

July 4, 1961

P. H. DARRAH

2,990,887

WINDMILL

Filed May 11, 1959

3 Sheets-Sheet 1

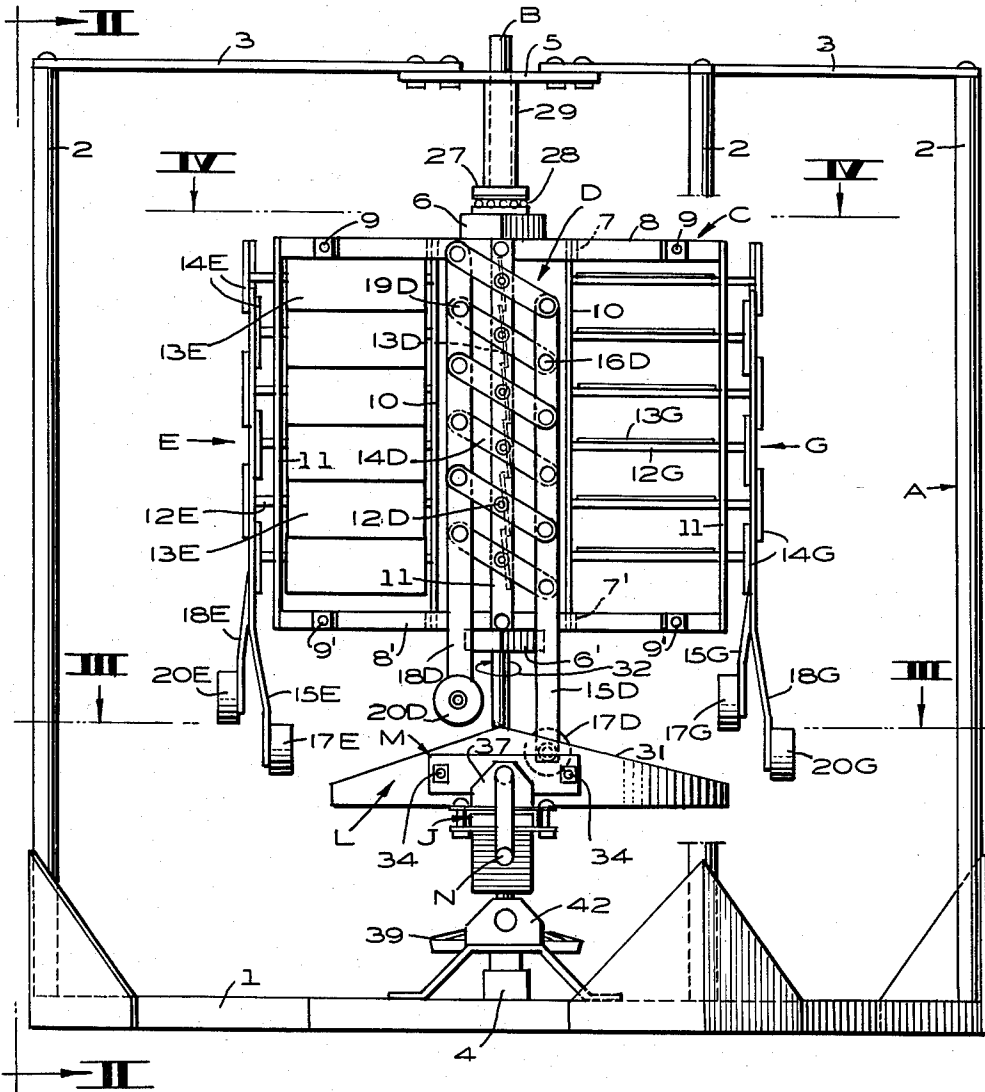


