(No Model.) 3 Sheets—Sheet 1.

C. H. BURLEIGH & W. A. WHEELER.

Wind Engine.

No. 233,977. Patented Nov. 2, 1880.

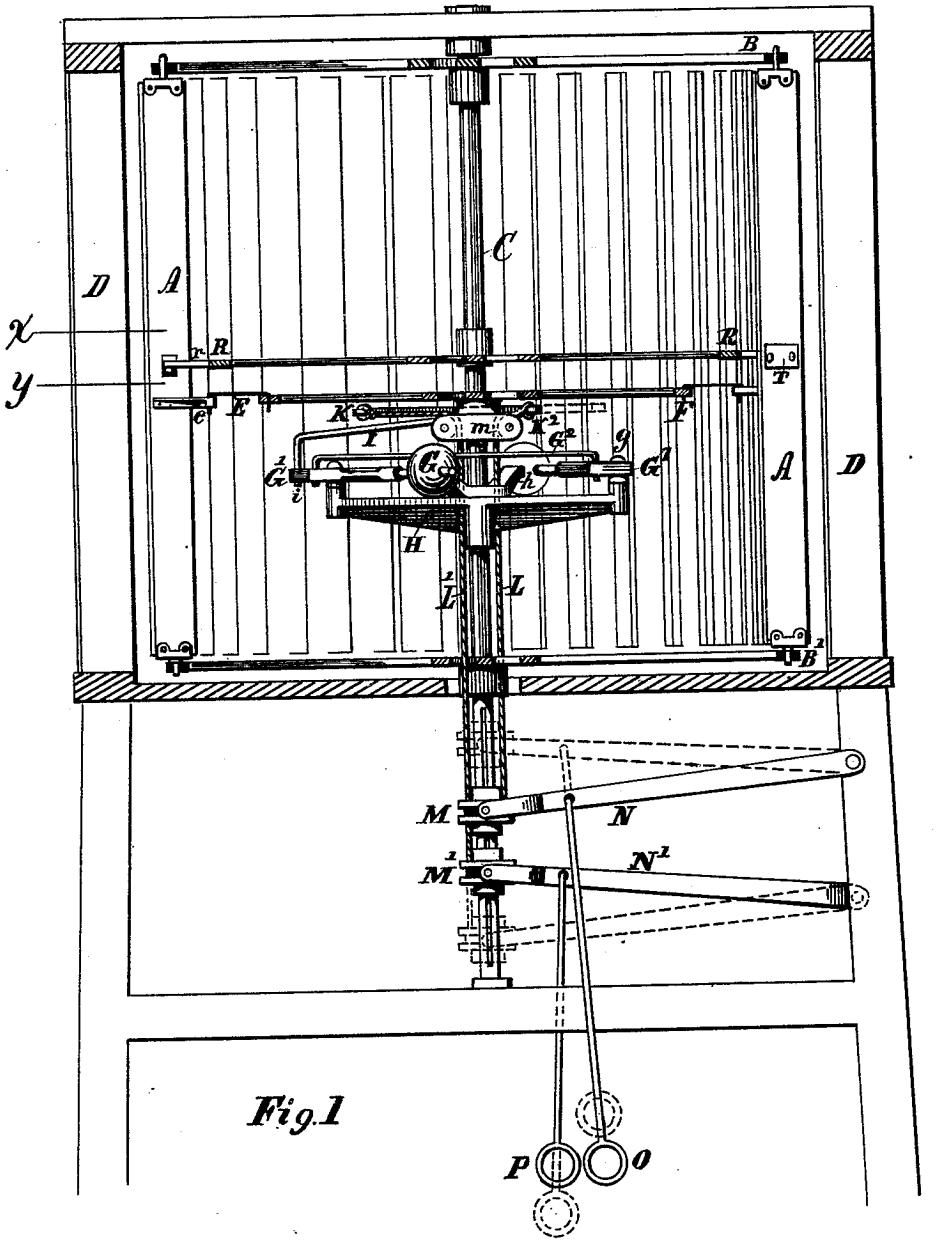

Fig. 1

Witnesses

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