June 25, 1929. G. R. BRUCE 1,718,682

WINDMILL

Filed May 18, 1928 3 Sheets-Sheet 1

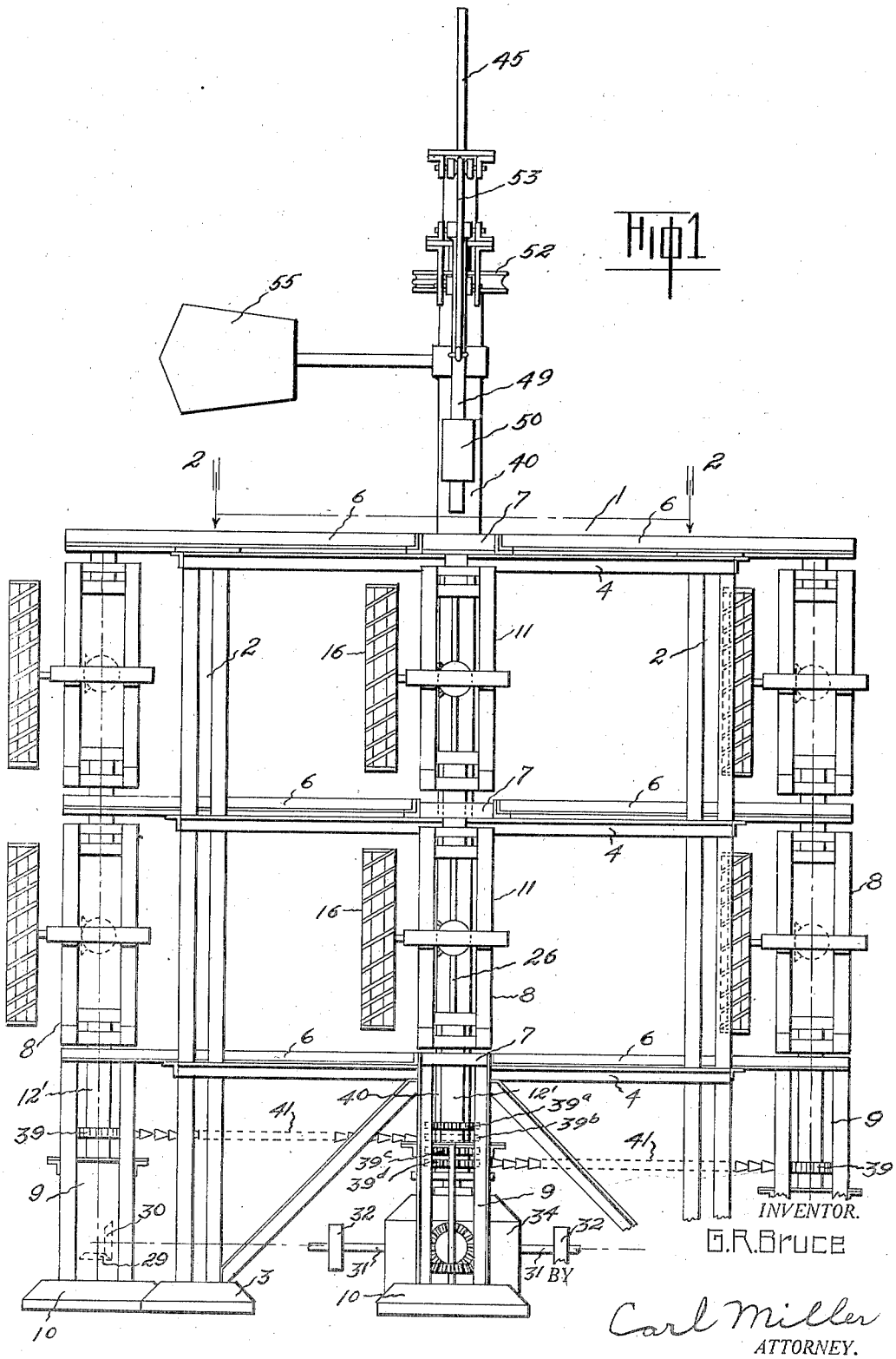

Fig 1

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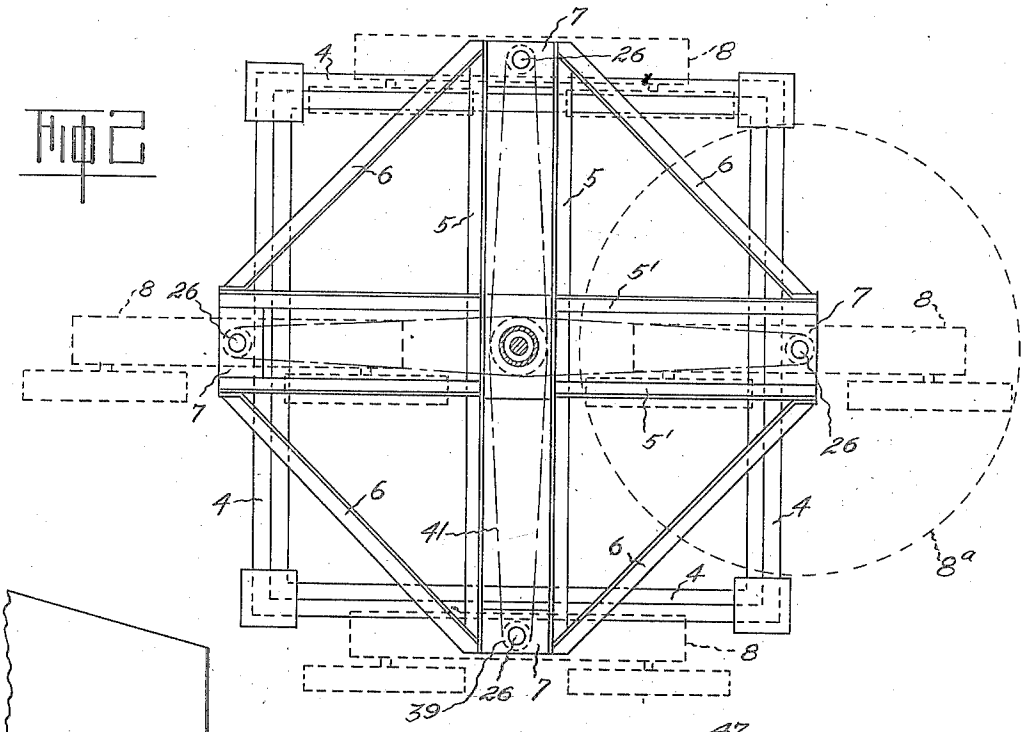