FIG. 1

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3 Sheets-Sheet 2

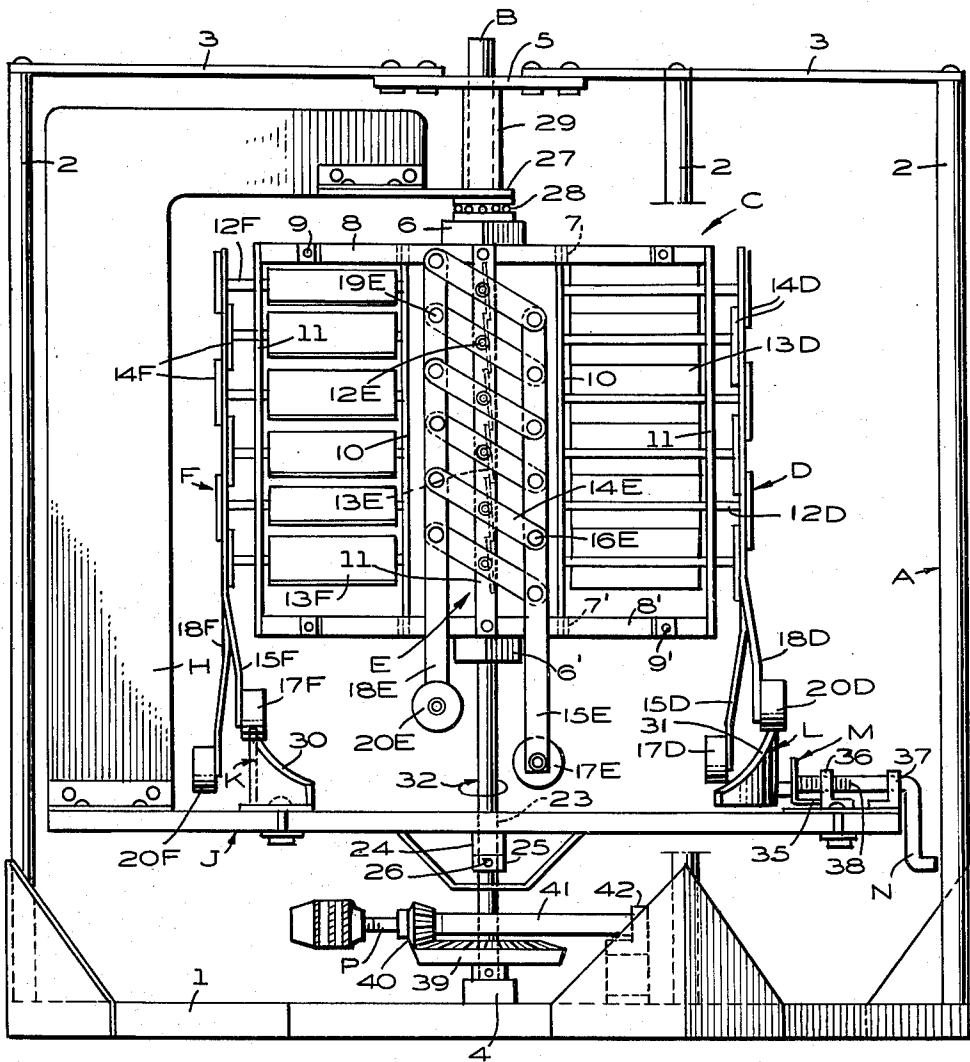


FIG. 2.

