C. F. CRADDICK.

WINDMILL.

APPLICATION FILED SEPT. 17, 1910.

1,009,896.

Patented Nov. 28, 1911.

3 SHEETS—SHEET 1.

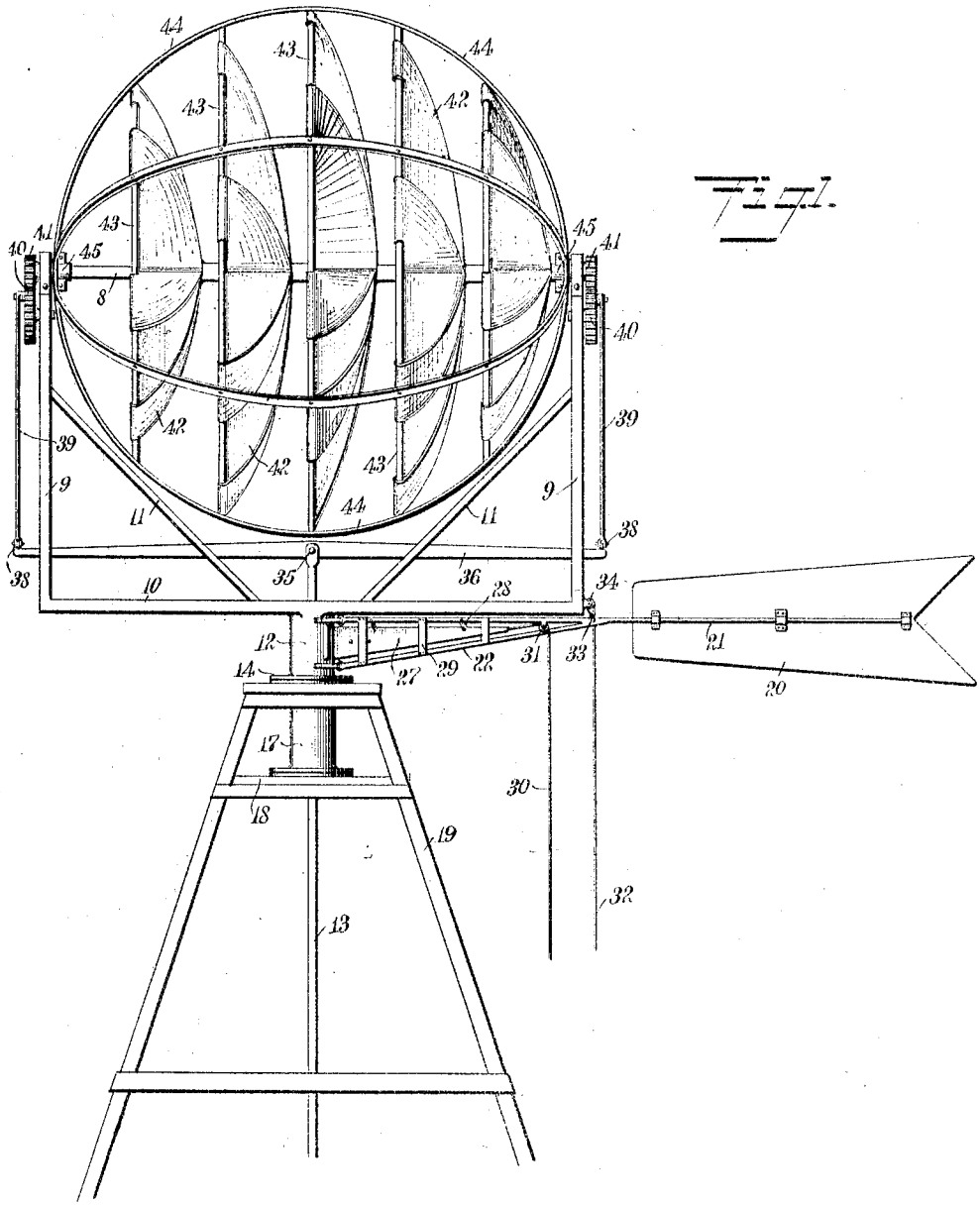

