June 25, 1935. A. M. LOCKWOOD 2,006,024

WINDMILL

Filed May 31, 1934 2 Sheets-Sheet 1

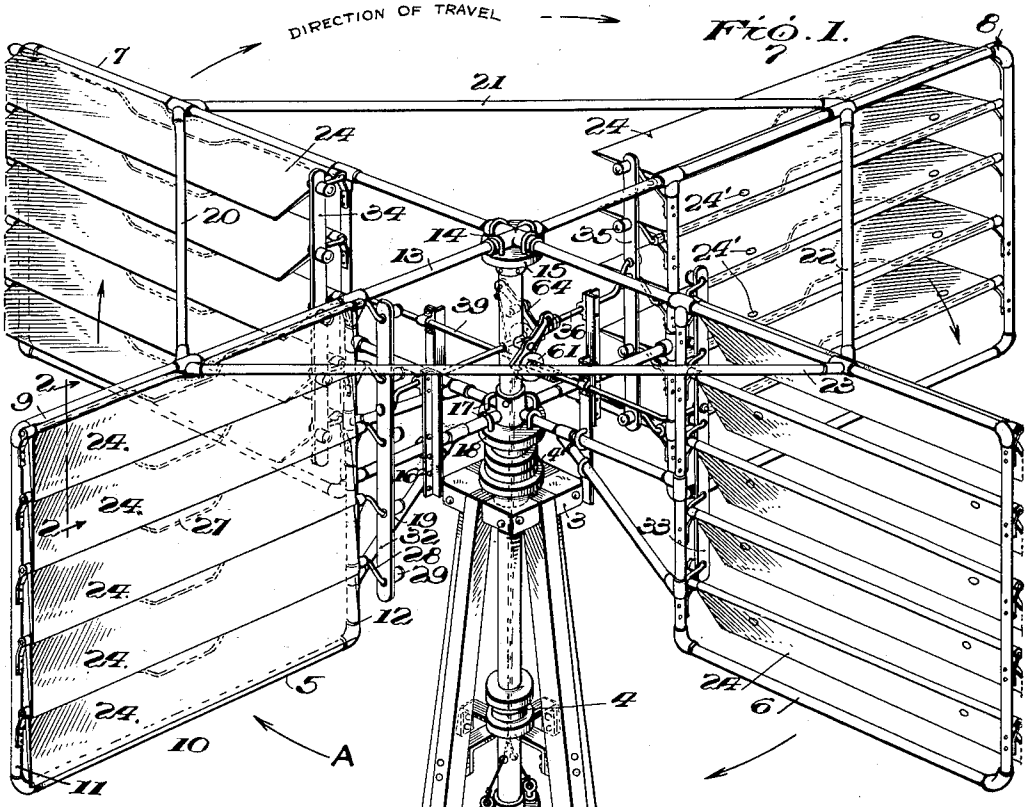


FIG. 1.

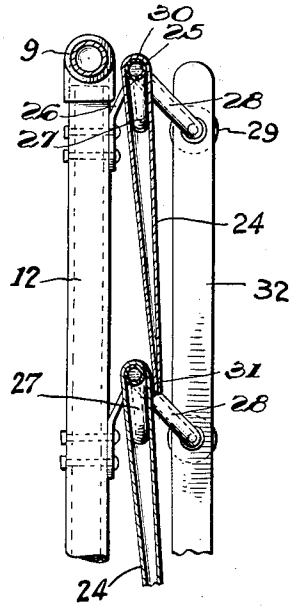
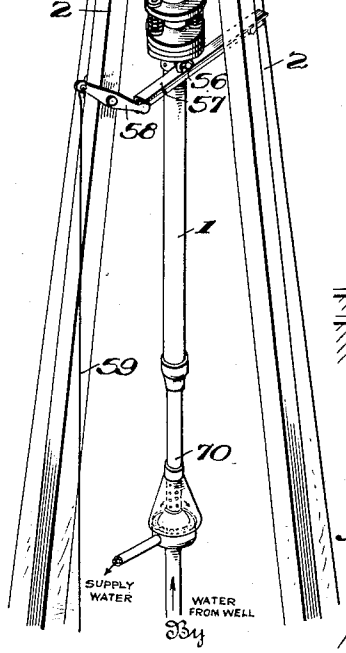


FIG. 2.



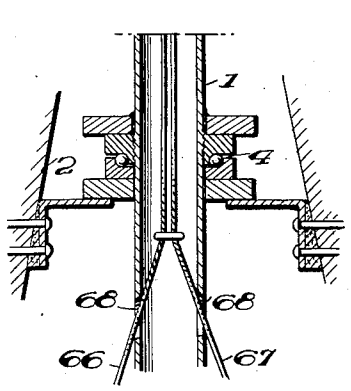


FIG. 3.

Inventor

Alvah M. Lockwood

By Samuel Scrivener Jr.

Attorney

June 25, 1935. A. M. LOCKWOOD 2,006,024

WINDMILL

Filed May 31, 1934 2 Sheets-Sheet 2

Fig. 4.

