H. C. VOGT, W. V. BOBY, AND S. D. LANCASTER.

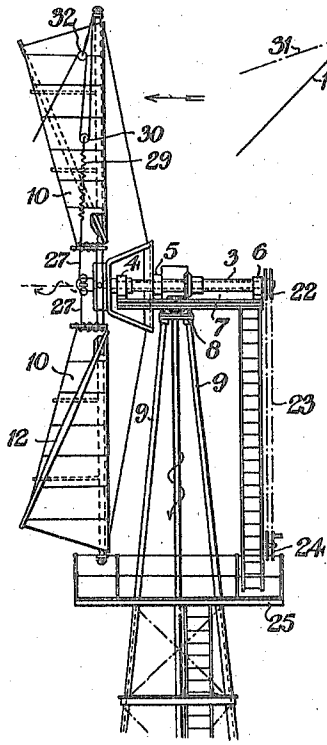
WINDMILL.

APPLICATION FILED MAR. 9, 1922.

1,417,000. Patented May 23, 1922.

2 SHEETS—SHEET 1.

Fig. 1.



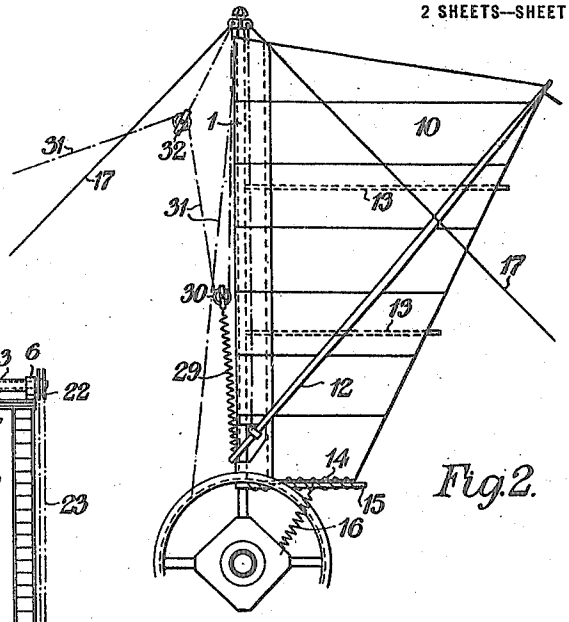




Fig. 2.

Fig. 3.

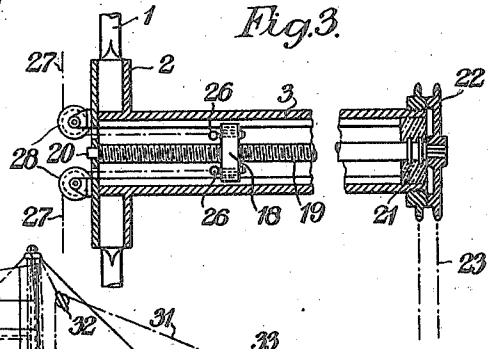
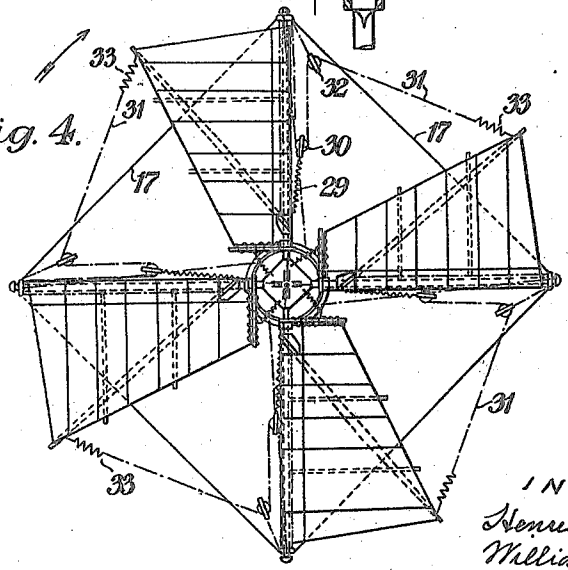



Fig. 4.




INVENTORS

Henrie C. Vogt

William V. Boby

Sidney D. Lancaster

By Wm Wallace White ATTY.

