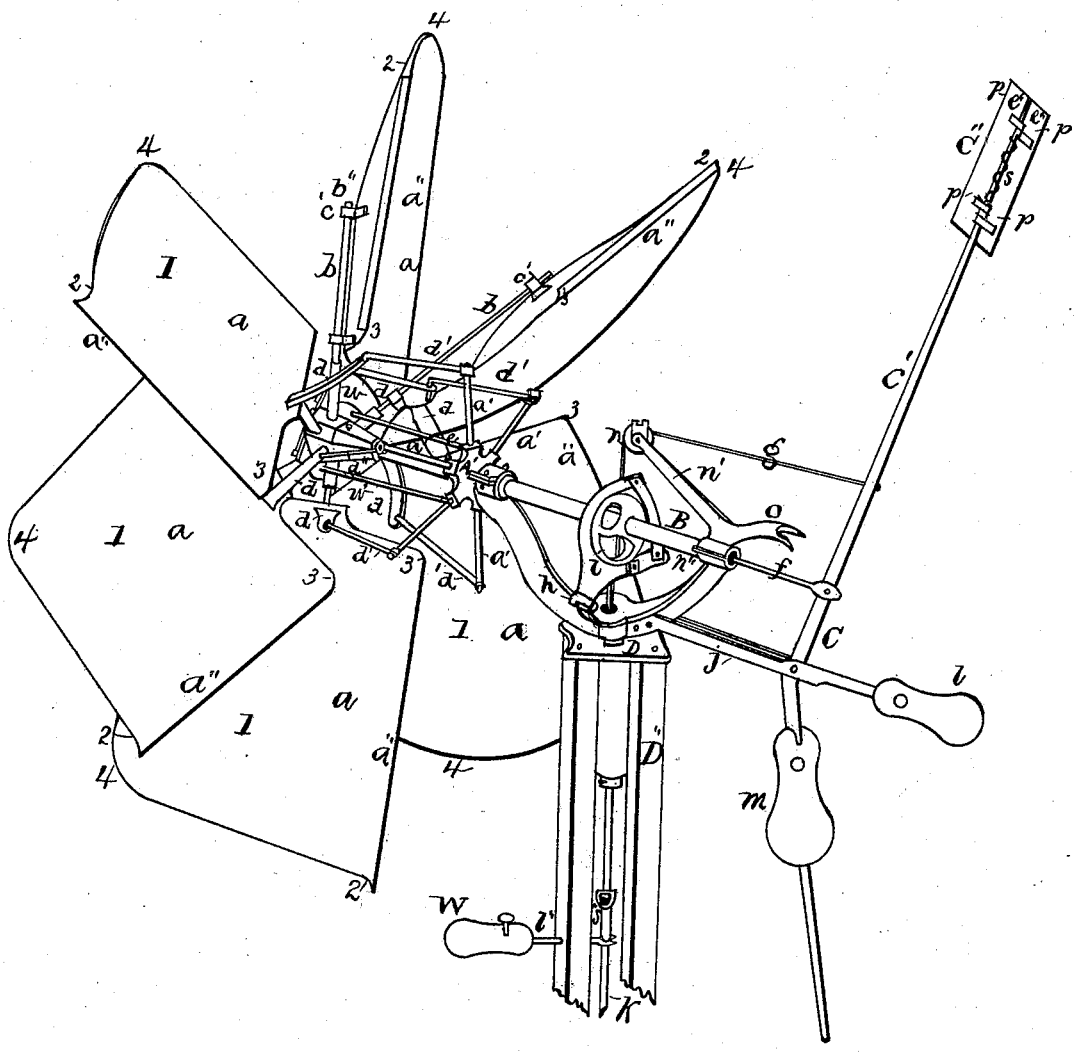
3 Sheets—Sheet 1.

F. W. SHELLABARGER.

Windmill.

No. 201,560. Patented March 19, 1878.

Fig. 1.



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F. W. SHELLABARGER.
Windmill.