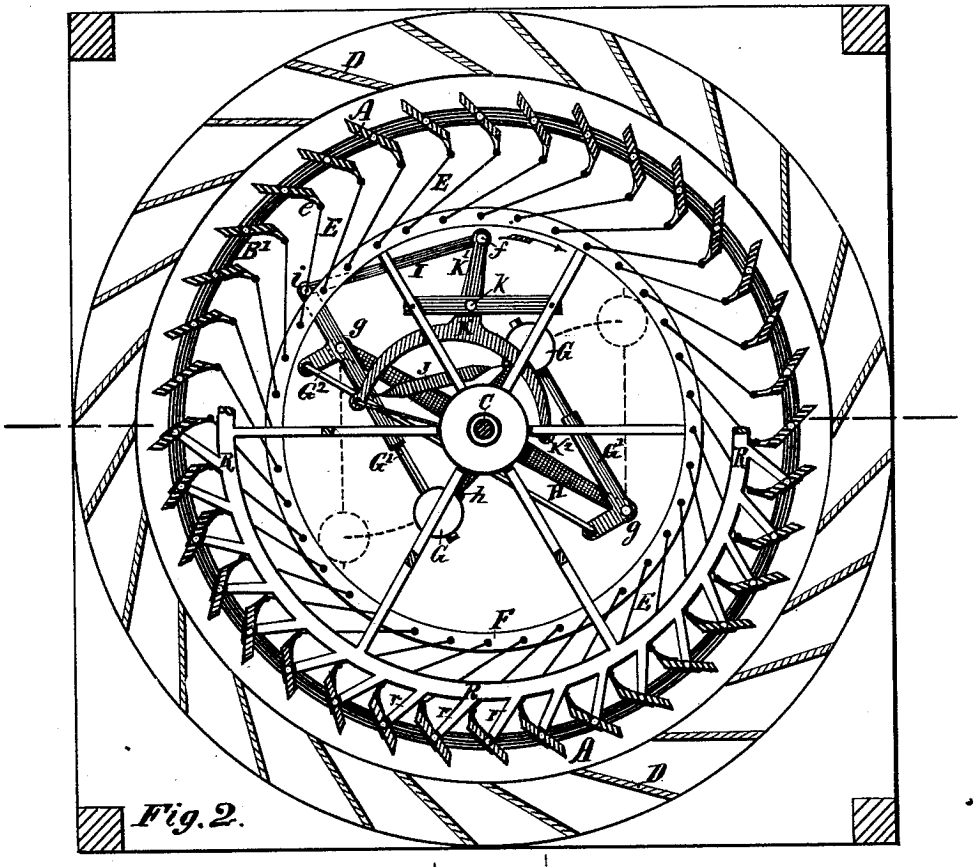

Fig. 2.

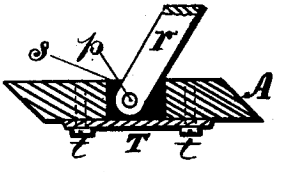

Fig. 7

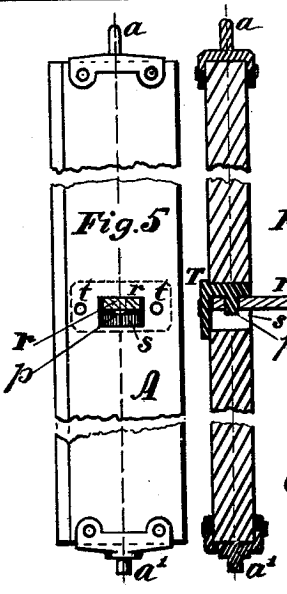

Fig. 5

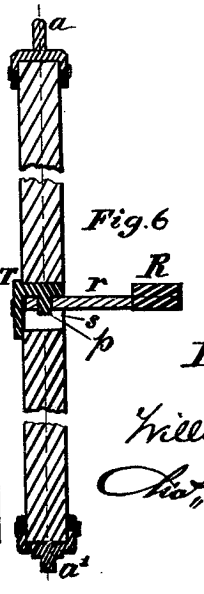

Fig. 6

Witnesses.