H. C. VOGT, W. V. BOBY, AND S. D. LANCASTER.

WINDMILL.

APPLICATION FILED MAR. 9, 1922.

1,417,000. Patented May 23, 1922.

2 SHEETS—SHEET 2.

*Fig. 5.*

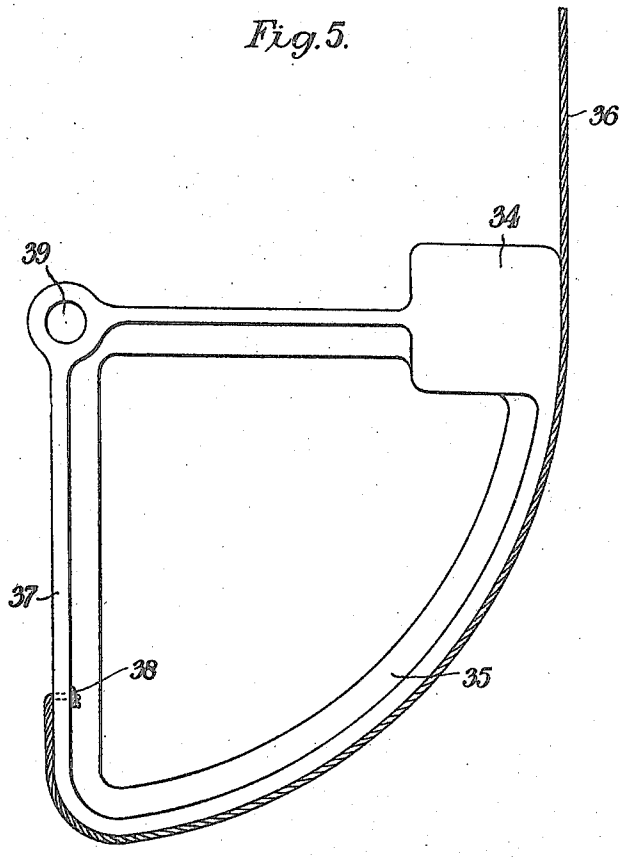



*Fig. 7.*

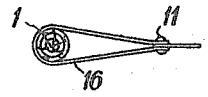
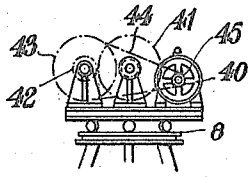



*Fig. 6.*




INVENTORS:
Henrie C. Vogt
William V. Boby
Sidney D. Lancaster
By Wm Wallace White
ATT'Y.

# UNITED STATES PATENT OFFICE.

HENRIC CHRISTIAN VOGT, OF COPENHAGEN, DENMARK, WILLIAM VINCENT BOBY, OF LONDON, AND SIDNEY DAVID LANCASTER, OF BARKINGSIDE, ENGLAND.

## WINDMILL.

1,417,000. Specification of Letters Patent. Patented May 23, 1922.

Application filed March 9, 1922. Serial No. 542,228.

*To all whom it may concern:*

Be it known that we, HENRIC CHRISTIAN VOGT, of Copenhagen, Denmark, a subject of the King of Denmark, WILLIAM VINCENT BOBY, of London, England, a subject of the King of Great Britain and Ireland, and SIDNEY DAVID LANCASTER, of Barkingside, England, a subject of the King of Great Britain and Ireland, have invented certain new and useful Improvements in and Relating to Windmills, (for which we have filed an application in Denmark, #116, Jan. 10, 1920,) of which the following is a specification.

This invention relates to windmills having a radially disposed sail system and has for its object to provide an improved construction of windmill of this kind better adapted than the windmill as heretofore constructed to fully utilize the energy of the wind.

With the construction of windmills heretofore employed it has been necessary to provide the somewhat complicated construction of tail-vane for the purpose of rotating the mill tower to bring and maintain the mill mechanism in the correct position relatively to the direction of the wind.

The improved construction according to our invention comprises a lee-winded arrangement of flexible sails and means for adjusting the turning of the sails round the masts relatively to the direction of the resultant wind to enable the driving sails to secure the best angle of incidence and consequent maximum rarefaction on their lee side and the position of the rotary mill tower to be adjusted automatically to the direction of the wind, and the usual tail-vane construction to be dispensed with.