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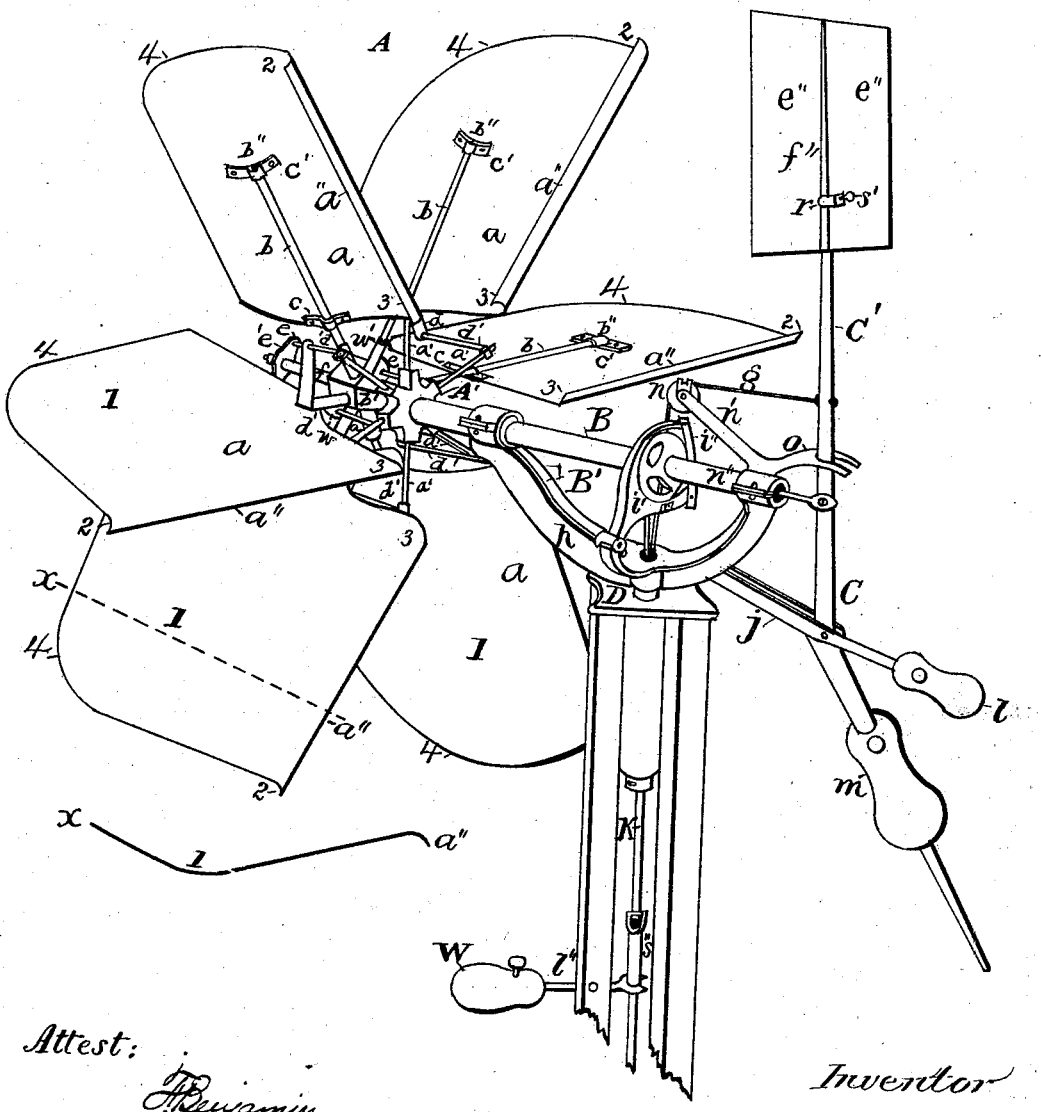
Fig. 2.



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3 Sheets—Sheet 3.

F. W. SHELLABARGER.

Windmill.

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Fig. 3.