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C. H. BURLEIGH & W. A. WHEELER.

Wind Engine.

No. 233,977. Patented Nov. 2, 1880.

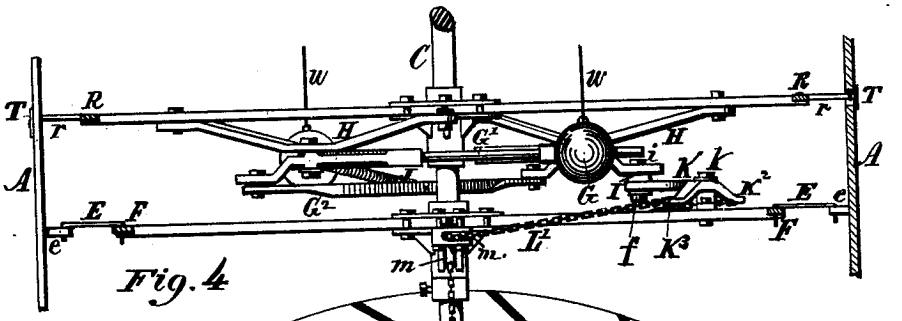

Fig. 4

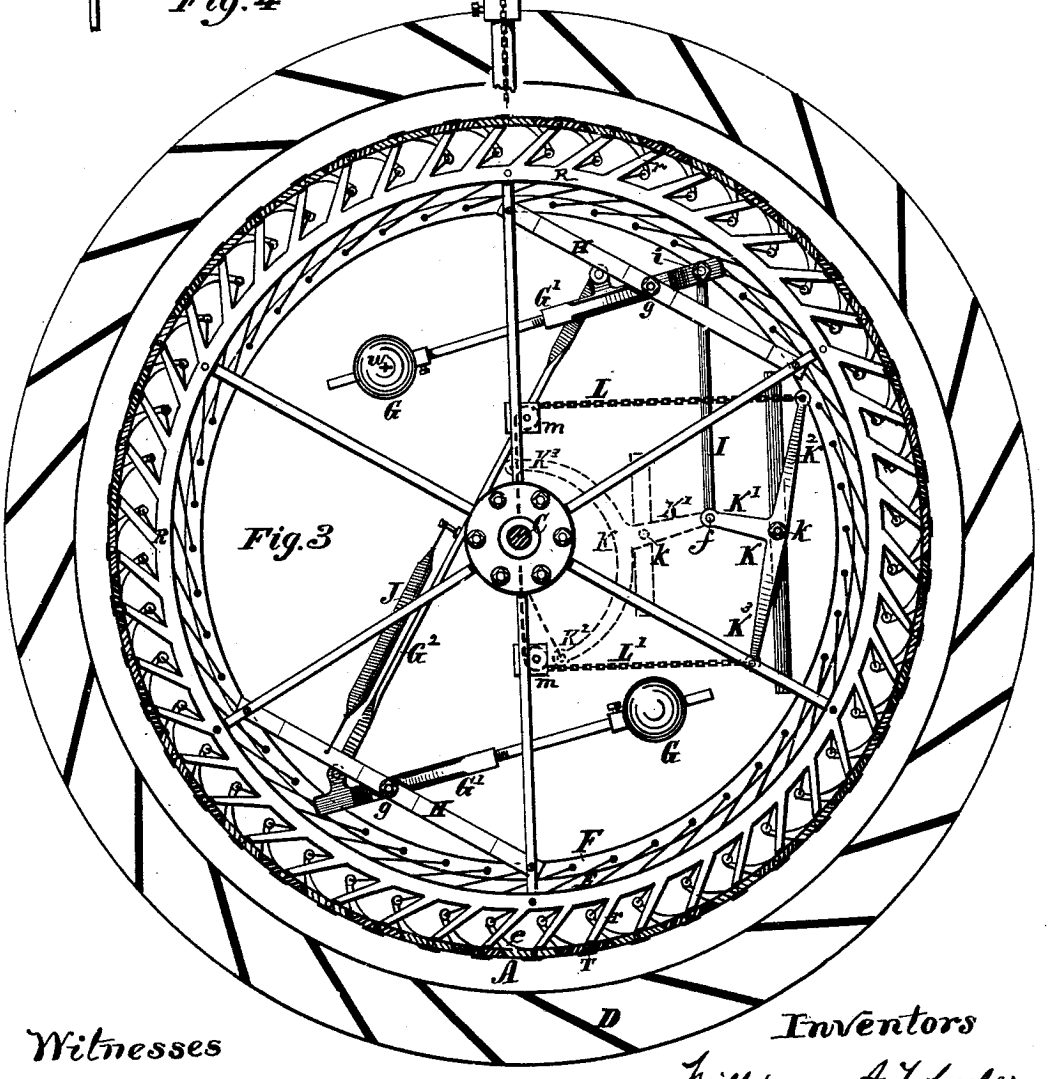

Fig. 3

Witnesses

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UNITED STATES PATENT OFFICE.

CHARLES H. BURLEIGH AND WILLIAM A. WHEELER, OF WORCESTER, MASS.

WIND-ENGINE.

SPECIFICATION forming part of Letters Patent No. 233,977, dated November 2, 1880.

Application filed March 29, 1880. (No model.)

To all whom it may concern:

Be it known that we, CHARLES H. BURLEIGH and WILLIAM A. WHEELER, both of Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Wind-Engines; and we declare the following to be a description of our said invention sufficiently full, clear, and exact to enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

Our invention relates to improvements in that class of wind-engines known as "horizontal mills," and more especially those having vertical sails, pivoted so as to change their angular adjustment, and automatically regulated by governing mechanism; and the objects of our improvements are to provide a simple, sensitive, and practical governor mechanism adapted for operating the rim by which the slats are turned; to provide convenient facilities for stopping and starting the mill at pleasure; to perfect the details of construction, and provide a support for the sails of such nature as will render the wind-wheel light, rigid, and effective in its action.

We attain these objects by mechanism substantially such as illustrated in the accompanying drawings and hereinafter described, the particular subject-matter claimed being hereinafter definitely specified.