FIG 2

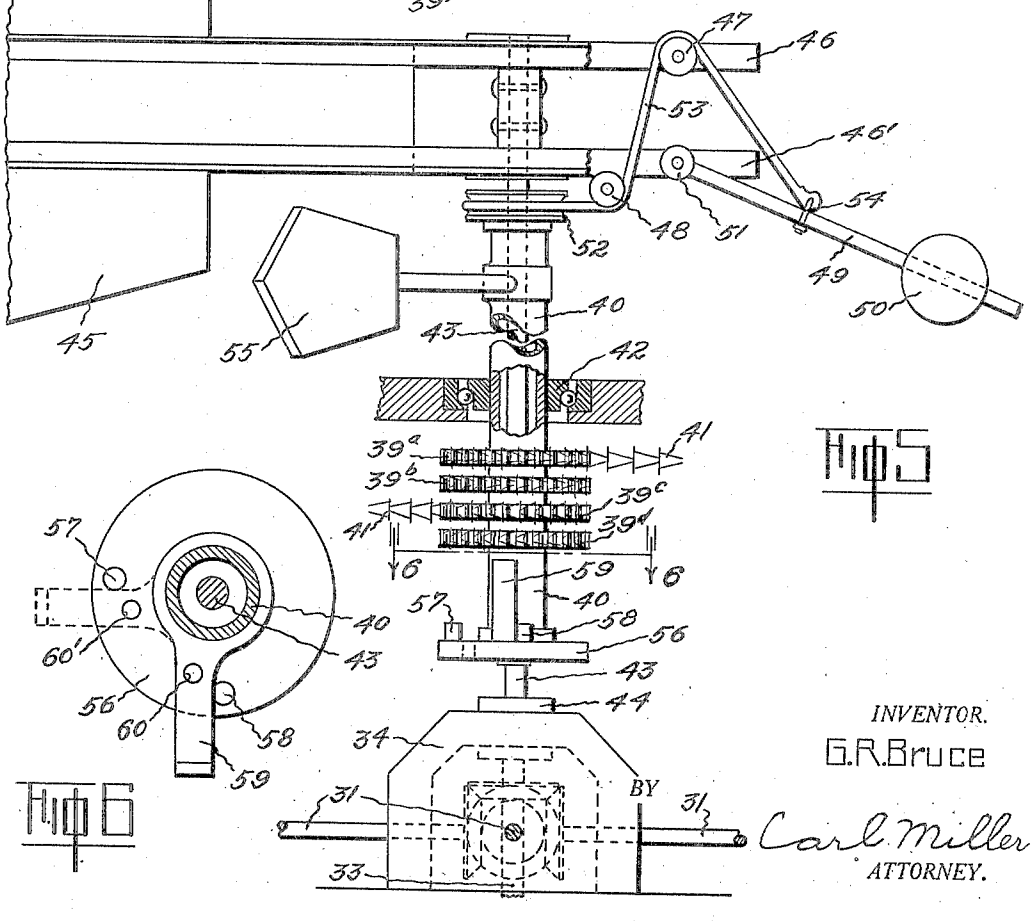

FIG 5

FIG 6

INVENTOR.
G.R.Bruce
BY
Carl Miller