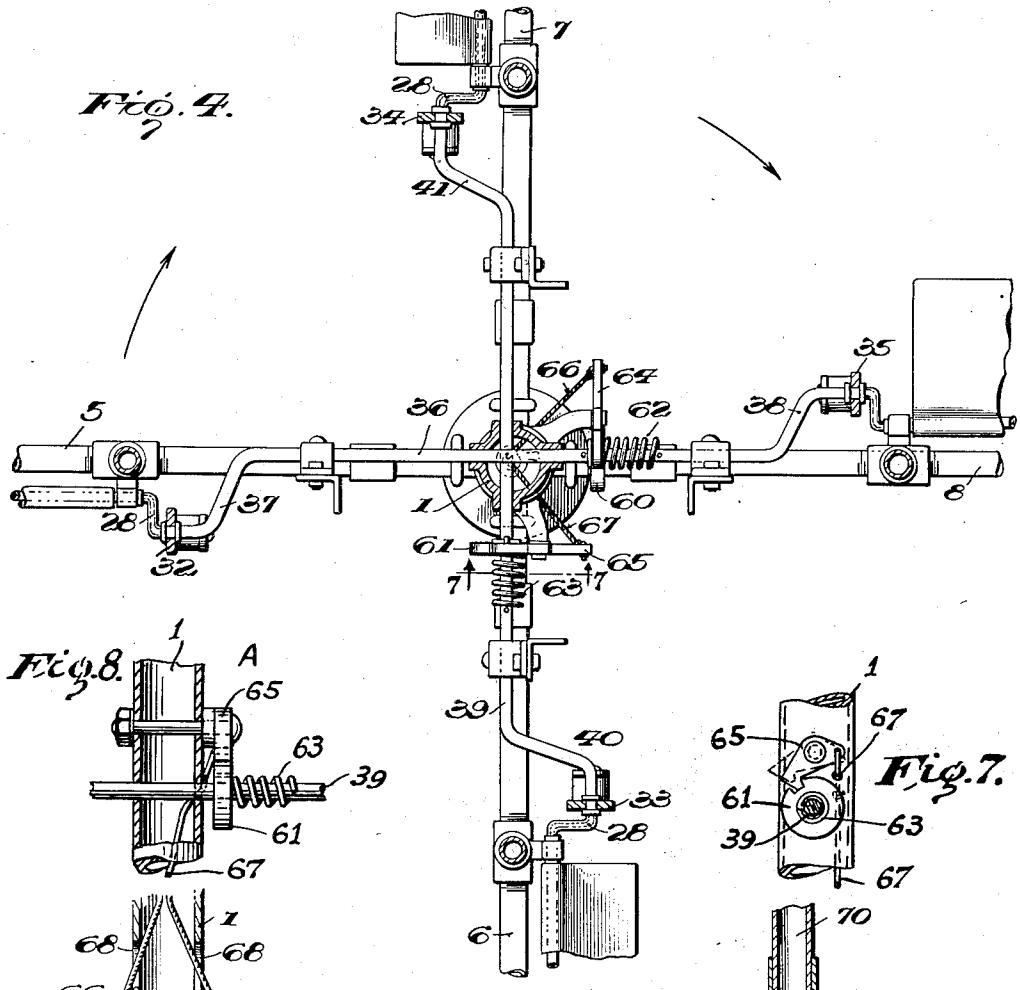


Fig. 8.

Fig. 7.

Fig. 5.

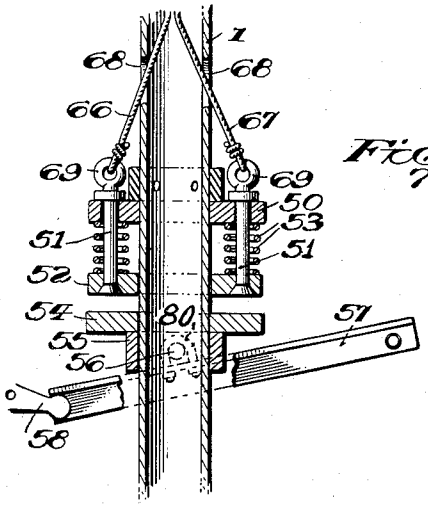
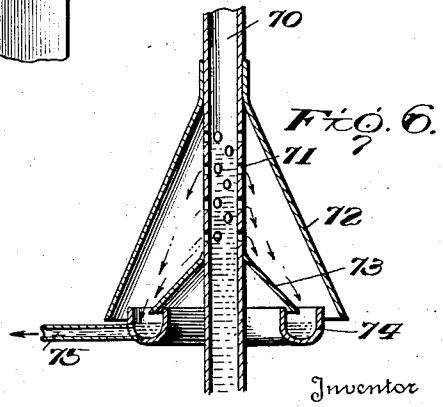


Fig. 6.



Inventor

Alvah M. Lockwood

By Samuel Scriven Jr.