In order that the invention may be clearly understood suitable arrangements in accordance therewith will now be described with the aid of the accompanying drawings, in which—

Fig. 1 is an edge-on view of the wind-wheel of a windmill constructed in accordance with our invention;

Fig. 2 is a view drawn to an enlarged scale of one of the sails shown in Fig. 1;

Fig. 3 is a sectional view of means for regulating the amount of sail surface directly exposed to the wind;

Fig. 4 is a face view of the arrangement shown in Fig. 1, showing how the sail masts are stayed to mutually support one another;

Fig. 5 is a modification of the arrangement shown in Fig. 3;

Fig. 6 shows a suitable reduction gearing for driving a dynamo from the driving shaft of the wind motor;

Fig. 7 shows a suitable form of attachment of each sail to the corresponding mast.

Referring to the drawings, a 4-masted mill is shown by way of example in which the root of each mast 1 is secured in a socket 2 provided on the lee-ward end of a flanged sleeve 3 which is supported in a horizontal position in bearings 4, 5 and 6 (Fig. 1) secured upon a base-plate 7 which again rests upon a circular ball-race 8 mounted upon the fixed frame 9.

Mounted upon each mast 1 is a sail 10 which may be made of linen or sail cloth or other suitable material and may conveniently be secured to the mast 1 by means of a loop formed by doubling back the inner edge of the sail round the mast and back upon the body of the sail to which the said edge may be fastened by means of headed pins 11, as shown in Fig. 7.

The sails may be given any desired form in outline but we have found by experience that the trapezium form as shown in the drawings is the most advantageous form to use for all purposes, the longest side being next to the mast and the longest end uppermost.

Each sail 10 is maintained in extended position by means of a rigid sprit 12 arranged diagonally across the sail (and by which the sail can be stretched) and having a flexible connection to the mast 1, while two or three thin flexible spars 13 are arranged transversely to the sail, each spar 13 having one end secured to one of the side edges of the sail and the other end fastened by means of thin rope stretchers to the opposite side edge, the end of each spar nearest to the mast being thinner than the opposite end to provide greater flexibility at the mast end of the spar.

The bottom end of each sail is secured by a running lashing 14 to a short boom 15 mounted so as to swing freely round the mast 1, but each boom 15 is urged inwards in opposition to centrifugal force and so as to secure a small angle of incidence by means of a tension spring 16.

The four masts 1 are secured in position in their sockets 2 and are made to mutually support one another in that position by means of the guy ropes 17 secured to the outer ends of the masts.

Within the sleeve 3 slides a block or nut 18 which is arranged so as to rotate with the sleeve but is capable of moving in the longitudinal direction along the sleeve. The nut 18 is pierced with a central hole co-axial with the axis of the sleeve 3 and this hole is tapped with a screw thread in which engages an externally screwed rod 19 having a reduced journal 20 at its inner end supported rotatably in a bearing formed in the inner end of the sleeve 3, the outer end of the rod 19 being supported in a bearing block 21 fixed in the outer end of the sleeve.

The reduced portion at the end of the rod 19 is formed as a square or with a flat thereon, and carries a sprocket wheel 22 connected by a gear chain 23 with a hand wheel 24 which is accessible to the operator standing on the platform 25 near the upper end of the mill tower.

To the nut 18 are secured, for example by means of ring pins 26, a number of light cables or sheets 27, one for each sail and each cable 27 is passed through the inner end of the sleeve 3 and around a small guide pulley 28 on the inner end of the sleeve. After passing over the guide pulley 28 each cable 27 is connected to the lower end of a long tension spring 29 to the upper end of which is secured a pulley block 30. Through the pulley block 30 is rove a cable 31 the standing end of which is secured to the outer end of the mast 1 while the running end is passed over a second pulley block 32 slung from the outer end of the said mast and is passed thence to the outer end of the swinging sprit 12 belonging to the next adjacent mast in the direction of the rotation of the wind motor, the cable 31 being connected to the outer end of the sail sprit 12 through a light spring 33. This combination of pulleys and springs forms an elastic accumulator, or purchase transmission, of the energy contained in the wind pulsations. The said elastic accumulator takes up energy in being stretched when the wind pulsations turn the sail, and it returns energy in bringing the sail back again. The light springs 33 near the outer ends of the sprits operate in slight winds and the strong springs 29 near the masts operate in powerful winds.