ATTORNEY.

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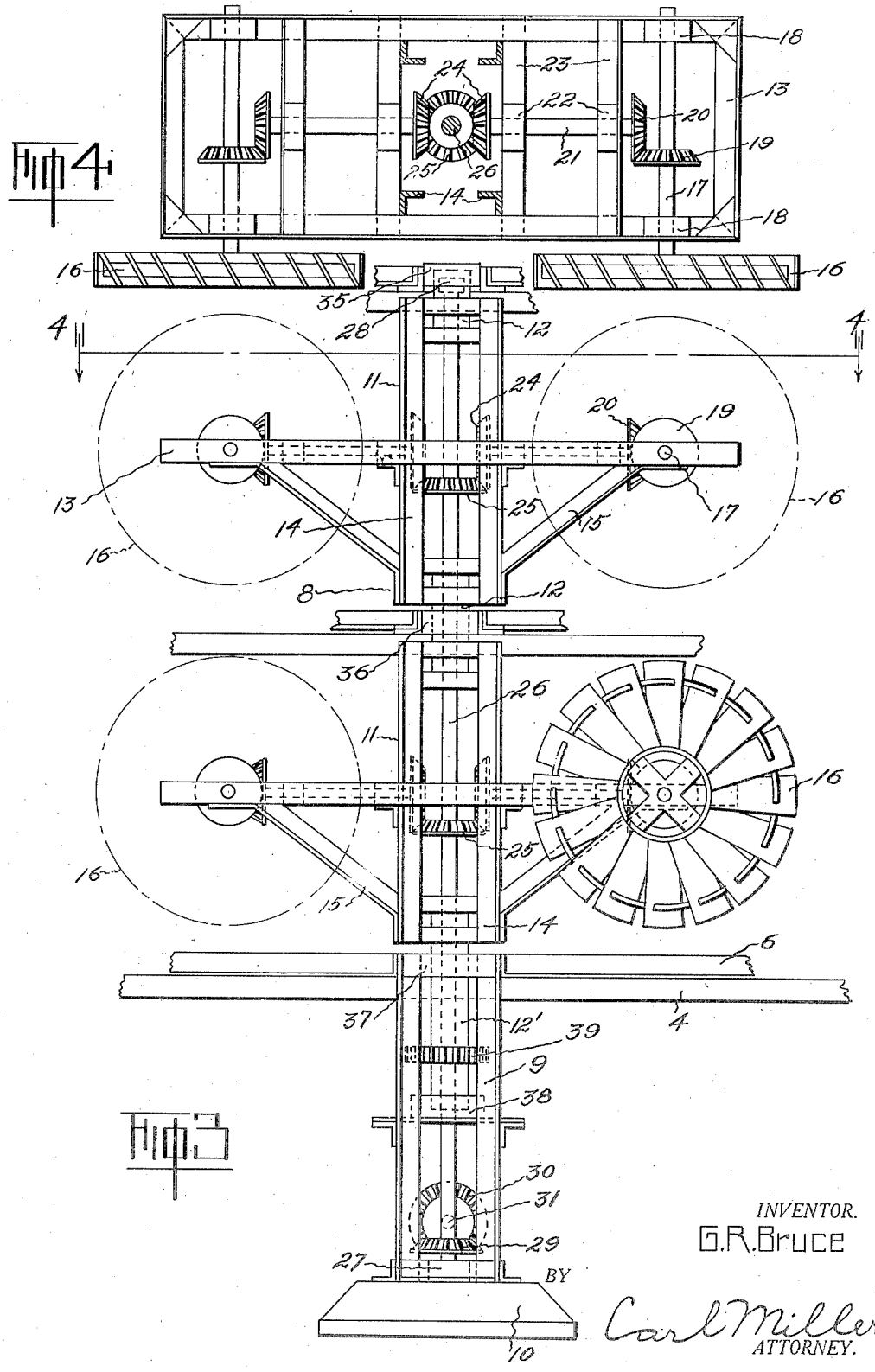