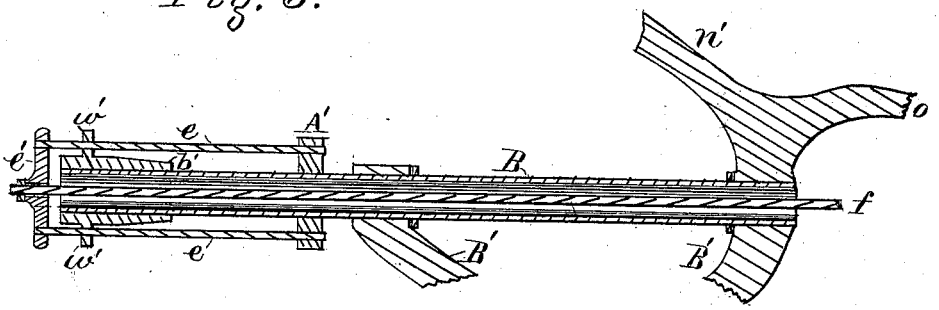
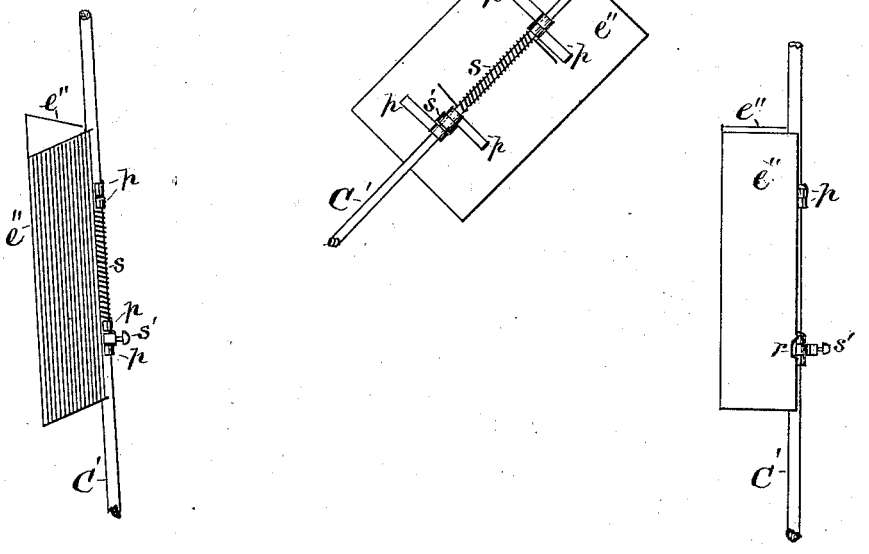


Fig. 4.



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M. M. Converse
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UNITED STATES PATENT OFFICE.

FLAVIUS W. SHELLABARGER, OF MIAMI COUNTY, OHIO.

IMPROVEMENT IN WINDMILLS.

Specification forming part of Letters Patent No. **201,560**, dated March 19, 1878; application filed December 13, 1877.

To all whom it may concern:

Be it known that I, FLAVIUS W. SHELLABARGER, of the county of Miami, in the State of Ohio, have invented a new and useful Improvement in Windmills, which improvement is fully, clearly, and concisely set forth in the following specification, reference being had to the accompanying drawings.

My invention consists in certain devices constructed and arranged in a windmill, as fully described hereinafter, to secure a better automatic adjustment of the vanes and regulation of the mill, and to increase its efficiency.

Three sheets of drawings accompany this specification—Sheet 1, with Figure 1, Sheet 2, with Fig. 2, and Sheet 3, with Figs. 3 and 4.

Fig. 1 is a perspective view of my improved windmill and its connections, shown in gear, or in the operative position. Fig. 2 is a perspective view of the same shown out of gear, or "out of the wind." A cross-section of wing *a*, through line *x*, is also shown. Fig. 3 is a longitudinal section of the main shaft, its bearings, the wheel-hub, and spider. Fig. 4 shows three views of the governor-fan, open, partially and wholly closed.