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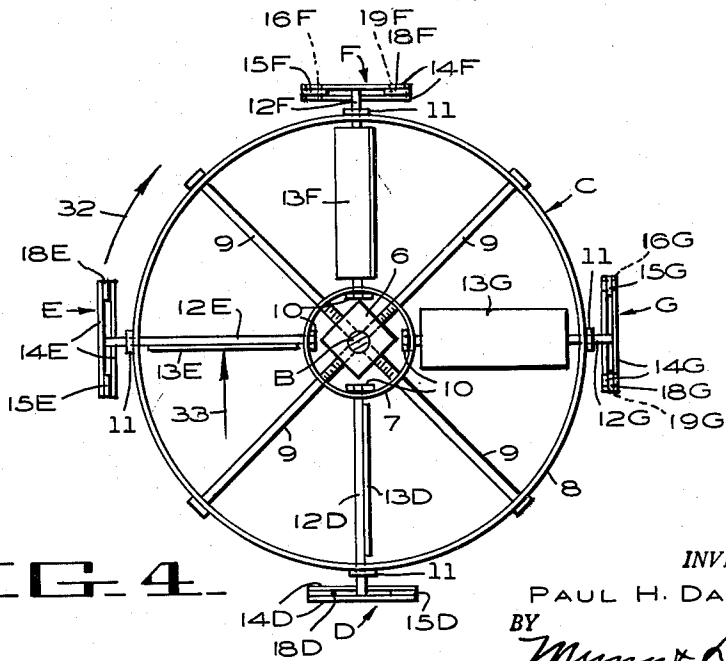
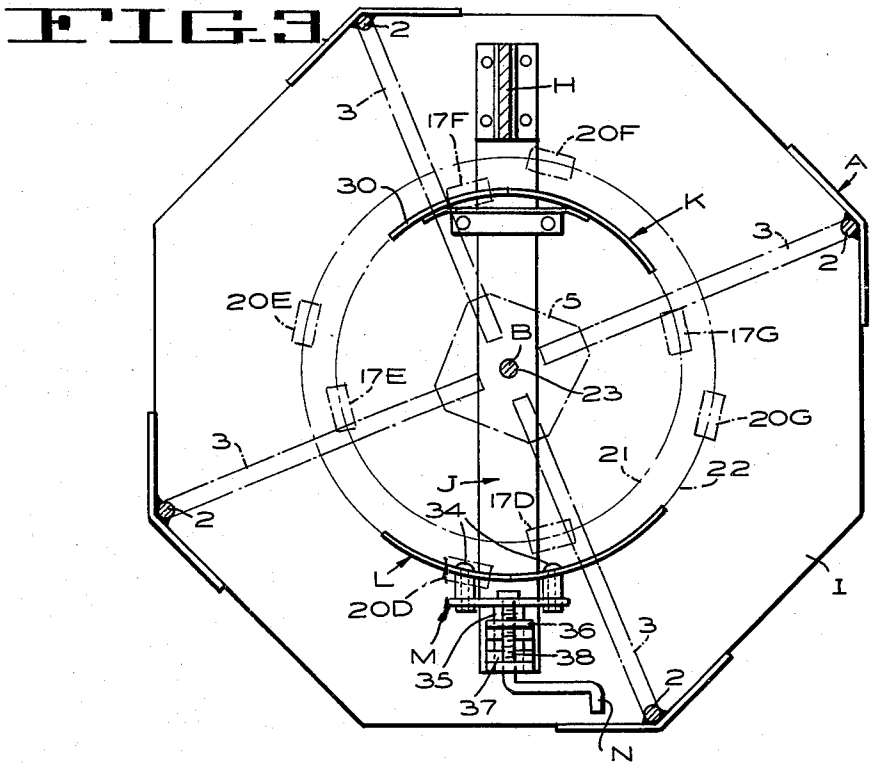
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3 Sheets-Sheet 3



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3 Claims. (Cl. 170-29)

The present invention relates to improvements in a windmill and it consists of the combinations, constructions and arrangements hereinafter described and claimed.

An object of my invention is to provide a windmill in which a frame supports a rotatable vertical shaft and a rotor is keyed to the shaft. The rotor carries a plurality of vertically-extending shutter assemblies that project radially from the shaft. Novel means is used for opening and closing the shutter assemblies so that the assemblies will be closed during substantially one-half of their travel through a complete cycle and will be opened during the remaining portion of the cycle, thus utilizing the flow of air through the rotor to strike the closed shutter assemblies in succession and rotate the rotor.

A further object of my invention is to provide a device of the type described in which the means for opening and closing the shutter assemblies includes a vertical vane that extends radially with respect to the rotor shaft and is free to be swung about the shaft by the flow of air so as to extend in the same direction as the air flow. The swinging of the vane will also move the means for opening and closing the shutter assemblies so that the shutter assemblies will be closed in succession during substantially one-half of their rotation through a complete revolution where they will be affected by the flow of air and will rotate the rotor; and the shutter assemblies will be opened in succession during the remaining portion of the revolution so as to permit the air to flow therethrough. The opening and closing means for the shutter assemblies can also be adjusted for keeping all of the shutters open when it is desired to stop further rotation of the rotor.