INVENTOR.
G.R.Bruce

BY
Carl Miller
ATTORNEY.

Patented June 25, 1929. 1,718,682

UNITED STATES PATENT OFFICE.

GEORGE R. BRUCE, OF SAN BENITO, TEXAS.

WINDMILL.

Application filed May 18, 1928. Serial No. 278,871.

My invention relates to improvements in windmills and is designed to utilize wind-currents for the purpose of generating power at maximum efficiency. The object of my invention is to provide a means whereby a plurality of wind-wheels or rotors are mounted on a rotatable unit, a plurality of similar units being supported in a suitable frame-work so that the power available in each unit, from the rotation of the rotors thereon, may either be individually or collectively employed. A further object of my invention is to make the same self-regulating so as to operate uniformly irrespective of the velocity of the wind. A still further object of my invention is to provide means whereby the windmill may be manually controlled so that the same may readily be thrown into and out of operation, whenever so desired. Other objects of my invention are to produce a windmill simple in construction, durable, easy to control and at the same time operate at maximum efficiency.

In the accompanying drawings illustrating my invention:—

Figure 1 is an elevation of the entire windmill structure.

Figure 2 is a plan view of the structure taken on line 2—2 of Figure 1, the rotating units being shown in dotted lines.

Figure 3 is an elevational view of one of the rotating units.

Figure 4 is a sectional view on line 4—4 of Figure 3 looking in the direction of the arrows, and shows the mounting of the rotors on the rotating unit.

Figure 5 shows partly in elevation and partly in section the control and cut-off mechanism for the rotating units.

Figure 6 is a section on line 6—6, Figure 5, looking in the direction of the arrows, showing a portion of the cut-off mechanism.

Similar characters of reference denote similar parts.

In the drawings 1 denotes the windmill frame work constructed entirely of structural steel forms such as angle bars, riveted or otherwise securely fastened together. The frame work comprises four fabricated columns 2 spaced equally from each other to form substantially the corners of a square, the lower ends of said columns being rigidly secured in a suitable support such as 3. The columns 2 are retained in their vertical position by the transverse members 4 arranged in three tiers one above the other, the foremost tier connecting the upper ends of the columns 2, and the intermediate and lowermost tiers being equally spaced from each other and the foremost tier. To further increase the rigidity of the structure, cross members 5 (see Figure 2) are arranged to connect the intermediate portions of the transverse members 4, and extend slightly beyond said members for a purpose to be hereinafter described. Additional cross members 5′ connect the intermediate portions of the cross members 5 and the other transverse members 4 and also extend beyond said members 4 in the same manner as do the cross members 5. Diagonal braces 6 connect the ends of the cross members 5 and 5′, forming substantially a square, the corners of which overlaps the center portions of the sides of the square formed by the transverse members 4.