Figure 1 is a central vertical section of a windmill embracing the features of our invention. Fig. 2 represents a sectional plan view, showing the parts in position as with the sails open, one half being shown at the height *x*, and the other half at the height *y*, Fig. 1. Fig. 3 is a sectional plan view, illustrating a modification adapted for large-sized wheels, and showing the parts in position as when the sails are closed for stopping the mill. Fig. 4 shows a side view of the governor devices and connections constructed similar to plan view, Fig. 3. Figs. 5, 6, and 7 are detail views illustrating the construction and arrangement of supports for sails.

In the drawings, A denotes the sail-slats; B and B′, the upper and lower end rims or sail-supporting wheels; C, the main shaft or axial support of the wheel; D, the cupola blind or deflector boards, arranged vertically about the tower, and E the operating-rods connecting the sail-boards or their arms *e* with the oscillating governor rim or wheel F. Said parts may be arranged and located in the manner shown, or substantially as described in Letters Patent No. 217,033. Their construction and operation need not, therefore, be herein more fully described.

Combined with the rim or wheel F, which is free to turn independent of the shaft C, we employ a governor mechanism located within the interior of the wind-wheel and constructed as follows: The weight or balls G are supported by horizontally-swinging levers G′, fulcrumed at *g* to a cross-piece or support-bar, H, which moves with shaft C. Pivoted at *i* to the shorter arm of the lever G′ is a connecting-rod, I, for operating the rim F and changing the adjustment of the sails as the balls G swing outward. Two weight-levers, G′, are preferably employed, set opposite each other and connected to work in unison by a link-bar, G^2, thus requiring but a single set of connecting devices between the governor and rim F. A spring, J, or its equivalent, is provided for drawing the balls G and levers G′ inward, and to the proper degree resisting the centrifugal force. Said springs may be made adjustable, if desired. Stops or buffers *h*, of any suitable form, may be arranged to prevent the balls from swinging too far inward by the action of the springs.

