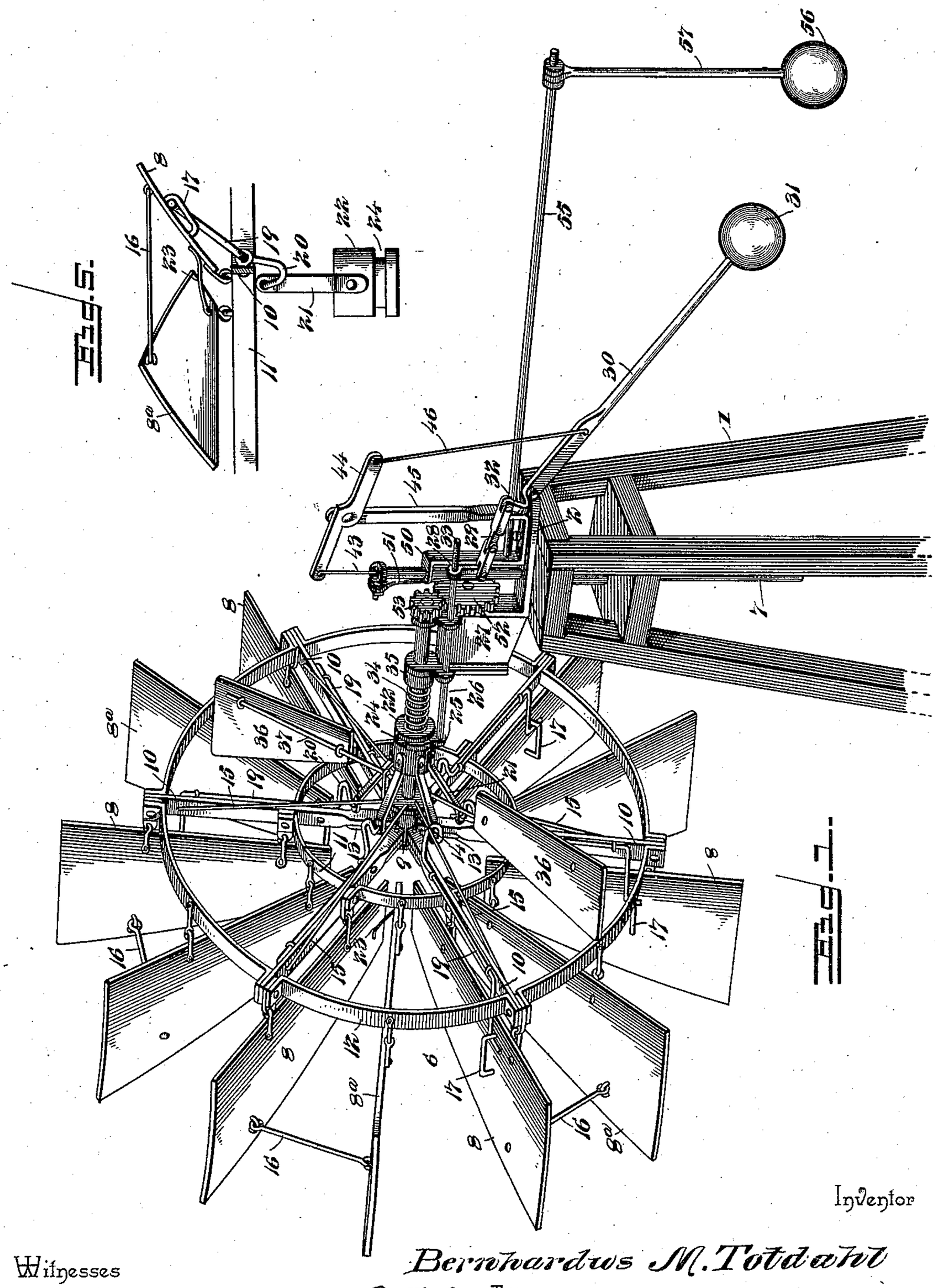
(No Model.)

2 Sheets—Sheet 1.

B. M. TOTDAHL.

WINDMILL.

No. 574,835. Patented Jan. 5, 1897.



Witnesses

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(No Model.) 2 Sheets—Sheet 2.