A is the wheel; *a a*, the wings, which are cut nearly square from sheet metal. The upper outside corner 4 is rounded; and in order to form a hollow or dish shape, the rounded corner is slit radially toward the center several inches, and the slitted parts lapped upon each other, and soldered or riveted together, though the wing can be struck up or swaged in dies the same shape. The inside or straight edge *a''* of the wing is in tangential line, and is curved backward to prevent vibration, and also to stiffen it. It also aids in guiding the wind-current into the hollow face of the wing.

b b are the spokes or arms of the wheel A. These can be made hollow, if preferred for lightness. *b'* is the hub of wheel A, which is fastened on the outer end of the hollow main shaft B. It is provided with six sub-arms for the insertion of the spokes *b b*. These latter pass through eye-plates *c c'* on the backs of the wings, as seen in Figs. 1 and 2. The upper or outer eye-plate *c'* is fastened near where the deflection of the wing toward its upper and outer corner 4 begins, or opposite to where its concavity is greatest, the arm *b* being about the middle line of the wing. The eye-plates *c* at the lower edge of the wing have a lever-arm, *d*, extending from them through the wing-plate forward nearly at right angles to its straight face, being cast in one piece with the same. These arms are curved somewhat laterally to bring them on an angle with the connecting-rods *d' d'*, by which they are flexibly coupled to the ends of the spokes *a' a'* of the spider A'. The spider A' is loosely fitted upon the shaft, so as to slide easily back and forth when operated by the governor C. Two parallel guide-rods, *e e*, connect the spider with a loosely-pivoted cross-head, *e'*, (which turns on rod *f* with the revolution of the wheel and spider,) at the wheel end of the main shaft B, passing through web-plates *w* in the wheel-hub *b'*, to guide and steady them, and from this cross-head the main connecting-rod *f* extends through the main shaft B (see Fig. 3) to the governor C at the opposite end. A broad curved fork, B', supports the shaft B in babbitted boxes. It has a long hollow stem, which extends down through the turn-table D (and its sleeve) to receive the pump-rod K, and the wire or cord *g*, attached to the governor-rod C'. On one side of the fork B' is a third arm, *h*, cast in one piece with it, to which is hinged the curved fork frame or guide *i'*, in which the eccentric *i* travels, the latter being fastened on the middle of the shaft.

To this fork-frame is pivoted the end of the pump-rod K, directly under the main shaft. A slotted horizontal arm, *j*, extends out some distance from the base of the main fork B', (at the opposite end from the wheel,) in line with the shaft B, and carries on it the balancing weight *l*. To this arm the governor-rod is pivoted, its upper part supporting the folding fan C'', and its lower extension the adjustable weight *m*. It is bent at an obtuse angle from its pivot outward, in line with the arm *j*, the upper part, which supports the fan, standing at an angle of about sixty degrees when the mill is in gear. The wire or cord *g* is attached to it, and passes over a small pulley, *n*, at the top end of the angular arm *n'*. This arm is cast in one piece with the upper section of the box *n''* on the governor end of the

fork B′, the arm extending over the eccentric *i*, while its lower extension, toward the governor-rod, has a fork, *o*, at the end, which stops the governor-rod C′ at the end of its movement toward the wheel, when throwing the latter out of gear.

The wire or cord *g*, after passing over pulley *n*, extends down through the hole for the pump-rod to the bottom of the derrick, and is used, when necessary, to operate the governor by hand in throwing the wheel out of the wind.

The fan C″ is in two sections, *e″ e″*. (See Figs. 1, 2, and 4.) It is divided vertically in the middle, where each section is hinged to the rod C′. To keep its two sections extended in line, a spiral spring, *s*, is coiled around the governor-rod between its hinges *p p*, having its ends bent out in opposite directions, so as to lie flat on the inside face of the plates *e″ e″*, bearing them back against a stop, *s′*, which is constructed in the form of a collar with a raised boss on its back end, (which forms the stop part,) and through which a set-screw is introduced to secure the fan to the rod. It is located between the two lower hinge-plates, as seen in the three views, Fig. 4. The stop has its set-screw and boss extending through a hole, *r*, formed by notches cut in the contacting edges of the two fan-sections next the rod. The fan is adjusted up and down on the rod by loosing the set-screw of the stop *s′*. When open the fan stands across the line of the main shaft, across the wind-current, which strikes it full on its face side *f″*. Its operation is shown in the views, Fig. 4, in which it is seen open, partially and wholly closed.