Mounted on the connected ends 7 of the cross members 5 and 5′ are four rotating units 8, the lower portions thereof being mounted on short columns 9. The columns 9 are securely held in suitable supports 10, the upper ends thereof being secured to the extending portions of the cross members 5 and 5′ in any suitable manner. The rotating units 8 comprise two rotor supports 11 rigidly connected together by tubular members 12 to form one unitary structure, the lower rotor support 11 having secured thereto a similar tubular member 12′. Each rotor support 11 comprises a substantially horizontal rectangular frame 13 mounted on a vertical support or column 14, said frame being also connected to its support through the medium of the diagonal braces 15, as clearly shown in Figure 3. Rotors or wind-wheels 16 are mounted on the shafts 17, said shafts in turn being mounted in the anti-friction bearings 18, see Figure 4. Secured on the shafts 17 are bevel gears 19 which mesh with similar bevel gears 20 carried by the shaft 21 which is supported by the anti-friction bearings 22, carried by the cross members 23 in the frame 13. On the inner ends of the shafts 21 are secured bevel gears 24 which mesh with the bevel gears 25 which are secured on the shaft 26. The shaft 26 rotates within the tubular members 12 and 12′, the opposite ends of said shaft being mounted in anti-friction bearings 27 and 28. As the rotors 16 are turned by the wind the shaft 26 will be caused to rotate through the medium of the bevel gear train 19, 20, 24 and 25. A bevel gear 29 is secured near the lower end of the shaft 26 and meshes

with a similar gear 30 which is mounted on a drive shaft 31. It is therefore apparent that the power produced by the turning of the rotors is transmitted from the shaft 26 to the shaft 31, in each unit, where it may be individually utilized by attaching a pulley 32 to said shaft, or it may be collectively utilized from the shaft 33, (Figure 5) which is connected by a bevel gear to each of the four shafts 31, within the support or housing 34.

The rotor supports 11 and rotors 16 are of such a size that they fit within the tiers formed by the transverse members 4, the dotted circle 8^a showing the rotational path of one of the units 8.

If desired additional rotors 16 may be attached to the opposite ends of the shafts 17, thereby doubly increasing the number of rotors in the windmill.

The upper tubular members 12 and the lower tubular members 12′ of each of the rotating units 8 are respectively mounted in anti-friction bearing members 35, 36, 37 and 38, see Figure 3.

Mounted on the tubular member 12′ of each unit is a sprocket 39 which is turned by a chain 41 connected to one of four similar sprockets 39^a, 39^b, 39^c, and 39^d carried by the center control member 40, which passes through the vertical axis of the windmill frame work 1. The center control member 40 Figure 5, comprises a tubular member or sleeve supported by anti-friction bearings 42 located in each of the tiers. Within the control member 40 is located a shaft 43 the lower end of which is mounted in an anti-friction bearing 44 carried by the support or housing 34, the upper end of the shaft 43 having rigidly attached thereto the main vane 45, through the medium of the angle bars 46 and 46′ which extend beyond the shaft 43. Pivotally mounted on the bars 46 is a pulley 47, a similar pulley 48 being pivotally mounted on a downwardly extension carried by the bars 46′. A rod 49 carrying a movable weight 50 is pivotally secured to the bars 46′ adjacent their ends, as at 51; the position of the weight 50 on the rod 49 may be regulated at will and is secured to the rod 49 in any suitable manner. A pulley 52 is rigidly secured to the upper end of the control member 40 adjacent the bars 46′, and has fastened thereto one end of a cable or chain 53 which passes under the pulley 48 and over the pulley 47, the other end of said cable or chain being fastened to the rod 49 by the bolt 54. An auxiliary or pressure vane 55 is rigidly secured to the control member 40 adjacent the pulley 52 and is positioned at an angle to the main vane 45. When the pressure vane 55 is in this position relative to the main vane 45, the weight 50 on the rod 49 is at its lowest position, see Figure 5.

Integral with the shaft 43 is a collar 56 having two upwardly extending lugs 57 and 58 spaced 90° apart. Mounted on the lower end of the control member 40 and rigidly secured thereto is a cut-off lever 59 which rests on the collar 56, said lever being positioned between the lugs 57 and 58. When the cut-off lever 59 is in the position shown in Figure 5, the windmill is in operation. When it is desired to stop the windmill the cut-off lever 59 is moved to the left until it engages the lug 57. In view of the fact that the cut-off lever 59 is rigidly secured to the control member 40, moving said cut-off lever to the left will cause the sprockets 39^a, 39^b, 39^c and 39^d to rotate, thereby causing each of the units 8 to turn in a direction so that the rotors 16 will not be affected by the wind.