It will be seen that by moving the nut 18 to the right as seen in Fig. 3 along the interior of the sleeve 3 all of the sheets or cables 27 will be hauled in and will thus pull upon the outer ends of the swinging sprits 12 to change the angle of inclination of the corresponding sails relatively to the direction of the wind. By allowing the nut 18 to move to the left, on the contrary, the said sheets 27 will be allowed to run out and the sails will therefore swing out more into the wind.

For the purpose of adjusting the position of the nut 18 and thereby also adjusting the angle of inclination of the sails to the direction of the wind the sprocket wheel 22 is provided. When the mill is in operation and rotating it will be understood that the sleeve 3 and all the parts connected therewith are also in rotation, including the sprocket wheel 22; hence, the chain 23 is also in circulation and the hand wheel 24 is rotated on its axis thereby. If the operator wishes to haul in the outer ends of the sail sprits 12 he holds the hand wheel 24 for an instant or two thus holding stationary the sprocket wheel 22 and the screwed rod 19. As the nut 18 continues to rotate with the sleeve 3 it will be seen that the said nut is forced to travel outwards along the screwed rod 19 thereby hauling in each of the sheets or cables 27 and thus effecting the desired adjustment of each of the sails relatively to the direction of the wind.

In order to ease off or pay out the sheets 27, the operator rotates the hand wheel 24 in the same direction in which it is rotated by the working of the mill but at an increased speed, whereby the nut 18 is caused to travel upon the rod 19 towards the inner or leeward end of the sleeve 3, thus allowing the sails 10 to fly out more with the wind.

Alternatively an arrangement may be employed for maintaining the tension upon the sails by the use of a variable compensating weight as shown in Fig. 5. Referring to this figure a compensating weight 34 is arranged at one corner of a quadrant 35 having a grooved periphery upon which engages a cable 36 the fixed end of which may be secured in a hole made for the purpose in the flange of the quadrant arm 37 by means of a button or knot 38. The quadrant 35 is pivoted at 39 on any suitable fixed member, preferably on the platform 25, while the free end of the cable 36 passes upwards and over a guide pulley into the open outer end of the sleeve 3 where it is fixed to a plate or analogous member, arranged to move freely along the interior of the sleeve 3, the sheets 27 from the sails being also secured to this plate. In this case the screwed rod 19 is of course dispensed with and the plate referred to takes the place of the nut 18.

It will be seen that the weight 34, as shown, is in its position of maximum lever-

age for opposing the action of a strong wind upon the sail. In any other position of the weight 34 lower than that shown down to the lowest possible position, a gradually diminishing pull is exerted thereby upon the sails to oppose the action of a correspondingly strong or weak wind. Thus there is a suitable position for the weight 34 for every degree of strength of the wind operating the mill and the weight is automatically raised by the prevailing wind into the proper compensating position which gives the best controlling effect upon the momentary position, and change of position of the sails.

For the purpose of generating electric current a dynamo 40 may be conveniently mounted upon the rotary mill tower and be connected through any desired arrangement of gearing to the rotating sleeve 3. In the arrangement shown in Fig. 6 for example, pinion 41 is fixed upon the sleeve 3 and engages a smaller pinion 42 fixed to or integral with a pulley 43 over which an endless belt 44 passes to a pulley 45 carried on the end of the shaft of the dynamo 40. It will of course be understood that any other arrangement of gearing may be employed to obtain from the slowly revolving sleeve 3 the desired speed of the dynamo shaft.

The above described adjusting arrangement illustrated in Figs. 1 to 4 we prefer to call an elastic tackle purchase by which name said apparatus is referred to in the claims. By easing off the sheets 27 of the said elastic tackle purchase until the sails fly with the wind the mill can be stopped at any time.