Attorney

Patented June 25, 1935 2,006,024

UNITED STATES PATENT OFFICE

2,006,024

WINDMILL

Alvah M. Lockwood, Charlotte, Tex.

Application May 31, 1934, Serial No. 728,444

28 Claims. (Cl. 170—28)

The present invention relates to windmills and, more particularly, to windmills of the horizontal rotation type, by which is meant windmills of the type rotating about a vertical axis.

It is an object of the present invention to provide a windmill having vane members which are so interconnected as to normally maintain each other in oppositely disposed angular positions, but which may be moved by the wind, or other force, from such a position to a vertical or horizontal position.

Another object is to provide a windmill having a plurality of frame members arranged in pairs, the members of each pair being disposed in a single plane, and each frame member being provided with a plurality of vane members.

Another object is to provide a windmill having a plurality of frame members, each of which is provided with a plurality of vane members, the vane members of each frame being rigidly connected together for simultaneous movement.

Another object is to provide a windmill having a plurality of sets of interconnected vane members, the vane members of one set being connected to those of another set in order to insure proper simultaneous operation of the sets of vanes under all wind conditions.

Another object is to provide a windmill having interconnected sets of vane members, with means for locking the interconnected vanes in predetermined positions.

Another object is to provide a windmill having novel means for braking the rotation thereof.

A further object is to provide a windmill having simultaneously operable means for braking the rotation of the windmill and locking the vane members in a predetermined position.

A still further object is to provide a windmill having novel means for lubricating the moving parts thereof.

A still further object is to provide a windmill having novel means for catching and discharging the water pumped by the windmill.

A still further object is to provide a windmill having vane members which are formed and constructed in a novel manner.

A further object is to provide a windmill which shall be strong and rugged in construction, which may be easily and economically manufactured and may be easily installed and adjusted.

Other objects and features of novelty will be apparent from the following description and the annexed drawings, it being expressly understood however, that the invention is in no way limited by such description and drawings or otherwise than by the appended claims.

Referring to the drawings in which similar reference numerals refer to like parts,

Fig. 1 is a perspective view of the windmill according to the present invention;

Fig. 2 is a view, partly in section, taken on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view of parts disclosed in Fig. 1;

Fig. 4 is a view showing the interconnecting means for the vane members. as disclosed more generally in Fig. 1;

Fig. 5 is a sectional view showing the braking mechanism,

Fig. 6 is a sectional view showing the water catching and discharging structure,

Fig. 7 is an elevational view of the vane locking mechanism taken on line 7—7 of Fig. 4, and

Fig. 8 is a side view, partly in section, of the mechanism illustrated in Fig. 7.

The windmill according to the present invention is of the type employing a vertical rotatable shaft which is adapted to be rotated by vane members, rigidly attached thereto and rotating in a horizontal direction. In the embodiment of the invention illustrated in the drawings of the present application, there is provided a vertical, rotatable shaft 1, the same being preferably formed as a hollow tube, and being supported and braced by means of a bracing frame comprising the members 2, which are supported at their lower ends on the ground, and at their upper ends bear against the shaft 1 at a point preferably adjacent its upper end. A head set or crown block 3 may be provided for attaching the braces 2 to the shaft 1, and a bearing 4 may be provided between an intermediate point of the braces 2 and the shaft 1 for guiding the shaft. A second bearing member 4' is provided and, according to the present invention the bearing 4' is both a supporting and guiding bearing and supports the entire rotating load of the mill, riser pipe and shaft.

Means are provided for rotating the shaft 1, and such means comprise a plurality of frame members 5, 6, 7, 8, which are rigidly attached to the shaft and are adapted to be acted upon by the wind in order to cause rotation thereof and consequent rotation of the shaft. In the preferred form of the invention, four of such frames are provided, such frames being disposed about the vertical shaft at intervals of ninety degrees and so arranged that they are supported in vertical, radial planes.

Referring, for illustration, to the frame 5, it will be seen that the same comprises a structure formed by the connection of pipes or other supporting members to form a rectangular, planar, frame comprising the upper and lower horizontal members 9, 10 and the outer and inner vertical members 11, 12. Such frame may be supported on the vertical shaft 1 by means of a rod or pipe 13 which forms an extension of upper horizontal member 9 and the end of which is connected, as by a U-bolt 14, to the horizontal surface of a bearing cap 15 rigidly fastened to the upper extremity of the vertical shaft 1. The frame 5 is also attached to the vertical shaft by means of a second rod or pipe 16 which is attached at one end to the mid-point of inner vertical member 12, and at its other end is attached, by means of a U-bolt 17, to the horizontal surface of a second bearing plate 18 which is rigidly attached to the shaft 1. A bracing member 19 may be provided for further supporting the frame, the same being attached at its upper end to the supporting rod 16 and extending therefrom angularly to be attached at its lower end to the lower portion of the inner vertical member 12 of the frame 5, all as clearly illustrated in Fig. 1. It will be apparent from the above that the frame 5 will be rigidly supported by and attached to the shaft 1 and that a force exerted on frame 5 at right angles to the plane thereof will cause rotation of shaft 1. The frames 6, 7, and 8 are constructed in exactly the same manner as frame 5 and as supported on the shaft 1 in exactly the same manner, and it will, therefore, be unnecessary to further describe the construction of each of such frame members. The four frames may be tied together by the rods or pipes 20, 21, 22, and 23, the same connecting the approximate midpoints of the upper horizontal members of each of the frames, whereby the rotating assembly will be braced and strengthened. Similar connecting braces may be provided between the lower horizontal members of the frames if desired.