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

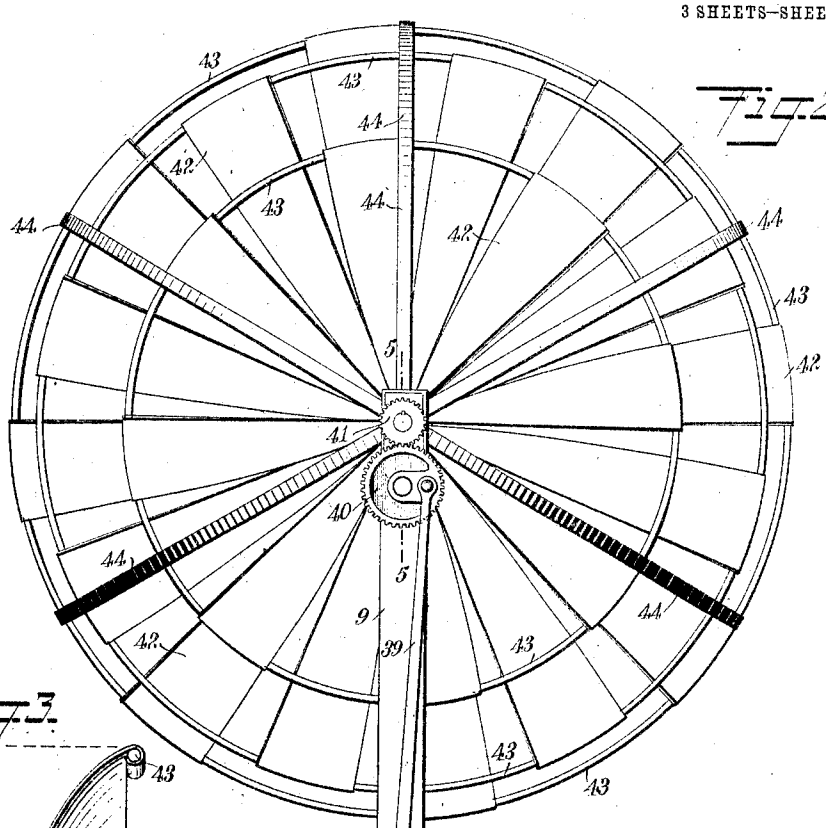


Fig. 3.

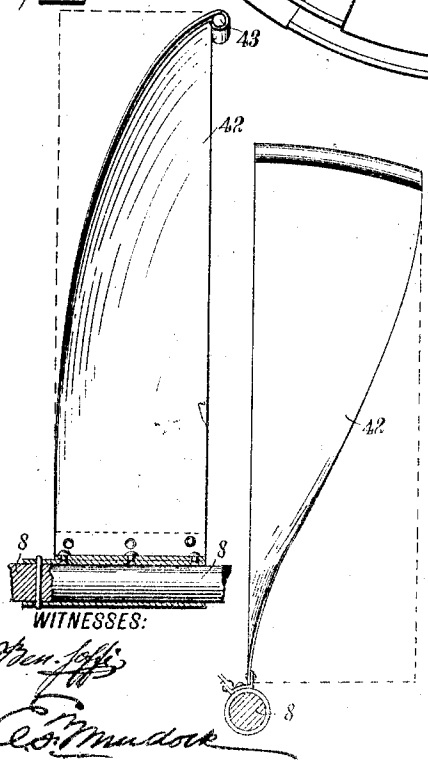
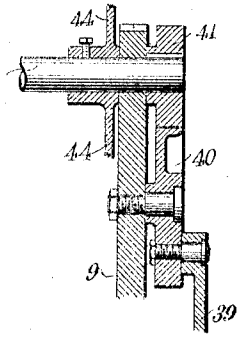


Fig. 4.

Fig. 5.