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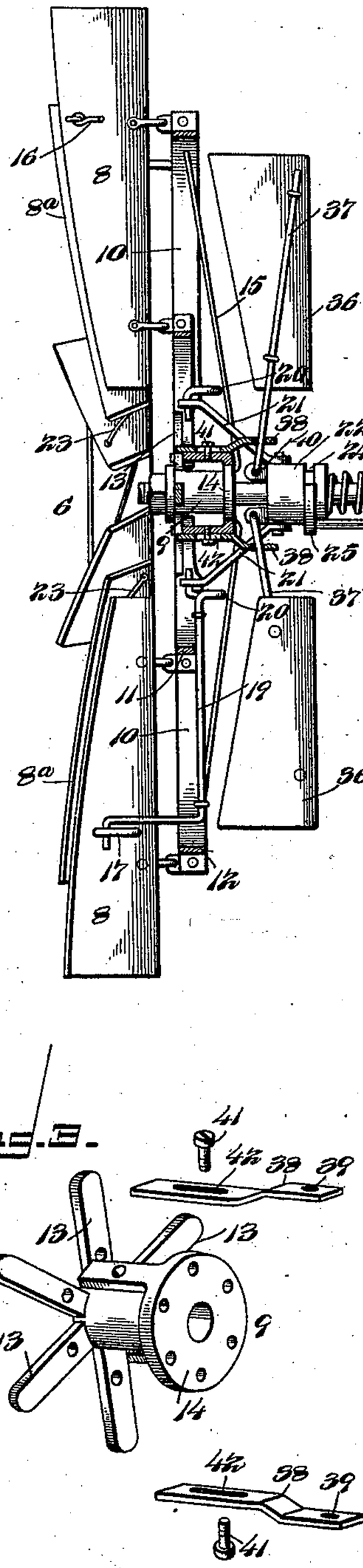
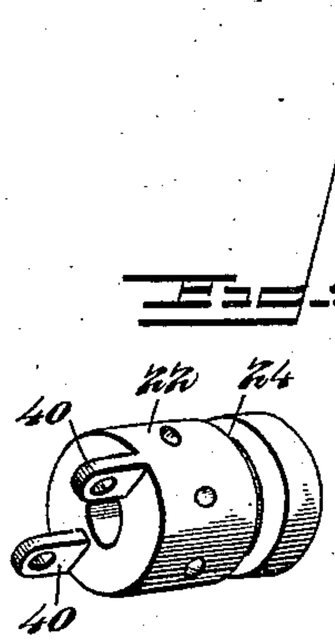


Fig. 2.

Fig. 3.

Fig. 4.



Witnesses
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UNITED STATES PATENT OFFICE.

BERNHARDUS MAGNUSHEN TOTDAHL, OF ST. OLAF, MINNESOTA.

WINDMILL.

SPECIFICATION forming part of Letters Patent No. 574,835, dated January 5, 1897.

Application filed April 1, 1896. Serial No. 585,769. (No model.)

To all whom it may concern:

Be it known that I, BERNHARDUS MAGNUSHEN TOTDAHL, a citizen of the United States, residing at St. Olaf, in the county of Ottertail and State of Minnesota, have invented a new and useful Windmill, of which the following is a specification.

The invention relates to improvements in windmills.

The object of the present invention is to improve the construction of windmills, and to provide a simple, efficient, and comparatively inexpensive one adapted to afford great power and capable of successfully withstanding heavy winds and automatically adjusting its speed to produce a uniform rotation of the wind-wheel at all times.

A further object of the invention is to enable the weight or weighted lever which is usually employed for holding windmills in operation to be used for holding them out of operation, thereby preventing any liability of an operating-wire breaking during strong or heavy winds and accidentally throwing the windmill into operation.

The invention consists in the construction and novel combination and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings, and pointed out in the claims hereto appended.

In the drawings, Figure 1 is a perspective view of the upper portion of a windmill constructed in accordance with this invention and shown out of operation. Fig. 2 is a side elevation, partly in section, the wind-wheel blades being in operative position. Fig. 3 is a detail view of the hub of the wind-wheel. Fig. 4 is a similar view of the sliding sleeve, which is connected with the blades of the wind-wheel. Fig. 5 is a detail view illustrating the manner of mounting and operating the hinged blades of the wind-wheel.

Like numerals of reference designate corresponding parts in all the figures of the drawings.

1 designates a tower constructed of any suitable material and supporting a rotary frame or turn-table 2, which is provided with a depending vertical tube 3, journaled in suitable bearings of the tower. The rotary frame or turn-table is provided at one side with a vertically-disposed bearing-arm, at the top of which is journaled a horizontal wind-wheel shaft 5, carrying a wind-wheel 6 at its outer end and connected at its inner end by gearing with a vertically-reciprocating tubular or hollow pump-rod 7.

