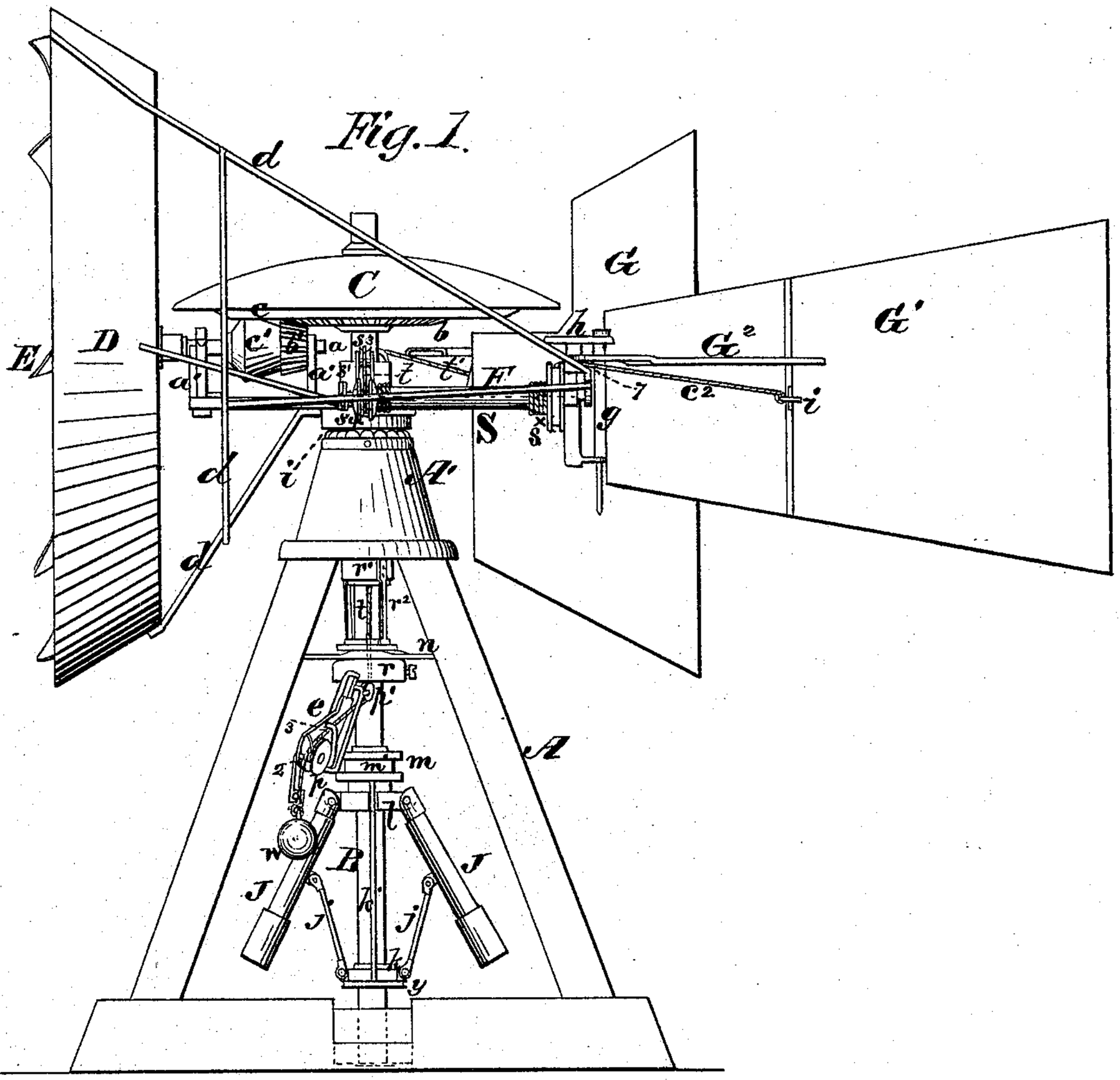
3 Sheets—Sheet 1.

G. R. COMSTOCK.

WIND-MILL.

No. 177,805. Patented May 23, 1876.

Fig. 1.



Witnesses.
R. F. Campbell,
L. N. Campbell

Inventor
Geo. R. Comstock
by
Mason, Fenwick & Lawrence.