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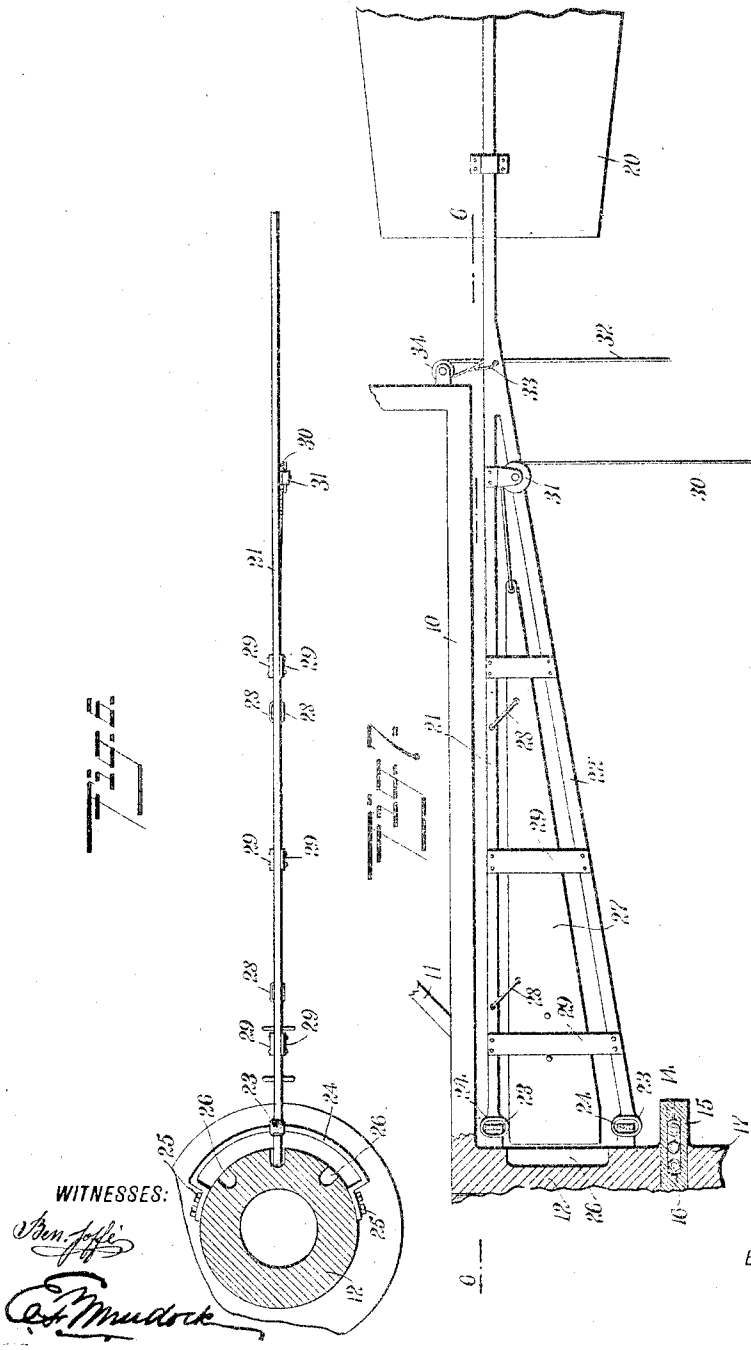
3 SHEETS—SHEET 3.



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CHARLES FLORENCE CRADDICK, OF BUTTE, MONTANA.

WINDMILL.

1,009,896. Specification of Letters Patent. **Patented Nov. 28, 1911.**

Application filed September 17, 1910. Serial No. 582,544.

To all whom it may concern:

Be it known that I, CHARLES F. CRADDICK, a citizen of the United States, and a resident of Butte, in the county of Silverbow and State of Montana, have invented a new and Improved Windmill, of which the following is a full, clear, and exact description.

Among the principal objects which the present invention has in view are: to provide a power head for a windmill of the character described, disposed and arranged as a series of turbine-shape rotating members; to provide a power head having a maximum wind pressure surface disposed in power relation to the wind, and having the minimum of exposed surface when disposed in angular relation to the wind; to provide regulating means for automatically varying the wind pressure under operative conditions; and to provide a simple, efficient and durable construction for the operative parts for the said head and means for operating and controlling the same.