The wind-wheel comprises a circular supporting-frame and a series of radially-disposed hinged blades 8 and 8ª, and the circular supporting-frame comprises a hub 9, radial spokes 10, and inner and outer rings 11 and 12, consisting of curved bars having their terminals bent at an angle and secured to the adjacent spokes. The hub is provided at its outer end with a series of radial arms 13, to which the inner ends of the spokes are bolted or otherwise secured, and at the inner end of the hub is arranged an annular flange 14, perforated for the reception of braces 15, extending from the hub to the periphery of the supporting-frame and secured at their outer ends to the spokes adjacent to the outer ring.

The blades 8 and 8ª, which are hinged to the supporting-frame at the inner and outer rings, are disposed in pairs, and the blades of each pair are connected by a link-rod 16, located adjacent to the outer ends of the blades contiguous to the outer edges thereof and hinged to them and adapted to cause them to swing simultaneously. The blades 8ª are located between the spokes, and the blades 8, which are provided adjacent to the outer ring with loops or keepers 17, are located adjacent to the spokes and are engaged by outer arms 18 of radially-disposed rock-shafts 19, which are journaled on the spokes and are adapted to swing the blades to open and close them. The outer arms are substantially L-shaped, and their engaging portions are arranged in the rectangular loops or keepers 17 with blades, and sufficient play is provided to permit the parts to operate freely.

In order to operate the blades simultaneously, the rock-shafts, which are provided at their inner ends with arms 20, are connected with angularly-disposed bars or arms 21 of a sliding sleeve 22. The latter is disposed on the horizontal wind-wheel shaft and arranged in the space between the wind-wheel and the bearing-arm of the rotary frame 2, and the arms or bars 20, which are arranged in an an-

nular series, extend outward from the sleeve to the inner arms of the radially-disposed rock-shafts. The inner arms 20 of the rock-shafts are curved to clear the spokes and the arms or bars 21 are rigidly secured to the sliding sleeve, which when moved outward closes the blades to bring the windmill into operation, as will be readily understood, and when the sliding sleeve is moved inward the blades are opened to allow the wind to pass freely through the wind-wheel.

The blades 8 and 8ª of the wind-wheel are slightly curved to present concave faces to the wind in order to obtain the desired power, and the blades 8ª of the pairs are provided at their inner ends with springs 23, arranged to engage the blades 8 to space the blades of the pairs properly.

The sliding sleeve is provided with an annular groove 24 and is engaged by arms of a yoke 25 of a horizontally-disposed sliding rod 26, whereby the sliding sleeve is swiveled to the rod 26. The horizontally-disposed rod is arranged in suitable guides 27 of the bearing-arm of the rotary frame and is provided at its outer end with an adjustable arm 28, depending from it and connected by a pair of links 29 with a weighted lever 30. The lever 30 is fulcrumed at its inner end on the rotary frame at the base thereof on the side opposite to the bearing-arm. It is provided at its outer end with a weight 31, preferably arranged in the form of a ball and rigid with it, and it has on its inner end an arm 32, extending upward from it at substantially right angles. The links 29 are pivoted to each other and to the arms 28 and 32, and the arm 28, which is provided with a threaded perforation, engages the inner end 33 of the rod 26, which is also threaded. By adjusting the arm 28 to and from the adjacent end of the rod 26 the movement of the sliding sleeve relative to the movement of the weighted lever 30 is regulated, and the parts are thereby adjusted to produce the proper movement of the blades of the wind-wheel.

When the weighted lever swings downward, as illustrated in Fig. 1 of the accompanying drawings, it is adapted to hold the windmill out of the wind by maintaining the blades in their open position, and by this arrangement there is no liability of an operating-wire or other connection between the lever and the base of the tower accidentally breaking during a storm or heavy wind and allowing the weight to fall and throw the windmill into operation, as would be the case were the weighted lever in a raised position when the windmill is out of operation.

When the weighted lever 30 is raised by means hereinafter described, the blades are partially closed to bring them into proper position for rotating the wind-wheel by a spiral spring 34, disposed on the wind-wheel shaft and engaging the inner end of the sliding sleeve. The inner end of the spiral spring 34 bears against a collar 35 of the wind-wheel shaft, and the collar is provided with a set-screw and is capable of adjustment to regulate the tension of the spring.