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Fig. 2

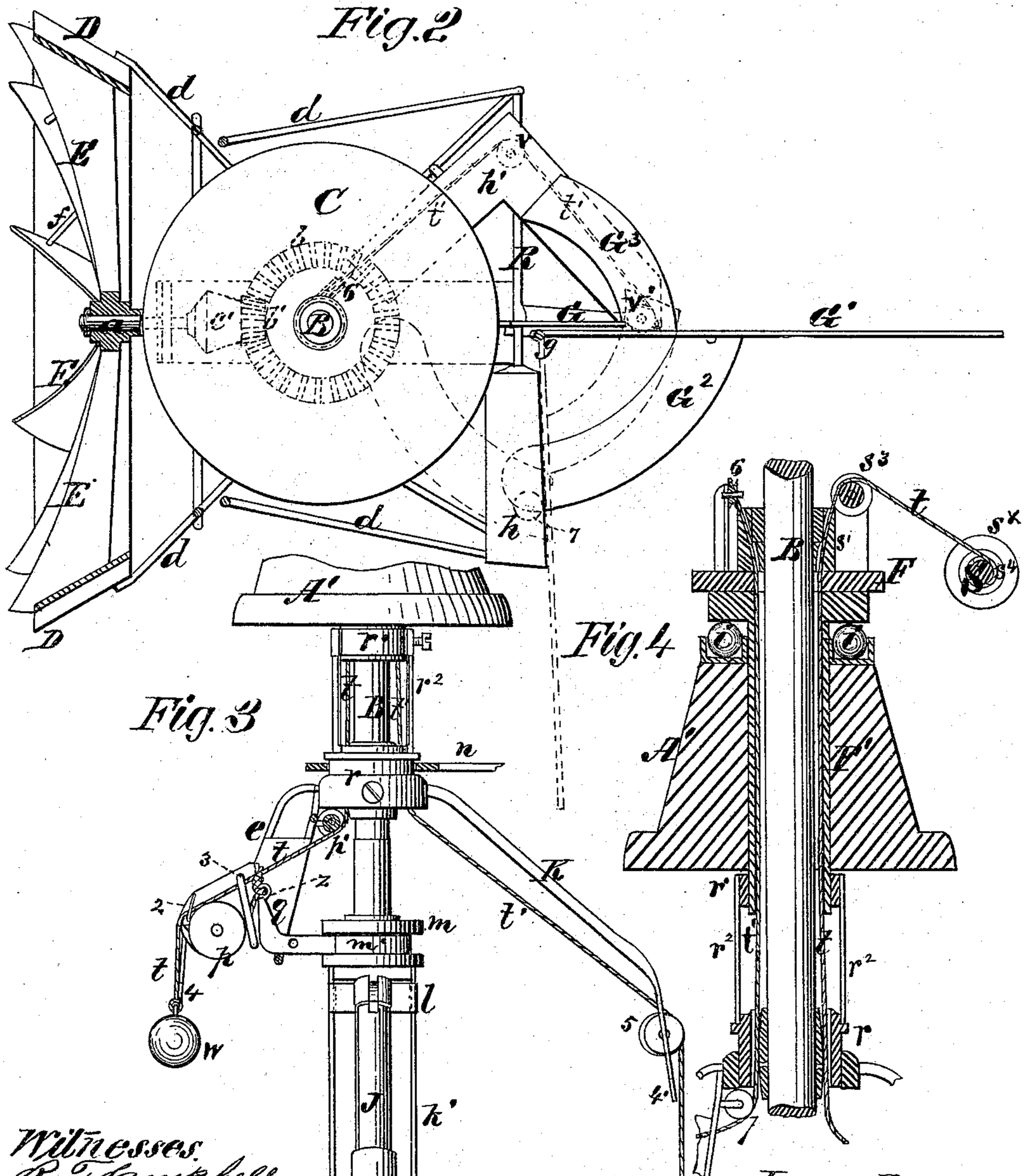

Fig. 3

Fig. 4

Witnesses.
R. F. Campbell
J. V. Campbell

Inventor
Geo. R. Comstock
by Mason, Fenwick & Lawrence.