Means are provided on each of the above described frame members for providing a surface against which the force of the wind may bear in order to cause rotation of the rotating assembly and shaft. Referring in particular to Fig. 1 of the drawings, it will be seen that such means comprise a plurality of vane members denoted by the reference numerals 24. In the embodiment of the invention illustrated in the drawings each frame member is provided with a plurality of such vanes, and all of such vanes are mounted on their respective frame members in the same manner. While the drawings show five vane members to be mounted on each frame member, it will be understood that any desired number of vanes may be provided on each frame member. I have found that the number of vane members will vary with the size of the windmill in order to give the most efficient operation. Referring to Figs. 1 and 2, it will be seen that such mounting means comprise the hollow rods 25, one of which is provided for each vane member, and which extend between the vertical members of the frame in parallelism to the upper and lower horizontal members. These rods are supported on the vertical frame members by means of brackets 26, which are attached at their lower ends, respectively, to the outer and inner vertical frame members, and whose upper ends are provided with aligned bearing openings through which the respective ends of the supporting rods 25 extend. Adjacent their midpoints each of the rods 25 is provided with an elongated deformed portion 27 for a purpose which will appear hereinafter. The inner ends of the supporting rods pass through the openings in the brackets on the inner vertical frame member, as described, and are then downwardly and outwardly turned to provide a crank arm 28, also for a purpose to be described hereinafter.

As stated hereinbefore, the supporting rods 25 are hollow and, according to the present invention, the outer ends of such rods, adjacent the bearings 26 on the outer vertical frame member, are closed by any suitable means such as a screw cap. The inner ends of the rods, at the end of the crank arms 28, are provided with grease cups 29 which may be screw-threaded to the inner end of the hollow rods. At the point where each rod passes through the bearing opening in the bracket members 26, each rod is provided with small openings 30 which are entirely covered by the bearing member. Due to the construction described, it will be apparent that the hollow rods 25 may be filled with grease, oil or other lubricant by means of the grease cup 29, such lubricant being retained in the rod by reason of the closed outer end thereof, but lubrication of the bearings being permitted by reason of the holes or openings in the rods at the bearing points. By this means complete lubrication of the bearing supports for the rods is effected.

According to the present invention, the vane members 24 are all formed in the same manner and all are mounted on their respective supporting rods in the same manner. Such vanes are preferably formed from a single, rectangular sheet of metal or other suitable material, and such sheets are adapted to be bent about their longitudinal medial lines about the supporting rod, in order to form vanes of two thicknesses which may be welded, riveted, or otherwise suitably connected at their meeting edges, as illustrated at 31 in Fig. 2. While it is intended that the vanes shall be tightly folded about the supporting rods, no positive connection between these elements is required, due to the hereinbefore described deformation 27 in the supporting rods adjacent the midpoints thereof. It will be apparent that, after assembly of the vanes and supporting rods, any rotation of the supporting rods will cause the deformations 27 to bear against an inner face of the vane, thereby causing such vane member to turn with the rod. It will also be noted, as particularly illustrated in Fig. 2, that the dimensions of the vane members and their relative positioning on the frames are so proportioned and arranged that the lower edge of each vane member overlaps the supporting rod of the next lower vane, whereby a continuous surface is provided. Buffer members 24' may be provided on the outer surface of each vane member, adjacent the upper edge thereof, for cushioning the abutment of the vane members. It will also be noted that the vane members are mounted on the trailing side of each of the frame members, in order that the force of the wind may be exerted on the frame members directly. Due to this construction the vanes of the frames 5 and 8 are disposed on opposite sides of the plane of these frames, as clearly disclosed in Fig. 1 of the drawings. The same construction and arrangement applies to the vanes of the frames 6 and 7.

Means are provided for causing all of the vane members mounted on a single frame to operate