In case the velocity of the wind becomes too great when the windmill is in operation, the increased pressure on the pressure vane 55, created by the wind will cause said pressure van to swing to the left, (Figure 5), thereby turning the control member 40 which carries the sprockets 39^a, 39^b, 39^c, and 39^d, and causing the units 8 to assume such a position that the speed of the rotors 16 will remain constant, thereby assuring a uniform production of power. As the pressure vane 55 swings to the left the cable 53 is wound on the pulley 52, as a result of which the weight 50 is caused to move in an upward direction. When the increased pressure on the pressure vane 55 diminishes the weight 50 will move downwardly, causing the control member 40 to rotate in an opposite direction, thus returning the units 8 to their original position. In case the pressure vane 55 makes a complete quarter turn, the cut-off lever 59 will contact the lug 57, thereby shutting off the windmill. The hole 60 on the cut-off lever 59, and the hole 60′ on the collar 56 adjacent the lug 57 will align with each other when the cut-off lever 59 assumes the position shown in dotted lines, Figure 6, so that a bar or rod may be inserted therein to permanently shut-off the windmill.

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

1. In a windmill, a plurality of parallel vertically disposed rotating units mounted on a supporting frame-work, a plurality of pairs of horizontal transverse shafts arranged in tiers on said units, rotors secured on said horizontal transverse shafts and adapted to rotate in the same direction at all times, a central vertical shaft mounted in each of said units, a bevel gear drive operatively connecting each of said pairs of rotors on a unit with said central shaft, a single drive shaft, and a series of bevel gear drives operatively connecting the central vertical shafts of each of said units with said single drive shaft, means automatically maintaining the rotors in operative position relative to the direction of the wind when said windmill is in operation, and

manually operative means connected to said automatic means to render said windmill inoperative.

2. In a windmill, a supporting frame-work, a plurality of parallel vertically disposed rotating units pivotally mounted on the sides of said frame-work, a plurality of pairs of rotors on said units and arranged in tiers thereon, a central control means mounted within said frame-work said control means comprising a tubular control member, a pressure vane carried by the upper end of said tubular control member, a plurality of sprockets carried by said tubular control member at the lower portion thereof, a sprocket on the pivot of each of said rotating units, a chain drive connecting each one of the sprockets on the tubular control member with a corresponding sprocket on one of the units so that rotation of said tubular control member will cause all of said units to move in unison and in the same parallel direction whereby all of said rotors will assume identical positions relative to the direction of the wind, and power take off means mounted within said frame-work and operatively connected to each of said units.

3. In a supporting frame work a windmill, a plurality of parallel vertically disposed rotating units, rotors thereon, a central control means comprising a tubular control member rotatively mounted on anti-friction bearings within said frame-work, a shaft within said tubular control member, a main vane secured on the upper end of said shaft, a pressure vane secured on the upper end of said tubular control member at an angle relative to the direction of said main vane, a pulley on said tubular control member, a plurality of pulleys mounted on the main vane, a rod carrying an adjustable weight pivotally connected to said main vane, and a cable having one end fastened to the pulley on said control member and engaging the pulleys carried by the main vane, the other end of said cable being fastened to said rod, said weight being pulled upwardly when an increase of pressure on the pressure vane causes said vane to swing towards the main vane, said pressure vane being pulled back by said weight to its original position, when the pressure thereon diminishes, said control means being adapted to regulate the angularity of the rotors relative to the direction of the wind whereby the speed of rotation of said rotors will be substantially uniform irrespective of the velocity of the wind.

4. A structure as called for in claim 3, and a manually operated cut-off means mounted on the lower portion of said central control means to render said windmill inoperative at will.

5. A structure as called for in claim 3, and a manually operated cut-off means mounted on the lower portion of said central control means comprising a collar integral with said shaft, said collar having integral upwardly extending lugs thereon arranged 90° apart, a lever integral with said tubular control member and engaging the upper surface of the collar, said lever being positioned between said lugs, an opening in said collar adjacent one of said lugs, a similar opening in said lever, whereby when said lever is moved to contact the above mentioned lug the opening will align with each other so that the insertion of a or rod therein will hold the windmill in an inoperative position.

In testimony whereof I have affixed my signature.

GEORGE R. BRUCE.