3 Sheets—Sheet 3.

G. R. COMSTOCK.

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Fig 5

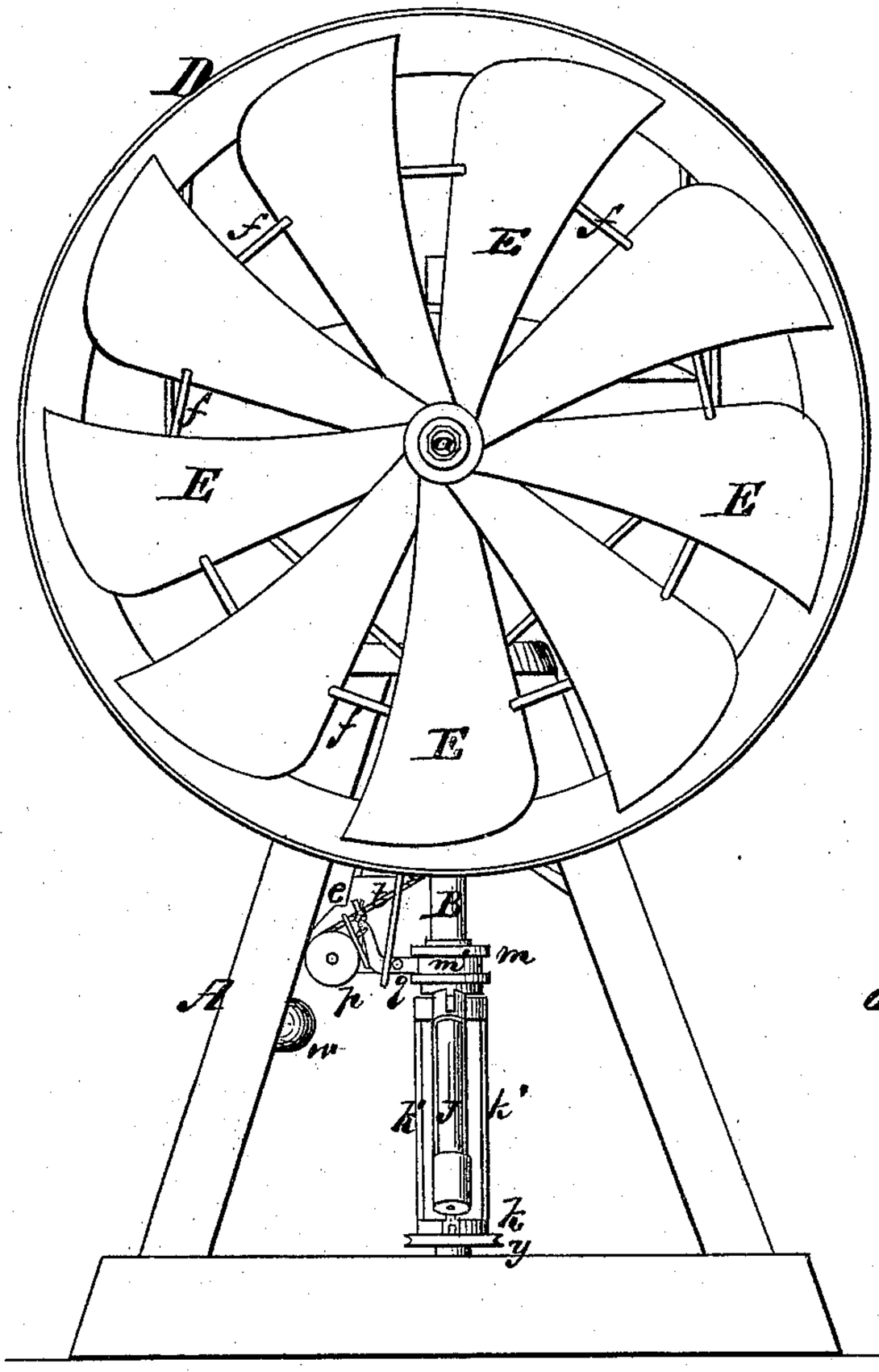
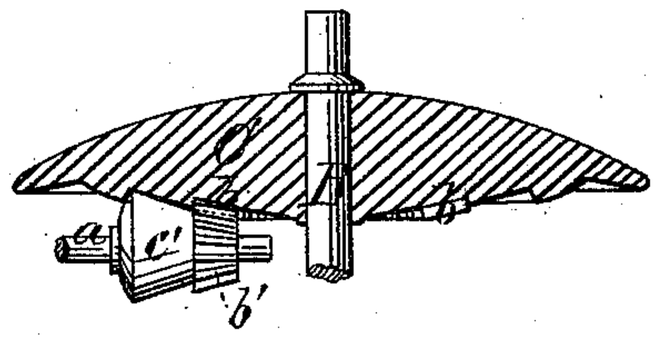