The windmill is automatically regulated to cause the wind-wheel to rotate at a uniform speed by a pair of oppositely-disposed governing-blades 36, hinged to levers 37, which are fulcrumed adjustably on the supporting-frame of the wind-wheel by means of a pair of supports 38, extending from the hub thereof. The levers 37 consist of rods passing through perforations 39 of the supports 38 and having their inner terminals hinged to lugs 40 of the sliding sleeve. The outer portions of the levers are disposed diagonally of the governing-blades 36, which are hinged in any suitable manner to the levers 37, and the governing-blades during the rotation of the wind-wheel assume a position parallel to the supporting-frame thereof and present their faces to the wind, which when it increases in power is adapted to force the governing-blades in the direction of the wind-wheel, whereby the sliding sleeve is moved inward on the wind-wheel shaft in opposition to the spiral spring to open the blades partially to expose less of their surface to the wind, thereby preventing any excessive rotation of the wind-wheel and causing the latter to travel at a uniform speed. As soon as the power of the wind decreases the spring 34 operates to open the blades to their normal position.

The rotation of the wind-wheel causes the governing-blades to present their faces to the wind, and as the blades are mounted on the outer portions of the levers 37 the wind, when it becomes stronger than the force of the spring, will swing the levers 37 outward, causing their inner ends to slide the sleeve in the direction of the rotary frame or turn-table and compress the spring, thereby opening the wind-wheel blades, which are connected with the sleeve by the means hereinbefore described. When the wind decreases in force, the spring will operate to close the wind-wheel blades to their normal position.

The degree of opening of the blades of the wind-wheel, resulting from the governing-blades, is regulated by the adjustable supports 38, which consist of a pair of plates secured to the hub at opposite sides thereof by means of set-screws 41, arranged in slots 42 of the supports, and permitting the latter to be moved longitudinally of the hub.

The sliding sleeve is capable of movement independent of the weighted lever 30, owing to the links 29, which connect the sliding rod 26 with the lever 30.

The hollow pump-rod, which is designed to be connected at its lower end by any suitable swiveled connection with any desired pump mechanism, forms a housing for a wire 43 or other suitable connection, which extends from the base of the tower to the inner end of a lever 44, fulcrumed intermediate of its ends on a post or standard 45 of the rotary frame 2, and the outer end of the lever is

connected by a wire 46 with the weighted lever 30. The wire 43 is connected by a swivel 47 with an operating-lever 48, suitably fulcrumed at the base of the tower, and adapted, as illustrated in Fig. 2 of the accompanying drawings, to engage a suitable stop 49 to hold the weighted lever in an elevated position when the windmill is in operation. Instead of mounting the operating-lever 48 as illustrated in Fig. 2 of the accompanying drawings, it may be arranged in any other desired manner and its construction may be varied.

The upper portion of the vertically-reciprocating pump-rod is arranged in a suitable opening of a guide 50 of the rotary frame 2, and is provided at its upper end with an arm or pin, and is connected by a pitman 51 with a wrist-pin of a gear-wheel 52. The gear-wheel 52, which is arranged below the plane of the horizontal wind-wheel shaft, meshes with a pinion 53 at the inner end thereof, whereby a reciprocating motion is communicated from the wind-wheel shaft to the pump-rod. The gear-wheel 52 is preferably provided with twice as many teeth as the pinion 53, in order that the wind-wheel will make two revolutions for each complete reciprocation of the pump-rod, but any other desired form of gearing may be employed. By causing the wind-wheel to make two revolutions to each complete reciprocation of the pump-rod it has been found that the wind-wheel produces the desired power and is readily susceptible to the action of the governing-blades, and is made to run at a uniform speed.

A horizontal rod 55 extends from the rotary frame on the side opposite the wind-wheel, and it carries at its outer end a swinging weight 56, arranged at the lower end of a rod 57, and the rod 57 is provided at its upper end with an eye to receive the rod 55, and it is hinged to the same by means of collars arranged on the rod at opposite sides of it. The weight 56, which is adapted to counterbalance the weight of the wind-wheel to equalize the strain on the turn-table, will relieve the windmill of sudden jars and strains, preventing it from jerking in high winds and heavy storms, as the weight in swinging has a varying power and permits the rotary frame, when the wind-wheel is struck by a heavy wind, to yield gradually to it. The weighted lever 30 is arranged on the same side of the rotary frame or turn-table as the counterbalance-weight 56, and it assists the same in counterbalancing the weight of the wind-wheel.

It will be seen that the windmill is simple and comparatively inexpensive in construction, that it is adapted to regulate automatically itself, so that the wind-wheel will rotate at a uniform speed, and that it is capable of withstanding heavy winds. It will also be apparent that the weighted lever is employed for holding the windmill out of the wind, and that there is no liability of a wire or other connection breaking and allowing the weighted lever to fall and throw the windmill into operation.