A further object of my invention is to provide a device of the type described which is simple in construction and is durable and efficient for the purpose intended.

Other objects and advantages will appear in the following specification and the novel features will be pointed out in the appended claims.

Drawings

For a better understanding of the invention, reference should be had to the accompanying drawings, forming a part of this specification, in which:

FIGURE 1 is a front elevation of the windmill with a part of the frame broken away so that the entire rotor is illustrated;

FIGURE 2 is an elevational view of the windmill when looking at FIGURE 1, from the left hand side as indicated by the arrows II—II, and a part of the frame is broken away so that the entire rotor can be viewed;

FIGURE 3 is a horizontal section on a smaller scale and is taken along the line III—III of FIGURE 1, and illustrates the relative positions of the cams used in actuating the means for opening and closing the shutter assemblies in a predetermined manner; and

FIGURE 4 is a horizontal section on the same scale as FIGURE 3, and is taken along the line IV—IV of FIGURE 1, and illustrates a top plan view of the rotor. The frame for supporting the rotor and the vane with associate cams is omitted from this view for sake of clarity.

While I have shown only the preferred form of my invention, it should be understood that various changes or modifications may be made within the scope of the annexed claims without departing from the spirit thereof.

2

Detailed description

In carrying out my invention, I provide a frame indicated generally at A, in FIGURES 1, 2 and 3. The frame includes a base 1, upwardly extending supports 2, and a top 3. A vertical shaft B, has its lower end mounted in a thrust bearing 4, and its upper end is journaled in a top plate 5.

A wind-actuated rotor C, is keyed to the shaft B, for rotating it. I will now describe the rotor construction in detail. An upper central block 6, see FIGURES 1, 2 and 4, is rigidly secured to the shaft B, and an inner ring 7, encircles the block. An outer ring 8, is held concentric to the inner ring 7, by bolts 9, and the inner ends of these bolts are threaded into the block 6. If desired the inner ends of the bolts 9, may contact the shaft B, for securing the block 6 to the shaft. This construction completes the upper end of the rotor C.

The lower end of the same rotor is of the same construction and parts making up the lower end which are similar to like parts in the upper end, will be given the same reference numerals, except that these will be primed. The lower central block 6', is keyed to the shaft B, and the bolts 9' support both the lower outer ring 8', and the inner ring 7'.

The upper and lower inner rings 7 and 7', see FIGURES 1, 2 and 4, have inner uprights 10, interconnecting them. The upper and lower outer rings 8 and 8', have outer uprights 11, interconnecting them. The inner and outer uprights 10 and 11, are arranged in pairs and are spaced apart to define the side boundaries of four shutter assemblies indicated generally at D, E, F and G, see FIGURE 4. I do not wish to be confined to any particular number of shutter assemblies. I have found that four such shutter assemblies, each one extending radially from the shaft B, provide the rotor C with a sufficient number of wind striking surfaces that will rotate the rotor when the wind blows through the frame A.

Since each of the four shutter assemblies D to G, inclusive, is identical, a description of the shutter assembly D, will suffice for all and like parts in the different assemblies will be given the same reference numerals except that the numerals for the assemblies will be followed by the letters D, E F or G, as a part of the numerals. The shutter assembly D, has a plurality of horizontally-arranged and equally spaced apart rods 12D that are rockably mounted in the spaced apart uprights 10 and 11. Each rod 12D carries a shutter 13D, and the shutter has its rod secured thereto along a line midway between the longitudinal sides of the shutter. A lever 14D, is secured to the outer end of each rod so that the rod is disposed midway between the ends of the lever, see FIGURE 1.