in unison and to simultaneously assume the same angular position at all times. Such means comprises the connecting rod 32 which extends parallel and adjacent to the inner vertical member 12 of the frame 5 and which is provided with a plurality of openings through which extend the outwardly turned portions of the crank arms 28 formed on the ends of the supporting rods 25. Referring particularly to Fig. 2 of the drawings, it will be seen that the crank arms 28 of the supporting rods are angularly disposed to the plane of the deformations 27 of the supporting rods and the vanes, in such manner that when the vanes are in their vertical position the crank arms are disposed at any angle of approximately forty-five degrees to the plane of the vanes, whereby a proper leverage may be exerted on the supporting rods by movement of the connecting rod. Referring now particularly to Figs. 1 and 4 of the drawings it will be seen that the crank arms 28 of the supporting rods of opposite frame members are oppositely disposed at equal angles of approximately forty-five degrees to the common plane of such frame members. For example, it will be seen that the crank arms 28 of the supporting rods of the frame 5 are disposed at an angle of approximately forty-five degrees to one side of the plane of frames 5 and 8, while the crank arms 28 of the supporting rods of the frame 8, which is disposed oppositely to frame 5, are disposed at an angle of approximately forty-five degrees to the other side of the plane of frames 5 and 8. The crank arms of the frames 6 and 7 are disposed in the same relation, all for a purpose to be described fully hereinafter. It will be also seen that the crank arms of each frame member are connected together by a connecting rod in the same manner as described in connection with frame 5. Specifically, the crank arms of the supporting rods of frame 6 are connected by connecting rod 33; those of frame 7 are connected by connecting rod 34; while those of frame 8 are connected by connecting rod 35.

Means are provided by the present invention for interconnecting the vanes of one frame member and those of that frame member which is disposed on the diametrically opposite side of vertical shaft 1. In the embodiment of the invention illustrated in the drawings, the vanes of the frames 5 and 8 are interconnected, while those of frames 6 and 7 are also interconnected. Referring particularly to Figs. 1 and 4 of the drawings, it will be seen that a cross-connecting rod 36 is provided, the same having a straight central portion extending through the vertical shaft 1, and at its ends being provided with oppositely-disposed crank arms 37, 38 which are connected, respectively, to the connecting rods 32 and 35 of the frames 5 and 8. Grease cup lubrication may be provided for the connecting rods preferably in a manner similar to the means provided for rods 25. As described hereinbefore, the crank arms of the supporting rods of frame 5 are disposed at an angle of ninety degrees to the crank arms of the supporting rods of frame 8. These crank arms being now interconnected rigidly by the shaft 36, it will be apparent that the vanes of frame 5 will constantly be maintained at an angle of ninety degrees to the vanes of frame 8 and at opposite sides of the plane of frames 5 and 8. Means are also provided for interconnecting the vanes of the frames 6 and 7, and such means comprise the cross-connecting rod 39, the same having a straight middle section extending through the vertical shaft 1, and having oppositely-disposed crank portions 40, 41 formed on the ends thereof and connected, respectively, to the connecting rods 33, 34 of the frame members 6 and 7. As stated hereinbefore, the crank arms 28 of the supporting rods of the frame member 6 are disposed at an angle of ninety degrees to those of the frame 7 and at opposite sides of the plane of frames 6 and 7. It will, therefore, be apparent that the vanes of the frame 6 and those of the frame 7 will be maintained in positions at right angles to each other at all times and on opposite sides of the plane of frames 6 and 7.

In the operation of the above-described structure, it may be assumed that the wind is blowing in the direction of the arrows A in Fig. 4, in which event rotation of the windmill will take place in a clockwise direction as viewed in Fig. 4. The force of the wind acting on the vanes of frame 5 will cause such vanes to assume a closed or vertical position, thereby presenting a continuous, rigid surface to the wind and causing rotation of the frames and vertical shaft 1. Due to the interconnection of the vane members of frame 5 by connecting rod 32, all of such vanes will move in unison, and such movement will be transmitted through cross-connecting rod 36, connecting rod 35, crank arms 28, and supporting rods 25 to the vanes of frame 8. As described hereinbefore, the interconnection of the vanes of frames 5 and 8 is such that such vanes are constantly maintained at right angles to each other and on opposite sides of the plane of frames 5 and 8, and it will, therefore, be apparent that when the vanes of frame 5 are in the vertical or closed position, those of frame 8 will be disposed in a horizontal position, pointing with the wind, as clearly disclosed in Figs. 1 and 4, and will be maintained in such position by the force of the wind. The frames 6 and 7 are, in the position shown in Fig. 4, disposed in a position paralleling the direction of the wind and there is, therefore, but little force exerted by the wind on these vanes. Consequently, the vanes of the frame 6 will balance the vanes of the frame 7 through cross-connecting rod 39, and each set of vanes will be disposed at an angle of forty-five degrees to the vertical, the vanes of frame 6 being disposed on one side of the plane of frames 6 and 7, while those of frame 7 are disposed on the other side thereof. The described positions of the various vanes will be maintained only while the vanes are in the position shown with respect to the wind direction A. As the frames move in a clockwise direction, which is their normal direction of rotation in accordance with the construction illustrated, the vanes of each frame will assume the vertical or closed position when such frame takes the place of that of frame 5 of Fig. 4, the vanes of the other frames taking the positions as illustrated and described. It will be apparent that (in the positions as illustrated in Fig. 4) the vanes of the frame 5 will offer a maximum bearing surface to the wind, while the vanes of the frame 8 will offer no resistance thereto, being parallel with and facing with the airstream. The vanes of frames 6 and 7 will also offer no resistance to the wind, these vanes being parallel with the airstream. It will, therefore, be apparent that maximum efficiency will be developed by the windmill, due to the fact that no appreciable resistance will be offered by any part of the windmill except that part actually causing the rotation of the mill.