Fig. 6



Witnesses.
R. F. Campbell.
J. H. Campbell.

Inventor
Geo. R. Comstock
by
Munn, Pennell & Pierce.

UNITED STATES PATENT OFFICE.

GEORGE R. COMSTOCK, OF MANKATO, MINNESOTA.

IMPROVEMENT IN WINDMILLS.

Specification forming part of Letters Patent No. **177,805**, dated May 23, 1876; application filed July 25, 1873.

To all whom it may concern:

Be it known that I, GEORGE R. COMSTOCK, of Mankato, in the county of Blue Earth and State of Minnesota, have invented certain new and useful Improvements in Windmills; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1, Plate 1, is an elevation of one side of the windmill when the wheel presents its full face to the wind. Fig. 2, Plate 2, is a top view of the windmill. Fig. 3, Plate 2, is a view in detail of the governor attachments. Fig. 4, Plate 2, is a sectional view of the anti-friction support; it also shows the halyards passing up through the tower-head. Fig. 5, Plate 3, is a face or front view of the mill. Fig. 6, Plate 3, is a vertical section through the compound gearing.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates to certain novel improvements on windmills of that class which will automatically edge to the wind, and which has a governor applied to its vertical shaft, for aiding in maintaining uniformity in the running of the mill.

My improvements relate, first, to the wind-wheel and its wind gatherer or chute, the latter being securely braced and rigidly connected to the horizontal turn-table of the mill; second, to a compound gearing between the wind-wheel shaft and the vertical driving-shaft of the mill, said gearing consisting of plain-faced friction bevel-wheels, one of which is a crown-wheel, so constructed that it serves as a balance-wheel, and also a water-shed, for protecting the mechanism beneath it from rain and snow; third, to a novel mode of connecting gravitating-weights to a hinged vane, and of connecting one of such weights to the vertically-movable collar of a ball-governor.

The following description of my invention will enable others skilled in the art to understand it.

In the accompanying drawings, A represents the tower of the windmill, which consists of four posts, secured at their lower ends to a rectangular base, and at their upper ends to a head, A′, which is the shape of the frustum of a cone, and is cupped at its upper end. Between the cupped end of the head A′ and a circular hub, *s*′, to which a horizontal turn-table, F, is rigidly secured, are a series of balls, *i*, which afford an anti-friction bearing, and allow the table F to turn freely. B represents the vertical driving-shaft, which passes centrally through the tower-head A′, and has a large horizontal wheel, C, keyed on its upper end. D represents a wind gatherer or chute, which is the shape of a short frustum of a cone, and which is permanently and rigidly secured to the turn-table F by means of inclined and diagonal braces *d*. (Shown in Figs. 1 and 2.) E represents the wind-wheel, which is composed of blades that present flat surfaces to the wind, which blades are suitably feathered, and secured to a hub on a horizontal shaft, *a*, and strengthened by braces *f*. The blades are increased in width from their hub outward, and their outer extremities are sloped, so as to give to them a shape corresponding somewhat to the peaked shape of a vessel's mainsail. Surrounding this wind-wheel is the chute D, above referred to, the object of which is to gather the wind into the wheel, and also to shield the wheel entirely from the wind when brought exactly edgewise thereto. As this chute D flares outwardly or toward the wind, its inner surface will deflect the wind toward the shaft *a*, against the blades of the wheel, thereby allowing the wind to exert its maximum force on the wheel. The wheel-shaft *a* is supported in standards *a*′ *a*′, rising from the turn-table F on one side of the shaft B, and on this shaft a plain-faced bevel-wheel, c^1, and a spurred wheel, *b*′, are keyed. (Shown clearly in Figs. 1 and 6.) The wheel c^1 impinges against a beveled surface, *c*, formed on the bottom of the crown-wheel C, and the wheel *b*′ engages with teeth *b*, also formed on the bottom of the wheel C.