One embodiment of the present invention is disclosed in the structure illustrated in the accompanying drawings, in which like characters of reference denote corresponding parts in all the views, and in which—

Figure 1 is a side elevation of a windmill constructed and arranged in accordance with the present invention; Fig. 2 is a front view of the power head and supporting frame employed by me; Fig. 3 is a fragmentary view in side elevation and on an enlarged scale, showing the molded shape of a power blade employed in the construction of the power head, and showing the forward bellying curve of the rear edge of said blade; Fig. 4 is a fragmentary view in front elevation and on an enlarged scale, of the blade shown in Fig. 3, and in connection with the driving shaft of the power head, the view showing the convolute shape of the forward edge of the power blade; Fig. 5 is a vertical section taken on the line 5—5 in Fig. 2, showing the translating gear for reciprocating the pump rod; Fig. 6 is a cross section taken on the line 6—6 in Fig. 7, of the rotary standard for supporting the power head, showing in connection therewith in top view, the wind vane arm; and Fig. 7 is a side view in detail and fragmentary in form, of the vane supporting arm and head locking regulating device connected therewith.

Windmills, wherein are employed power heads having turbine driven shafts, are steadier in operation than those provided with a single row or series of deflected blades or planes. The present invention belongs to the class wherein a plurality or series of sections arranged successively is employed, each series employing a number of spiral blades, said blades being disposed with relation each to the other to form a series of tortuous passages for the wind when driven therethrough. An increased pressure surface is thus obtained for rotating the driving shaft 8.

The driving shaft 8 is supported in bearings formed in the upper end of stanchions 9, 9. The stanchions 9, 9 are erected on a lateral frame member 10, and reinforced in braced relation therewith by braces 11, 11. The frame member 10 is secured to a cylindrical standard 12, which is hollow to pass a pump rod 13, and is provided with an extended flange 14 wherein a bearing ball race is formed, as seen particularly in Fig. 7 of the drawings. The flange 14 may be integrally formed with the standard 12, or be shaped from a plate rigidly secured thereto, as indicated in said Fig. 7 of the drawings. In both cases the flange rests upon a second flange 15, wherein is formed a companion race for the disposition of the bearing balls 16, 16. The flange 15 is formed on a tubular standard 17, which is rigidly secured to, and supported by the platform 18 of a derrick 19.

The extension of the arms of the frame member 10 may be varied, but it is preferred to have equal extension so that the power head and devices connected therewith are evenly placed on the bearing balls 16. In this manner it will be observed that simple means are provided for the rotation of the standard 12 in answer to the impulses of the breezes whereby the mill is operated.

The standard 12 and power head connected therewith, are rotated by a wind vane 20. The vane 20 is fixedly mounted upon a supporting rod 21, which is an extension of the upper frame rod of a bracket 22. The arms of the bracket 22 are provided with loop ends 23, 23, slidably mounted upon two running loops 24, 24. The loops 24, 24 are rigidly secured at 25, 25 by suitable bolts, or other fastening devices, to the standard 12. Disposed within the loops 24, 24 are vertical grooves 26, 26, provided to receive the end of a locking plate 27. The locking plate 27 is pivotally

swung from the upper bar of the bracket 22 by means of links 28, 28. The plate 27 is guidably mounted between connecting side braces 29, 29, these being parted to permit the said plate to lie between in guided relation therewith. The disposition of the links 28, 28 is such that the weight of the plate 27 throws the locking end thereof into the grooves 26, 26 when not otherwise prevented. The plate 27 is controlled by a cable 30, which is reeved over a pulley 31 mounted in the bracket 22, the cable 30 being extended down to an operating station near the ground. The cable 30 may either be belayed to a running block, or securely fastened on the derrick structure. When the cable 30 is drawn upon the plate 27 is held out of engagement with the grooves 26, 26.

The means thus described for locking the bracket 22 and the vane 20 carried thereby to the standard 12, is that the relation of the power head and the frame 10 carried thereby may be varied, permitting, as it does, an offset or angular disposition of the power head with reference to the operating of the controlling breeze, which will, under all conditions remain parallel with the extension of the vane 20, it being the office of the vane 20 to maintain the power head set in the eye of the wind.

The variation of the power head with the bracket 22 and the vane 20 is controlled by a cable 32, which is connected by a ring 33 to the bracket 22, and said cable is reeved over a pulley 34 mounted on the stanchion 9 at the rear of the frame of the power head. The cable 32 is made fast to the framing structure, or other stationary fixture, at the base of the tower or derrick upon which the mill is mounted. It is obvious that by taking in or drawing upon the cable 32 the lateral play of the power head is varied by the extent of the cable connecting the pulley 34 and ring 33. The play thus provided relieves the power head of any stiffness or rigidity of action, and permits it to shift to accommodate the slight variations of the breeze which the slower action of the vane might not effect without threshing.