It is pointed out that this improved construction, whether using springs or weights as described above, enables the windmill to be left entirely to itself for long periods of time, for example, the mill may be left alone to run all night without attention.

Many modifications in detail may be introduced in the apparatus employed without exceeding the scope of the invention.

What we claim and desire to secure by Letters Patent is:—

1. In a windmill, in combination, a hollow sleeve forming the hub of the mill, masts secured to said sleeve, flexible sails secured to said masts, a sprit arranged diagonally across each sail, a plurality of spars located transversely on each sail, and means for regulating the angle of the sails to the direction of the wind.

2. In a windmill, in combination, a hollow sleeve forming the hub of the mill, masts secured to said sleeve, flexible sails secured to said masts, an elastic tackle purchase for regulating the angle of the sails to the direction of the wind, comprising a controlling member movable within the sleeve, and means for adjusting the position of said member.

3. In a windmill, in combinatiton, a hollow sleeve forming the hub of the mill, masts secured to said sleeve, flexible sails secured to said masts, and means for regulating the angle of the sails to the direction of the wind comprising a screwed rod arranged axially within the sleeve, a nut rotatably mounted on said rod, both the rod and nut normally rotating with the sleeve, a plurality of cables one for each sail, one end of each cable being secured to the nut and the other end of each cable to one of said sails.

4. In a windmill, in combination, a hollow sleeve forming the hub of the mill, a series of radial sockets arranged round and secured to the sleeve, masts fitting in the sockets, flexible sails secured to the masts, a sprit arranged diagonally across each sail, the foot of the sprit flexibly secured to the corresponding mast and the head of the sprit secured to the sail, and an elastic tackle purchase for regulating the angle of the sails to the direction of the wind comprising a controlling member movable within the sleeve, means for adjusting the position of the said member, a number of cables, one for each sail, one end of each cable being secured to the controlling member and the other end after passing over a guide being secured to the inner end of a coil spring, a pulley secured to the outer end of said spring, another pulley secured to the outer end of the corresponding mast, and a cable passing through both said pulleys one end of the cable being secured to the outer end of the corresponding mast and the other end after passing through the pulleys being flexibly secured through a relatively weak spring to the outer end of the sail sprit of the next adjacent mast, the combination of pulleys and springs thus forming an accumulator of the energy of the wind pulsations when the sails are turned thereby and the springs are stretched, and giving up energy in turning the sails back, the weak springs alone operating in light winds and both sets of springs in strong winds.

5. In a windmill, in combination, a hollow sleeve forming the hub of the mill, a series of radial sockets arranged round and secured to the sleeve, masts fitting in the sockets, flexible sails secured to the masts, a sprit arranged diagonally across each sail the foot of the sprit flexibly secured to the corresponding mast and the head of the sprit secured to the sail, and means for regulating the angle of the sails to the direction of the wind comprising a screwed rod arranged axially within the sleeve, a nut working on the screwed rod, both the rod and nut normally rotating with the sleeve, a number of cables one for each sail, one end of each cable being secured to the nut and the other end after passing over a guide being secured to the inner end of a coil spring, a pulley

secured to the outer end of said spring, another pulley secured to the outer end of the corresponding mast, and means for varying at will the position of the nut upon the screwed rod.

6. In a windmill, in combination, a hollow sleeve forming the hub of the mill, a series of radial sockets arranged round and secured to the sleeve, masts fitting in the sockets, flexible sails secured to the masts, a sprit arranged diagonally across each sail the foot of the sprit flexibly secured to the corresponding mast and the head of the sprit secured to the sail, and means for regulating the angle of the sails relatively to the direction of the wind, comprising a controlling member freely movable longitudinally within the sleeve, a number of cables, one for each sail, one end of each cable being secured to the said member and the other end being passed over guides and secured to the outer end of the corresponding sail sprit, a variable compensating weight, and a connection therefrom to the centre of the controlling memebr, to cause the weight acting upon the sail sprits to vary in accordance with the strength of the wind, and consequently with the position of the controlling member within the sleeve.

In testimony whereof we have signed our names to this specification.

HENRIC CHRISTIAN VOGT.
WILLIAM VINCENT BOBY.
SIDNEY DAVID LANCASTER.