A vertically-extending shutter opening member 15D, is pivotally secured at 16D, to all of the right hand ends of the levers 14D, see FIGURE 1. A cam follower 17D, which in this instance is a roller, is rotatably mounted at the lower end of the member 15D. A vertically-extending shutter closing member 18D, is pivotally secured at 19D, to all of the left hand ends of the levers 14D, see FIGURE 1. A cam follower 20D, which in this instance is a roller, is rotatably mounted at the lower end of the member 18D. The lower ends of the shutter opening members 15D, are bent inwardly a slight distance (see the members 15E and 15G in FIGURE 1) and the rollers 17D to 17G, are mounted on the inner faces of these members so that a rotation of the rotor C, will cause the rollers to follow a circular path indicated generally by the inner dot-dash line 21, in FIGURE 3. The lower ends of the shutter closing members 18D, are bent outwardly a slight distance (see the members 18E and 18G, in FIGURE 1 and the rollers 20D to 20G, are

3

mounted on the outer faces of these members so that a rotation of the rotor C, will cause the rollers to follow a circular path indicated generally by the outer dot-dash line 22, in FIGURE 3. The shutters 13D, are of such an area and shape that when they are closed as shown at 13D and 13E, in FIGURE 1, they will cover an area extending the entire height of the rotor C, and between the spaced apart uprights 10 and 11. The shutters 13G, in FIGURE 1, are shown in a horizontal or open position.

I provide novel means for opening and closing the shutter assemblies, D to G inclusive, and this means includes a vane H, that extends radially to the shaft B, and is free to swing around the rotor C, as the wind changes direction, see FIGURE 2. The vane H, has its lower end mounted on an elongated support J, and both FIGURES 2 and 3, show the support provided with an opening 23, for rotatably receiving the shaft B. The support J is spaced below the bottom of the rotor C, and is carried by a sleeve 24, that is secured thereto and the sleeve rotates freely on a collar 25, that is attached to the shaft B, by a set screw 26. The top of the vane H, extends toward the shaft B, and is disposed above the top of the rotor C, see FIGURE 2. An arm 27 is secured to the top of the vane H, and is rotatably mounted on the shaft B, so as to be free to swing therearound. A ball bearing 28, is placed between the arm 27, and the top of the block 6, and a spacing sleeve 29, is mounted on the shaft B, and extends between the ball bearing 28, and the top plate 5.

I mount a shutter-opening inner cam K, on the top of the elongated support J, and near the vane H, see FIGURE 2. Reference to FIGURE 3, shows that the cam is curved so that its upper cam edge 30, will lie in the circular path 21, and will cause the rollers 17D to 17G, inclusive, to ride upwardly on this edge successively and move the shutter-assemblies D to G, inclusive, associated therewith, into open positions. The shutters 13F in the assembly F, in FIGURE 2, are shown being swung into open or horizontal position as the roller 17F rides up on the curved cam edge 30.

I use a retractive cam L, see FIGURE 2, for closing the shutter assemblies D to G, inclusive, in succession and the cam is curved and its upper edge 31, normally lies in the dot-dash line outer circle 22 of FIGURE 3. When the cam L is in operative position; i.e., when the cam edge 31, coincides with the dot-dash outer circle 22, the rollers 20D to 20G, inclusive, will ride upwardly on the cam edge successively and will move the shutter assemblies D to G inclusive, associated therewith into closed positions. The cam L, has just acted on the roller 20D, in FIGURE 1, and has caused the roller to move upwardly to the high point of the edge 31, as the rotor C, rotates in the direction of the arrow 32. The upward movement of the roller 20D, will move the shutter closing member 18D, upwardly to swing the levers 14D, and close the shutters 13D.

The windmill rotor C, will continue to rotate, so long as wind will blow as indicated by the arrow 33, in FIGURE 4, and the shutter assemblies are closed on the left hand side of the figure, and are opened on the right hand side of the same figure. The pairs of shutter opening and closing members 15D and 18D, to 15G and 18G, balance each other as the shutters in each assembly D to G, inclusive, will remain in the positions into which they have been swung.

If it is desired to stop the rotation of the rotor C, the retractive cam L, is moved out of line with the outer circular path 22, and the rollers 20D to 20G, inclusive, will not be lifted to close their shutter assembly and the air will flow past the shutters which will all lie in horizontal planes. Therefore the wind cannot act on the shutters while they remain in horizontal planes and the rotor will stop rotating.