Changes in the form, proportion, and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of this invention.

What I claim is—

1. In a windmill, the combination of a tower, a rotary frame, a wind-wheel arranged at one side of the rotary frame and provided with hinged blades, a rigid horizontal rod extending from the opposite side of the rotary frame, a depending rod hinged at its upper end to the horizontal rod and provided at its lower end with a weight, a weighted lever mounted on the rotary frame, located at the same side as the horizontal rod, and connections between the weighted lever and the hinged blades, substantially as described.

2. In a windmill, the combination of a tower, a rotary frame, a wind-wheel mounted at one side of the rotary frame and provided with hinged blades, a spring connected with the hinged blades and arranged to hold the same normally closed to cause the wind-wheel to rotate, a weighted lever connected with the blades and adapted to hold them open against the action of the said spring, and means for operating the weighted lever from the base of the tower, whereby the weighted lever is held elevated to permit the spring to maintain the blades in their closed position, substantially as described.

3. In a windmill, the combination of a rotary frame or turn-table, a horizontal wind-wheel shaft, a wind-wheel mounted thereon and provided with hinged blades, a sliding sleeve mounted on the shaft and connected with the hinged blades, a weighted lever fulcrumed on the rotary frame or turn-table, governing devices connected with the sliding sleeve, a sliding rod guided on the frame or turn-table adjacent to the shaft, having its outer ends connected with the sleeve, and a pair of links connecting the sliding rod and the weighted lever, whereby the sleeve is permitted to slide independently of the weighted lever when the latter is raised, to permit an operation of the governing devices, substantially as described.

4. In a windmill, the combination of a rotary frame or turn-table, a horizontal wind-wheel shaft, a wind-wheel mounted on the shaft and provided with hinged blades, a sliding sleeve connected with the blades, a weighted lever fulcrumed on the rotary frame or turn-table, a sliding rod guided on the frame or turn-table, swiveled at its outer end to the sliding sleeve, and provided at its inner end with an adjustable arm, and a pair of pivoted links connecting the adjustable arm with the weighted lever, substantially as described.

5. In a windmill, the combination of a horizontal wind-wheel shaft, a wind-wheel mounted thereon, provided with hinged blades, a

lever fulcrumed on the wind-wheel and connected with the hinged blades and adapted to open and close the same, and a governing-blade hinged to the lever and adapted to swing to a position parallel to the wind-wheel during the rotation thereof, and capable of automatically swinging edgewise to the wind when the windmill is thrown out of operation, substantially as and for the purpose described.

6. In a windmill, the combination of a horizontal wind-wheel shaft, a wind-wheel provided with hinged blades, a sliding sleeve mounted on the shaft and connected with the blades, a lever fulcrumed on the wind-wheel and connected with the sliding sleeve, and a governing-blade hinged to the lever and adapted to swing to a position parallel with the wind-wheel during the operation of the windmill, and capable of assuming a position at right angles to the frame of the wind-wheel when the windmill is out of operation, substantially as described.

7. In a windmill, the combination of a horizontal wind-wheel shaft, a wind-wheel having hinged blades, a sliding sleeve mounted on the shaft and connected with the blades, a support adjustably secured to the frame of the wind-wheel, a lever fulcrumed on the support and connected at its inner end to the sliding sleeve, and a governing-blade hinged to the outer portion of the lever, substantially as described.

8. In a wind-wheel, the combination of a supporting-frame, blades hinged to the supporting-frame and arranged in pairs, links connecting the blades of the pairs, springs interposed between the pairs of blades and holding the same separated, and means for operating the blades, substantially as described.

9. In a windmill, the combination of a rotary frame or turn-table, a wind-wheel shaft, a wind-wheel provided with hinged blades, a sliding sleeve mounted on the wind-wheel shaft, connected with the blades and adapted to open and close the same, means for engaging the sleeve to close the blades automatically, a weighted lever fulcrumed on the rotary frame or turn-table, connected with the sleeve and adapted to hold the blades open and maintain the windmill out of operation, a lever 44 fulcrumed intermediate of its ends on the rotary frame or turn-table and connected at its outer end with a weighted lever, a tubular pump-rod, the connection 43 passing through the bottom rod and connected with the inner end of the lever 44, an operating-lever, and a swivel connecting the operating-lever with the connection 43, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

BERNHARDUS MAGNUSHEN TOTDAHL.

Witnesses:
L. A. LEVORSEN,
N. P. RANNCORR.