In large machines, where the levers G′ are quite long, wires or rods *w*, extending to the top wheel-spokes, may be used to sustain the gravity of the balls and prevent excessive side strain on the levers G′. (See Fig. 4.)

K indicates a controlling-lever for changing the position of the rim F relatively to the point of connection of the governor devices, so that the sails A can be opened and closed independently and without strain on the governor mechanism. Lever K is pivoted or fulcrumed at *k* on a suitable supporting-piece attached to or forming a part of the rim-wheel F. Said lever is made with three arms, one of which, K′, carries the pivot *f*, attaching rod I, which pivot is practically the point of connection between the governor mechanism and the sail-

adjusting rim F. To the other arms, K^2 K^3, of said lever are attached cords, chains, or equivalent connecting devices, L and L′, which pass around sheaves *m m*, for changing their direction, and are carried downward near the shaft C, through suitable openings in the hubs and journals, to a position below the wind-wheel, where they are respectively attached to the hubs or collars M and M′, that are arranged to slide toward and from each other along the shaft C, as indicated in Fig. 1. Forked levers N N′ (or equivalent devices for converting a revolving to a stationary connection) are arranged for actuating said collars, from which pull rods or cords are carried to any convenient location, as desired, where they terminate in suitable handles, O and P, by means of which the controlling mechanism may be operated at will, as follows: When the handle O is drawn down, the lever N slides the collar M down the shaft, and the lever K is, by the draft on chain L, caused to take position, as shown in Figs. 1 and 2, with its arm K^2 nearest to the shaft C, and the fulcrum *k* at the left of a radial line passing through the axis of the shaft C and connecting-pivot *f*. This brings the rim F to a position where the sails A will be open, as shown in Fig. 2, while the governor-balls G are at their inner position, resting on the stops *h*, the mill being then subject to the action and control of the governor mechanism; and as the speed of the mill causes the balls G to swing outward toward the position indicated by dotted lines, Fig. 2, the rim F will be moved by the rod I, and the sails thereby, to a greater or less degree, closed together, according to the force of the wind, giving greater or less speed to the wheel.

When the handle P is drawn down, (see dotted lines, Fig. 1,) the lever N′ slides the collar M′ down the shaft, and the lever K is, by the draft on chain L′, caused to assume the position indicated in Fig. 3, (dotted lines show a lever formed as in Fig. 2,) the arm K^3 being drawn nearest to the shaft and the fulcrum *k* carried to the right of a radial line through the axis of shaft C and pivot *f*, thereby moving the rim F independent of the governor mechanism, so that the sail-slats A are closed while the balls G are in against their stops *h*. The relative position of the rim F and point of governor-connection *f* is thus changed or shifted by the swing of the arm K′, so that the sails will remain closed, as shown in Fig. 3, until again opened by drawing the pull O or swinging the lever K to its former position. The mill can thus be stopped and started at will.

The rod I might, if desired, be pivoted directly to the rim F, in case no controlling devices were needed.

R indicates a rim or circle provided with a series of short inclined arms, *r*, for supporting and pivoting the sails. This rim R is retained by a central hub on shaft C, and a suitable number of radial spokes to keep it in proper position. The sails A are connected to the ends of the arms *r* by pivot blocks or castings T, arranged as indicated in Figs. 5, 6, and 7. Mortises or openings *s* are formed in the sail-boards A, into which the tongue part of the castings T and the ends of arms *r* are inserted from opposite sides of the sail, so that the pivot-pins *p*, which may be formed on either the arm or casting, will occupy a central position within the sail-board, or so that their axial lines will correspond with the axial lines of the upper and lower pivots, *a a′*. The flange or plate of the pivot-block T, through which the holding-screws or fastenings *t t* pass, rests upon the back of the sail, while the strain of the arm *r* is from the front, so that the force of the wind against the front of the sails tends to hold the pivot-blocks and sail-boards more firmly together instead of straining upon the attaching-screws *t*.