Means are provided by the present invention for braking the rotation of the windmill and for

simultaneously engaging and holding the vanes of the windmill in a predetermined position. Such braking means comprise a plate 50 which is sleeved about and rigidly fixed to the rotating vertical shaft 1 at a point approximately midway of its length. Disposed below plate 50 and loosely sleeved about shaft 1 is a braking disc 52, the same having rigidly attached thereto a plurality of upwardly-extending bolts 51 which extend loosely through the plate 50 and which are provided, above plate 50, with washers which bear against the upper face of plate 50. Compression springs 53, preferably surrounding the bolts 51, are disposed between the plate 50 and braking disc 52 and constantly urge plate 50 and braking disc 52 apart and against the washers above the plate. Below the braking disc 52, and suitably sleeved about shaft 1 for sliding movement along the same is a second braking disc 54, the same being provided on its lower face with a downwardly-extending collar 55, which carries a radially-extending pin or projection 56. Pivotally mounted at one end on a suitable one of the supporting frame members 2 is a lever member 57, the other end of which is engaged by one end of a lever 58, which is pivoted at its center on a suitable one of the supporting frame members 2. An upwardly-extending loop or strap 60 is carried by the lever 57 and the entire lever assembly is so disposed that the strap 60 fits over and engages the pin or projection 56. It will be apparent that the lower braking disc 54 will be supported on lever 57 between the pivots of the levers 57 and 58. An actuating rod or cable 59 may be attached to the outer or free end of lever 58 in order to operate the same.

The operation of the above-described braking device will be obvious. A downward force on cable or rod 59 will cause movement of lever 58 about its pivot in such a way as to raise the free end of lever 57 about the pivot thereof, thereby raising the lower braking disc 54 into engagement with the upper braking disc 52 which is fixed to the vertical shaft 1 through bolts 51 and plate 50 and consequently rotates therewith. Rotation of lower braking disc 54 being prevented because of its attachment to the supporting structure 2 through lever 57, it will be apparent that engagement between braking discs 57 and 58 will cause braking of the rotation of vertical shaft 1 to any desired extent, depending upon the force applied to the brake operating member 59.

The means according to the present invention for locking the vane members in a predetermined position about the axes of their supporting rods 25, comprises ratchet wheels 60 and 61, the same being loosely sleeved about the cross-connecting rods 36 and 39 respectively, adjacent the bearing between such rods and the vertical shaft 1. Rigidly connected to the ratchet wheel 60 is one end of a spring 62 which is coiled about the cross-connecting rod 36 and the other end of which is connected to the cross-connecting rod 36, thereby providing a resilient connection between the ratchet wheel 60 and rod 36. A similar resilient connection between ratchet wheel 61 and cross-connecting rod 39 is provided by means of spring 63, the same being coiled about rod 39. Each of the ratchet wheels 60, 61 is provided with a depression or tooth, and such depressions are adapted to be engaged, respectively, by pawl members 64, 65 which are pivotally carried by vertical shaft 1 in such a position that the free ends thereof are closely adjacent to the depressions in the ratchet wheels. The pawl members are normally held out of engagement with the ratchet wheels by means of cables 66, 67 which extend into and through the hollow shaft 1 and emerge therefrom through openings 68 in the walls of the shaft adjacent the bearing plate 50, and are attached at their lower ends to eyes 69 formed on the upper ends of bolts 51. The cables 66, 67 are of such length that they are drawn taut between the eyes and the ends of pawls 64, 65, whereby the said pawl members will normally be held out of engagement with the depressions on the ratchet wheels 60, 61.

It will be apparent that when the braking device described hereinbefore is operated to brake the rotation of shaft 1, the upper braking disc 52 will be moved upwardly by lower braking disc 54, thereby also raising the bolts 51 and consequently relieving the tension on the cables 66, 67. As soon as such tension is relieved, the pawl 64, 65 will be released and the free ends thereof will engage the ratchet wheels 60, 61 and the depressions therein, thereby establishing a resilient connection between the cross-connecting rods 36, 39 and the vertical shaft 1 through spring 62, 63, ratchet wheels 60, 61 and pawls 64, 65. In this manner, rotation of the rods 36, 39, except through the limited angle permitted by the springs 62, 63 is prevented, thereby causing the vanes of all of the frames to be maintained in a fixed position.

In operation, it is intended that the braking means will first reduce the rotating speed of the mill to a predetermined point, after which the compression of springs 53 and the relief of the tautness of cables 66, 67 will cause the pawls 64, 65 to engage the depressions in the ratchet wheels. While it is intended that the vanes may be held by the pawl and ratchet mechanisms in any desired position, the preferred arrangement contemplates that the vanes of adjacent frames, for example 5 and 6 may be held in vertical position, while those of frames 7 and 8 will be held in horizontal position. With the vanes maintained in this position the mill will act, in effect, as a weather vane and there will be no rotation thereof.