The means for moving the retractive cam L, is shown

4

in FIGURES 1, 2 and 3. The cam L, is supported by bolts 34, which in turn are carried by a movable support M, and the support has a tongue 35, that rides between two brackets 36 and 37. A crank N, is rotatably mounted in the bracket 37, and the crank has a threaded portion 38, that is received in the threaded bore of the bracket 36. FIGURE 3, shows the head of the crank operatively connected to the movable support M. A rotation of the crank in a certain direction will move the support M, so as to remove the cam L, from the circular path 22, in FIGURE 3. The rotor C, will cease rotating. An opposite rotation of the crank will move the cam L, back into the circular path 22, and the rotor C, can be manually turned to cause one or more shutter assemblies to close or one or two of the members 18D to 18G, which are on the left side of FIGURE 4, may be raised for closing their shutter assemblies.

Operation

From the foregoing description of the various parts of the device, the operation thereof may be readily understood. The windmill is shown in FIGURES 1, 2 and 4, as operating so that the rotor C, will rotate shaft B, in a clockwise direction when looking at FIGURE 4. The wind is blowing in the direction of the arrow 33, and therefore the vane H, will swing the support J, into the position shown in FIGURE 3. This will swing the cams K and L so that the cam L, will actuate the shutter assemblies in succession to close them and the cam K, will actuate the shutter assemblies in succession to open them in a manner already described.

The rotor shaft B, can be connected to a driven shaft P, by a bevel gear 39, keyed to the shaft B, meshing with a bevel gear 40, keyed to the shaft P. The shaft P, has its inner end rotatably supported in a stationary member 41, that is secured to a bracket 42, see FIGURE 2. Any other means of support may be used and any other type of power take-off from the shaft B, may be utilized.

The rotation of the rotor C, can be brought to a stop by merely rotating the crank N, for retracting the cam L, to a position where the rollers 20, will move clear of the cam edge 31.

I claim:

1. In a windmill: a frame; a vertical shaft rotatably carried by the frame; a rotor secured to the shaft for rotating it; said rotor having a plurality of vertically-disposed and radially-extending shutter assemblies; each shutter assembly including spaced apart uprights with a plurality of horizontally-disposed rods, arranged one above another at equal distances and having their ends rotatably supported in the spaced apart uprights; a shutter carried by each rod; means operably connected to the rods of each shutter assembly and including a first cam follower for rocking the rods of that assembly in unison in one direction for swinging their shutters into horizontal planes when the cam follower is moved upwardly; and including a second cam follower for rocking the same rods of one assembly in unison in the opposite direction for swinging the assembly of shutters into substantially a vertical plane; the areas of adjacent shutters being large enough to cooperate with each other to form a contiguous surface co-extensive with and covering the area between the uprights; the first mentioned cam follower of each shutter-operating means being moved in one circular path around the vertical shaft as the rotor rotates and the second mentioned cam follower of each shutter-operating means being moved in a second circular path that is concentric with the first mentioned circular path; a cam placed in the first circular path for causing the first mentioned cam followers as they pass thereover in succession, to actuate the means associated with the cam follower for positively swinging the shutters into a horizontal or open position; and a second cam placed in the second circular path for causing the second mentioned cam followers as they pass thereover in succession, to actuate the same means for

5

positively swinging the shutters into a vertical closed position; whereby the wind striking the closed shutters will cause the rotor to rotate.

2. The combination as set forth in claim 1, and in which means including a rotatable crank are provided for moving the second cam out of the second named circular path so that the shutter assemblies will remain with their shutters in horizontal positions and the rotor will cease rotating.

3. The combination as set forth in claim 1, and in which the two cams are mounted on a horizontal support that is rotatably mounted on the shaft; and a vertically-extending vane carried by the support and being positioned

6

beyond the periphery of the rotor and extending radially with respect to the axis of the shaft; the vane being swingable by the wind and moving the support and both cams therewith; the first-mentioned cam for opening the shutters being disposed adjacent to the vane; and the second-mentioned cam for closing the shutters being disposed on the opposite side of the shaft from the first cam and being substantially diametrically opposed thereto.

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