The pump-rod K is swiveled, and the swivel part *s″* of its coupling is extended in the form of a sleeve or collar, to form a bearing for the fork end of lever *l″*, which is seen in Figs. 1 and 2 pivoted to uprights in the derrick-frame, and extends out from the same, and carries the adjustable counter-weight W. This weight moves up and down with the pump-rod, and as it serves to ease its operation and regulate its motion, it can properly be combined with the governor of a windmill.

The coupling *s″* can be placed at any convenient place on the pump-rod, and the lever *l″* be placed opposite to it, so that its fork can operate against the sleeve; or a collar can be formed on the rod for the same purpose.

In the full-sized mill the lever *l″* is usually located about half-way down the derrick, inside of the same, being pivoted in uprights placed in the frame for that purpose.

In controlling the wheel by the action of the governor, it will be noticed that by slipping the weight *m* up higher on its arm, and the fan being also raised toward the top of the rod C′, the wheel A is easier thrown out of gear, while, by lowering each, it is more difficult to throw out of gear, the leverage of the governor-rod C′ being increased or lessened thereby.

I claim as my improvement—

1. A windmill provided with adjustable vanes, and with a regulator for governing said vanes, having a self-adjusting fan, *c″*, substantially as set forth.

2. In a wind-wheel, A, the wings *a a*, of nearly quadrilateral form, having the upper right or exit corner 4 rounded, the face of the wing dished or concaved at the point 1, and the forward edge *a″*, from angle 2 to angle 3, curved backward, substantially as shown and specified, as and for the purpose set forth.

3. In the wings or fans for windmill-wheels, having the forward edges *a″*, from 2 to 3, in tangential lines, and curved backward from the face, as described, a spherical triangular concavity, 1, struck up or formed by cutting and lapping the edges of the cut parts at the rounded corner 4 of said wing, said concavity being formed to concentrate the air-current at the point where the greatest amount of effective power may be given.

4. A wing or fan for wind-wheels, *a*, having a curve, 1, in its cross-section, and a scroll-edge through line *x*, as shown and described, as and for the purpose hereinbefore set forth.

5. Arm or lever *d* of the wing *a*, constructed in a single piece with the eye-plate *c*, as shown and specified.

6. Hub *b′*, having web-plates *w′* on each side of the same, cast between the two pairs of its sub-arms, provided with holes for supporting the guide-rods *e e*, inserted through them, as and for the purpose hereinbefore set forth.

7. A wind-wheel provided with radial adjustable vanes, hollow shaft B, inner rod *f*, connected to the vane-adjusting devices, and governor, provided with self-adjusting vanes, connected to said rod, as specified.

8. The combination, with the shaft B and eccentric *i*, of the forked vibrating guide-frame *i′*, attached to the pump-rod, as set forth.

9. Fork B′, having a curved side arm, *h*, a horizontal balance-arm, *j*, and an upper angular arm, *n′*, having a fork, *o*, and attached to its box *n″*, constructed substantially as set forth.

10. The combination, with the adjustable vanes, of an independent adjustable governor, with a fan which shall double up or shut together gradually in the direction of the wind-current as the latter increases in velocity, and open out again automatically as it decreases in velocity, as hereinbefore set forth.

11. Fan C″, having sections *e″ e″*, eye-plates *p p*, and spiral spring *s*, for securing it to the governor-rod C′, and operating it automatically as it is released from the pressure of the wind-current.

12. In a governor for windmills, a vertically-pivoted angular rod, C′, having an adjustable folding fan, C″, with a stop, S′, upon

its upper limb, and an adjustable weight, *m*, on its lower limb, said rod being pivoted to an arm, *j*, of the main fork B′, for the purpose of operating the wheel A through lever *f*, substantially as described.

13. The pivoted lever *l″*, having an adjustable counter-weight, W, constructed and arranged in relation to the derrick of a windmill, and its pump-rod and swivel or collar, as shown and described, as and for the purpose set forth.

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