Novel means are also provided by the invention for catching and delivering the water pumped by the windmill, and such means are disclosed in Fig. 6 of the drawings, in which is disclosed the riser pipe 70 of the well, the same being a continuation of and rotated by the vertical shaft 1. Such riser pipe extends downwardly into the well and water pumped from the well flows upwardly in such pipe and out of the same through openings 71 therein. It is contemplated that water may be pumped upwardly through the riser pipe by means of a pumping device such as is disclosed in my copending application Serial No. 728,443. In this case, it will be seen that no pump rod need be employed, the rotation of the riser pipe providing the motive force for the pump. A conical hood 72 may be attached to riser pipe 70 and cover the openings 71 for excluding dust therefrom and for preventing wind from blowing the discharged water away. A second conical hood 73 may be attached to riser pipe 70 below the openings 71, and an annular trough 74 surrounds the lower annular edge of the conical hood 73, from which a pipe 75 leads to a suitable reservoir. The annular trough 74 is preferably supported by discharge pipe 75, but may be carried by either the conical hood 72, the conical hood 73 or may be supported from an outside point. It will also be obvious that the conical hoods 72

and 73 may be supported either on the pipe 70 or on some outside point.

It will be obvious that water being pumped upwardly through riser pipe 70 will flow out therefrom through openings 71, over conical hood 73 and into trough 74 and pipe 75.

While I have illustrated and described herein one embodiment of my invention, it will be apparent to those skilled in the art that the invention is susceptible of further embodiments, modifications and improvements, which may be practiced without departing in any way from the spirit of the invention, for the limits of which reference must be had to the appended claims.

What is claimed is:

1. A windmill comprising a rotatable shaft, a plurality of frame members carried by said shaft, a plurality of vane members carried by each of said frame members, means connecting the vane members of each of said frame members, and means interconnecting said vane connecting means and capable of rotating movement for causing simultaneous swinging movement of said vane members.

2. A windmill comprising a rotatable shaft, a plurality of vane members carried by said shaft, a member connecting said vane members, a second plurality of vane members carried by said shaft, a member connecting said second vane members, and a rotatable shaft connecting said connecting members for causing simultaneous swinging movement of said vane members.

3. A windmill comprising a frame member, a shaft rotatably mounted on said frame member and having a deformed portion intermediate the ends thereof, and a vane member disposed about said shaft and said deformed portion.

4. A windmill comprising a frame member, a shaft rotatably mounted on said frame member and having a deformed portion intermediate the ends thereof, and a vane freely mounted on said shaft and adapted to be engaged by said deformed portion.

5. In a windmill construction, a frame member, bearing members mounted on said frame, a hollow shaft mounted in said bearing members and having openings therein adjacent said bearing members, and a grease cup mounted on the end of said shaft.

6. A windmill comprising a rotatable shaft, a frame carried by said shaft and having a plurality of vanes rotatably carried thereby, a second frame carried by said shaft and having a plurality of vanes carried thereby, means connecting the vanes of said first and second frames for causing simultaneous swinging movement thereof, and co-operating means carried by said rotatable shaft and by said connecting means for locking said vanes for rotation about their axes.

7. A windmill comprising a rotatable shaft, a frame carried by said shaft, a plurality of vanes carried by said frame, means for interconnecting said vanes, a second frame member, a plurality of vanes carried by said second frame member, means for interconnecting the vanes of said second frame member, a member connecting said interconnecting means, a ratchet wheel carried by said connecting member, and a pawl carried by said rotatable shaft and engageable with said ratchet wheel for preventing movement of said vanes about their axes.

8. A windmill comprising a rotatable shaft, a braking disc resiliently fixed to said shaft, and a second braking disc movable into engagement with said first braking disc for braking the rotation of said shaft.

9. A windmill comprising a rotatable shaft, a collar fixed to said shaft, a braking disc resiliently fixed to said collar, a second braking disc mounted adjacent said first braking disc, and a lever supporting said second braking disc and operable to move said second braking disc into engagement with said first braking disc.

10. A windmill comprising a rotatable shaft, a frame member carried by said shaft, a vane member mounted on said frame member for movement about an axis, means for locking said vane member from movement about said axis, means for braking the rotation of said shaft, said locking means being operable on actuation of said braking means.

11. A windmill comprising a rotatable shaft, a vane member carried by said shaft and rotatable about an axis, and simultaneously operable means for locking said vane member from rotation about said axis and for braking the rotation of said shaft.

12. A windmill comprising a rotatable shaft, a vane member carried by said shaft and rotatable about an axis, means for locking said vane member from rotation about said axis, resilient means for normally preventing the operation of said locking means, and means for relieving the action of said resilient means for permitting the operation of said locking means.

13. A windmill comprising a rotatable shaft, a riser-pipe connected to said shaft, a plurality of openings in said pipe, a hood surrounding said pipe below said openings, and a trough surrounding said hood.

14. A windmill comprising a rotatable shaft, a plurality of vane members disposed on diametrically opposite sides of said shaft, said vanes being adjustable to a plurality of angular positions, and means for resiliently locking said vanes in a predetermined position.