The two wheels c^1 *b*′ might be described as a long cone, a portion of whose periphery is plain and another portion is toothed. I thus combine friction and toothed surfaces in two wheels, the toothed surfaces being intended to prevent slipping under all circumstances, and the friction-surfaces being intended as the principal means for transmitting motion from

the wheel-shaft *a* to the vertical driving-shaft B. The wheel C is made of such diameter relatively to the parts beneath it that it will protect these parts from rain and snow, thus serving as a water-shed. This wheel C, its shaft B, and the parts hereinafter described as being connected to this shaft, are all supported upon the wheels c^1 b'; consequently the friction between the beveled surfaces c c^1 will be considerable, and may be still further increased, if desired, by loading the wheel C. This will also add to the wheel C additional power of equalizing the movements of the mill, for it will be seen that wheel C operates as a balance or fly wheel as well as a water-shed.

Just outside of the frictional surface *c* of the wheel C there is an annular flange, c^3, which overlays the outer end of the wheel c^1, and prevents endwise displacement of the wheels c^1 b', which would materially interfere with a free and smooth working of the mill.

To that end of the turn-table F opposite the wind-wheel is secured an auxiliary vane, G, which is in a vertical plane, intersecting the axes of the shafts *a* B, and in a plane which is at right angles to the plane of the face of wheel E. The vane G always maintains its position with respect to the wheel E. To one side of this vane G a vane, G^1, is connected by a vertical hinge, *g*, which allows this vane to swing from a plane at right angles to the plane of wheel E one-quarter around to a plane parallel to the plane of said wheel, as indicated by the full and dotted lines, Fig. 2. This hinged vane is the one which gives direction to the wheel E, and to it segment-shaped stays G^2 G^3 are secured, which extend out laterally, and are guided by wings *h* *h'*.

When the vane G^1 is in the position indicated in full lines, Fig. 2, the wind-wheel E presents its face squarely to the wind; but when said vane is in the position indicated by dotted lines, Fig. 2, the wind-wheel will be brought fully around, edge to the wind, and will be out of operation. This being the case, it is obvious that as the vane moves around from the full-line to the dotted-line position, the angle of the wheel E with respect to the wind-wheel varies, and its speed will be gradually diminished as it approaches the edge-to-the-wind position.

I will now describe the governor and its connections with the hinged vane G^1, for varying the angle of the same, as the force of the wind increases or diminishes.

The main governor on the vertical driving-shaft B consists of two loaded legs, J J, which are hinged at their upper ends to a flange, *l*, fixed on the shaft B, and which are connected below to a sliding collar, *k*, by means of links *j* *j*. Below the collar *k* is a pulley, *y*, from which motion can be communicated to any machinery by means of a belt. The collar *k* is connected, by means of vertical rods *k'*, to an annularly-grooved sliding collar, *m*, which moves with the collar *k*, and which is loosely embraced by a band, *m*, on which is an arm, *q*, of the form of an obtuse angle, as shown in Figs. 2 and 5. A cord is attached to the outer end of the arm *q*, which cord passes under a pulley, *p*, on an arm, *e*, and is connected to a cord, *t*, which passes over this pulley. The arm *e* is secured rigidly to and depends from a grooved collar, *r*, which surrounds the shaft B loosely, and which receives a bridge-tree, *n*, into its groove, which bridge-tree is rigidly secured to two standards of the tower A. The collar *r* is free to rotate in its bridge-tree, but not to move vertically, and the shaft B is free to rotate in the collar. The cord *t* has a weight, *w*, attached to its lower end, and this cord is held on its pulley by a loop, 2, and passes through a loop, 3; thence beneath pulley *p'*, up through the collar *r*, and up through a tube, F', and hub s^1; thence over a pulley, s^3, to and around a pulley, s^4, on a horizontal shaft, S, to which latter the cord *t* is secured.