The openings *s* are made somewhat deeper than the thickness of the arms and pivot-block tongues, so that by lifting up the sails the pivots *p* may be released from their holes and the sails readily disengaged from the arms *r* when desired. The inclination of the arms *r* from the rim R permits of the sail being swung around for their open and closed adjustment without interfering; and this, together with the manner of jointing, avoids the necessity of reducing the sail area by cutting off the sails to give space for the connections.

The arms *r* being short, and also supported by the rim R quite near the sails, and the connections being made to support the sails in the manner set forth, permits of all of said parts being made comparatively light, while at the same time rendering the mechanism quite strong and rigid and supporting the thin narrow sail-boards firmly against springing or vibrating, while allowing their free action for adjustment. One, two, or more rims, R, with arms *r*, may be employed for supporting or for bracing the sails A, as desired. The rim provided with arms for supporting the sails, and the manner of connecting the sails thereto, are features of our invention.

If desired, the governor mechanism may be supported by the same hub or wheel which supports the rim R, as in Figs. 3 and 4, in lieu of a separate supporting-piece, as in Figs. 1 and 2, and the controlling lever or device K may be constructed and arranged in any convenient manner for changing the relative positions of the rim F and governor-connection by means of the pull devices, without departure from the spirit of our invention.

By connecting the arm K′ to a part of the wheel or support H the lever K and pull mechanism could be used for opening and closing sails in a mill having no governor.

What we claim as of our invention, and desire to secure by Letters Patent, is—

1. In a wind-engine, the combination of a series of narrow pivoted sails adapted to open and close, as set forth, an adjusting-rim, with

connections for simultaneously operating said sails, and a governing device located adjacent to and connected to operate said rim, consisting of one or more weighted levers fulcrumed to swing in a plane perpendicular to the axis of the main shaft and to revolve with the wheel, and a counteracting spring or springs, whereby the rim and sails will be automatically adjusted, in the manner set forth.

2. The combination, with the governor mechanism and the adjusting-rim by which the sails are operated, of an intermediate controlling mechanism actuated by hand-pulls, substantially as described, for changing the position of said rim in relation to the governor-connection, and, independent of the governor devices, stopping and starting the mill, as set forth.

3. In a wind-engine, the combination, with the supports H, attached to and moving with the main wheel or shaft C, and the rim F, by which the sails are adjusted, of the levers G′, fulcrumed at *g* and carrying balls G, connecting-rod G^2, spring J, and bar I, for the purposes set forth.

4. The combination, with the governor-connection I and adjusting-rim F, of the lever K and pull-chains L L′, for the purpose set forth.

5. The combination, with the governor mechanism and adjusting-rim, of the lever K, the chains L L′, sheaves *m*, and sliding collars M M′, for the purposes set forth.

6. The combination, with the sail-adjusting rim F, of the lever K, chains L L′, collars M M′, lever or forks N N′, and handles O and P, for the purposes set forth.

7. In a wind-engine having pivoted sails, a circle or rim provided with a series of short arms for supporting or bracing said sails, substantially as set forth.

8. The combination, with the sails and sail-supporting arms, located intermediately between the ends of the sail, of the connecting-pivots, arranged centrally in relation to the thickness of the sail-boards, substantially as and for the purpose set forth.

9. The pivot-blocks or flanged castings T, constructed and arranged substantially as described, in combination with the mortised sail-slats A and supporting-arms *r*, as set forth, whereby the force of the wind is transmitted to the arms without strain on the attaching-screws *t*.

Witness our hands this 13th day of March, A. D. 1880.

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WILLIAM A. WHEELER.

Witnesses:
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J. A. RICE.