15. A windmill comprising a rotatable shaft, a plurality of frames attached to said shaft, a plurality of vanes rotatably supported in each of said frames, a member associated with each frame for connecting together the vanes thereof, and a rotatable shaft interconnecting the connecting member of one frame with the connecting member of another frame.

16. A windmill comprising a rotatable shaft, a plurality of frames attached to said shaft, a plurality of shafts journaled in each of said frames, each of said shafts having a crank portion, a member associated with each frame and connecting the said crank portions of each frame, a rotatable shaft extending between the said members of different frames and having crank portions on the ends thereof engaging said members.

17. A windmill comprising a rotatable shaft, a plurality of sets of vanes carried by said shaft, means interconnecting the vanes of opposite sets for translating the angular movement of one set of vanes to another set of vanes, means for locking said interconnecting means, a braking device for said rotatable shaft, and means connected between said braking device and said locking means for causing actuation of said locking means when said braking device is operated.

18. In a windmill, a rotatable shaft, a vane connecting rod carried by said shaft, means carried by said shaft and said rod for locking said rod from rotation about its axis, means for braking rotation of said shaft, cables connecting said locking means and said braking means and normally

holding said locking means in inoperative position but operable on actuation of said braking means for permitting operation of said locking means.

19. A windmill comprising a rotatable shaft, a collar fixed to said shaft, a disc slidably mounted on said shaft adjacent said collar, pins fixed to said disc and extending loosely through said collar, springs surrounding said pins for resiliently urging apart said collar and disc, a support exterior to said shaft, and a second disc carried by said support and movable into and out of engagement with said first disc.

20. A windmill comprising a rotatable shaft, an upper bearing member carried by said shaft, a lower bearing member carried by said shaft and spaced from said upper bearing member, a plurality of frames disposed about said shaft, each of said frames having horizontal and vertical members, members connecting each of said frames to said upper bearing, other members connected to said frames intermediate the ends of the vertical members thereof and connected to said lower bearing.

21. In a windmill, a frame having horizontal and vertical members, brackets carried by said vertical members, hollow shafts journaled in said brackets for rotary movement therein and having crank portions on the ends thereof, and vane members carried by said shafts.

22. A windmill comprising a rotatable shaft, frame members disposed on opposite sides of said shaft, means connecting said frame members to said shaft, a plurality of shafts carried by each of said frame members, each of said shafts having a crank portion on the end thereof, a connecting rod connecting the crank portions of the shafts of each frame member, a rotatable shaft having crank portions on the ends thereof connected to said connecting rods for transmitting the movement of one connecting rod to the other.

23. A windmill construction comprising a frame member, a shaft rotatably journaled on said frame member, and a vane member having its central portion disposed closely adjacent said shaft and its longitudinal side portions extended away from said shaft on both sides thereof and extending toward each other, to provide a vane member disposed entirely on one side of said shaft.

24. A windmill construction comprising a frame member having a plurality of vanes rotatably mounted thereon, a second frame member having a plurality of vanes rotatably mounted thereon, means connecting the vanes of said first frame to the vanes of said second frame for causing simultaneous swinging movement of said vanes about the axes thereof, and means cooperating with said connecting means for locking said vanes from movement about their axes.

25. A windmill construction comprising a frame member having a plurality of vanes rotatably mounted thereon, a second frame member having a plurality of vanes rotatably mounted thereon, means connecting the vanes of said first frame and the vanes of said second frame for causing simultaneous swinging movement of said vanes about the axes thereof, and means resiliently engaging said connecting means for locking said vane members from rotation about their axes.

26. A windmill comprising a rotatable mill shaft, a plurality of frames attached to said shaft, a plurality of vanes rotatably supported in each of said frames, a member associated with each frame for connecting together the vanes thereof, a rotatable rod interconnecting the connecting member of one frame with the connecting member of another frame, a ratchet wheel sleeved about said rotatable rod, means resiliently connecting said ratchet wheel to said rod, a pawl carried by said rotatable shaft and positioned for engagement with said ratchet wheel.

27. A windmill comprising a rotatable mill shaft, a plurality of frames attached to said shaft, a plurality of vanes rotatably supported in each of said frames, a member associated with each frame for connecting together the vanes thereof, a rotatable rod interconnecting the connecting member of one frame with the connecting member of another frame, a ratchet wheel sleeved about said rotatable rod, a spring connecting said ratchet wheel to said rod, a pawl carried by said rotatable shaft and positioned for engagement with said ratchet wheel, means normally holding said pawl out of engagement with said ratchet wheel, braking means associated with said rotatable shaft, and means operable on operation of said braking means for releasing said holding means for causing said pawl to engage said ratchet wheel.

28. A windmill construction comprising a rotatable shaft, a riser-pipe directly connected to said shaft, a plurality of openings in said riser-pipe, and water-receiving means disposed below said openings and surrounding said riser-pipe.

ALVAH M. LOCKWOOD.