The shaft S is supported at one end by an arm which extends out horizontally from the turn-table F, and at the other end shaft S is supported by a cross-beam, R, which is secured to the outer end of the turn-table, at right angles to it. Near the cross-beam R a pulley, $s^\times$, is keyed to the shaft S, around which passes a cord, c^2, which is carried outward and passes around a small pulley, 7, on the beam R, and thence to the vane G^1, to which latter the cord c^2 is secured at *i*. Diametrically opposite the arm *e* another arm, K, is secured to the grooved roller *r*, which carries a pulley, 5, on its outer end. A cord, *t'*, having weight *w'*, passes over pulley 5, and is carried up through the collar *r*, thence through tube F' and hub s^3, over a pulley, 6, thence around a pulley, *v*, at the outer end of beam R, and around another pulley, *v'*, at the outer end of the turn-table F. The cord *t'* is finally attached to the vane G^1, nearly opposite the attachment *i* of the cord *t*.

When there is no wind acting on the vane G^1, and the wheel E is face to the wind, the weight *w'*, pulling down on the cord *t'*, will hold the vane in the position shown in full lines, Fig. 2, and when it is desired to rigidly fix the vane in this position the cord *t'* is made fast around an extension, 4', of the arm K. The collar *r* is connected by short rods r^2 to a collar, r^1, above it, which latter is secured fast to the lower end of the tube F^1, that passes freely through the tower-head A', and has the turn-table F secured on its upper end. The collar *r*, with its arms *e* R, and the collar r^1, are thus caused to rotate around the shaft B with the turn-table; consequently the cords *t* *t* will not be wound upon the shaft B by the rotation of the turn-table.

It will be seen, from the above description, that, as the governor-arms rise by the speed of the mill, the collar *m* will also be lifted, and with it the arm *q*, which latter, being connected to the cord *t* by a short cord passing beneath and over pulley *p*, will draw down cord *t*, and move the vane G^1 more or less around out of a position at right angles to the

face of the wheel E. This will cause the wheel E to leave its position of face to the wind, and of course diminish the force of wind against it, and reduce the speed of the mill. The governor-arms then descend again when the force of the wind decreases, and allow the weight w' to draw the vane G^1 back to its former position, at right angles to the face of the wheel E.

By these means the governor regulates the speed of the mill, and in a strong gale of wind, which would be liable to destroy or derange the mill, the vane will be brought one-quarter around, and in a plane parallel to the face of the wheel E, when the latter will assume a full edge-to-the-wind position, and will not be rotated.

If it is desired that the governor shall not operate on the vane G^1, the cord t is made fast around an extension, 4, of the arm e.

In carrying out my improvements I propose to employ a number of windmills, constructed alike, and connected together by belts passing around pulleys y on the shafts B. Such mills will have comparatively small wind-wheels, and, in light winds, all of the mills may be run at the same time, and their collective power applied to drive machinery. In strong or very strong winds less than the whole number of mills may be run.

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

1. In a windmill, the combination of the crown-wheel C, constructed on its under side with plain and toothed bevel-surfaces, the braces and shaft of the wind-wheel, the compound toothed and plain bevel-gear C′, and the power-shaft B, all arranged and operated substantially as herein set forth.

2. The large wheel C on shaft B, serving both as a balance-wheel and a water-shed for the mill, substantially as described.

3. The adjustable or hinged vane G^1, hinged to G, and connected, by cords c^2 t and an arm, q, to the sliding collar m of the governor, for the purpose of having the governor regulate the speed of the mill according to the force of wind, substantially as described.

4. The cord t', connected to vane G opposite the point of attachment of the cord t to this vane, and carried over pulleys v', v, and 6, thence down through tube F and collar r, and thence over a pulley on the outer end of an arm, K, in combination with the weight w' and extension 4′, substantially as described.

5. The belaying-extension 4 on arm e, for the cord t, which is acted on by the governor, substantially as described.

6. The revolving but vertically-fixed collar r, carrying arms e K, and connected rigidly to a collar on the lower end of a tube, F′, substantially as described.

7. The pulleys $s^\times$ s^4 on shaft S, carrying cords c^2 and t, the cord c^2 being connected to the vane G^1, and the cord t communicating with the governor, substantially as described.

GEORGE R. COMSTOCK.

Witnesses:

JAMES BROWN,

JAMES A. WISWELL.