The pump rod 13 is pivotally connected at 35 to a cross beam 36. The cross beam 36 is extended through vertical slots 37 in the stanchions 9, 9, and is pivotally connected at 38, 38 to pitman rods 39, 39. The pitman rods 39, 39 are pivotally connected to crank wheels 40, 40, which are mounted in bearings in the upper end of the stanchions 9, 9, and are tooth-engaged with pinions 41, 41. The pinions 41, 41 being fixedly connected to the driving shaft 8, the power exerted by the shaft and pinions upon the wheels 40 is multiplied, while the reciprocation of the pitmen and the pump rod is proportionately reduced.

The driving shaft 8 is rotated by propeller blades 42, 42. The blades 42, 42 are fixedly connected to the shaft 8, the connecting ends of said blades extending parallel to the center of said shaft. The outer ends of the blades 42, 42 are fixedly connected with hoops 43, 43. There are a series of hoops 43, each fixedly attached to a circular ring brace 44. The braces 44, 44 are fixedly connected with the driving shaft and secured to the collar heads 45, 45 thereof.

The number of hoops 43 employed in the power head varies according to design. The blades 42, 42, as stated, are connected to the driving shaft 8 ir longitudinal disposition thereon. The outer edge is curved over the hoops 43, the body of the vane being bent or molded to a spiral plane in thus disposing the outer and inner ends of each of the blades at an angle of 90° relatively each to the other. The blades 42, 42 in the succeeding series, or the blades connected with each of the hoops 43 successively from the front to the rear end of the driving shaft, are so disposed that the succeeding blades cover the gaps in the preceding blades. In this manner the blades, although of narrow area, are disposed to offer a direct and solid expanse to the passage of the breeze.

While there has not been here described a construction whereby the bracket 22 may be disposed on the standard 12 at an angle of 90° to the driving shaft 8, it will be understood that such an arrangement would merely necessitate an added number of grooves 26. When the vane 20 is thus disposed with reference to the power head it will be seen that it operates as a governor, and that when the wind pressures on the vane exceed that on the power head, the vane swings in line with the direction of the wind and presents thus the edge of the blades 42 to the wind, thus relieving the mill from the wind pressure and preventing racing.

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

1. A windmill embodying a power head, comprising a longitudinally extended driving shaft; a plurality of longitudinally disposed bowed braces arranged in globe-like form; a plurality of hoops graduated in diameter from large to small, fixedly connected in rib-like manner to said braces; and a plurality of spiral blades connecting said hoops and said driving shaft, the ends of said blades being extended in parallel disposition with the said hoops and said shaft to which they are attached.

2. A windmill embodying a power head, comprising a longitudinally extended driving shaft; a plurality of longitudinally disposed bowed braces arranged in globe-like form; a plurality of hoops graduated in

diameter from large to small fixedly connected in rib-like manner to said braces; a plurality of spiral blades the ends whereof are extended in parallel relation to the members to which they are attached; a pump rod; a supporting frame; and a translating mechanism connecting said driving shaft and said pump rod for converting the rotary motion of said shaft to the reciprocating motion of said rod.

3. A windmill embodying a power head, comprising a longitudinally extended driving shaft; a plurality of longitudinally disposed bowed braces arranged in globe-like form; a plurality of hoops graduated in diameter from large to small fixedly connected in rib-like manner to said braces; a plurality of spiral blades the ends whereof are extended in parallel relation to the members to which they are attached; a pump rod; a supporting frame; a translating mechanism connecting said driving shaft and said pump rod for converting the rotary motion of said shaft to the reciprocating motion of said rod; a rotary standard for supporting said power head, said standard being provided with a series of recesses vertically disposed; a wind vane provided with a supporting frame loosely mounted on said standard; guide members for said vane supporting frame fixedly mounted on said standard; a locking plate pendulously mounted in said frame and adapted to engage said recesses; a pull line connected with said plate to extend to near the ground and arranged to retract said plate from said recesses when drawn upon; and flexible connections between said power head and said vane supporting frame for varying the free play between the same.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES FLORENCE CRADDICK.

Witnesses:
T. V. LOWNEY,
CLARENCE R. JOHNSON.