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1,829,062

WIND WHEEL VANE

Filed Dec. 8, 1926

2 Sheets-Sheet 1

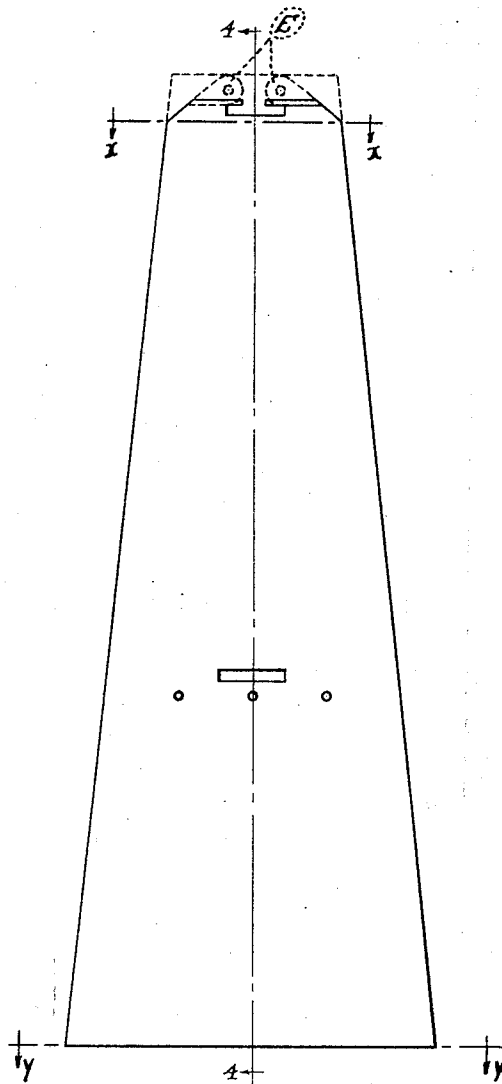


Fig. 1

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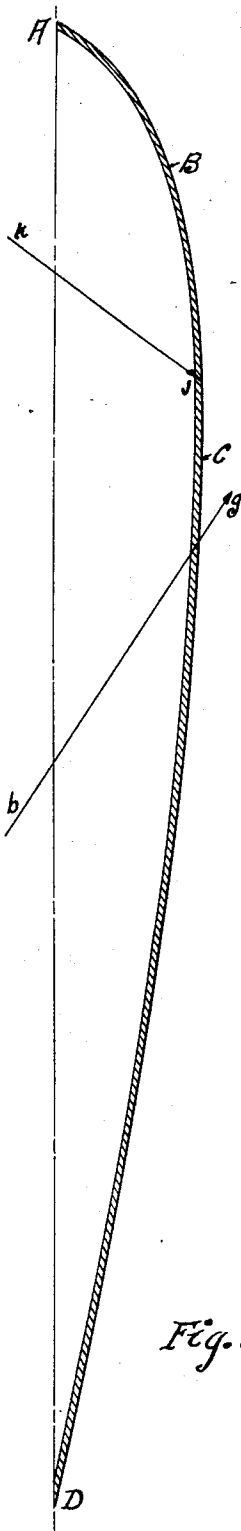


Fig. 3

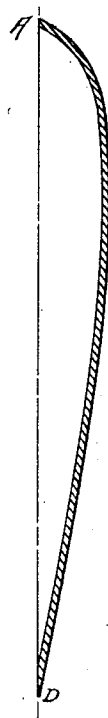


Fig. 2

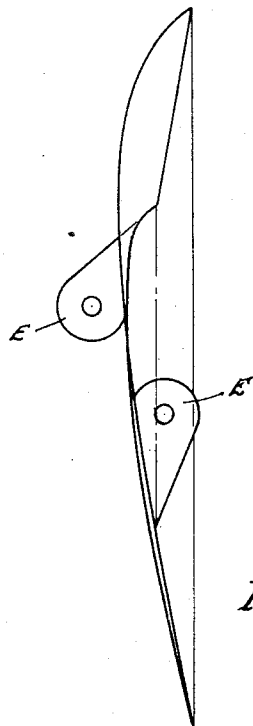


Fig. 5

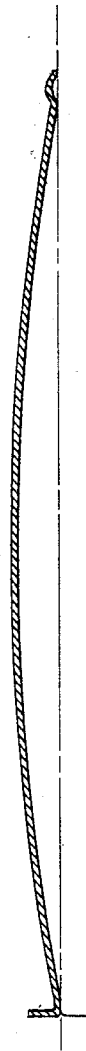


Fig. 4

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WIND-WHEEL VANE

Application filed December 8, 1926. Serial No. 153,390.

My invention relates to improvements in windwheels, and more particularly to improvements in and a method of constructing the vanes or sails for use on the driving wheels of wind-driven apparatus.

The object of my invention is to provide a windwheel vane of a design which can be manufactured at a cost comparable to the vanes in use at the present time, and adapted to be mounted on the wheel by existing methods, and yet which will be a great deal more efficient in operation.

A further object of my invention is to provide a wind-vane which may be formed of a single piece of flat material, without abrupt curves, yet having strength at least equal to present forms and giving results markedly superior to the older types of wind-vanes.

Further objects and advantages of my invention will appear from the drawings and the following description thereof.

The description of my invention is confined herein to its application to windmills. This is intended to be only by way of example, as the same general construction may be embodied in other apparatus in such a way as to fall within the spirit of my invention.

The novelty of the wing herein described is the shape of the member adapted to receive energy from the air impinging upon its surface. It has been the custom for years to employ a plurality of wings or vanes, usually radially disposed, as is contemplated in the present case, on a rotating windwheel. The usual practice has been to construct each vane either with a plane surface or one which is very slightly cambered, with a uniform curvature from leading edge to trailing edge across the wing, and to set the vanes at an angle to the plane of rotation of the wheel. The latter practice is preferably retained in mounting my newer vanes, as is that of increasing the width of each of the vanes from the center to the periphery of the wheel.

Instead of this usual uniform curvature of a transverse section of the wing, I use a wing that has curves of different radii, the curvature being greatest, i. e., having the shortest radius, nearest the leading or entering edge

of the wing. The radius of curvature increases greatly to a point substantially one-tenth the chord distance from leading edge to trailing edge; the remainder of the width of the sail has a section which is curved very slightly, i. e., on a comparatively large radius. Transverse sections of the vane are preferably of substantially the same contour no matter at what point taken.

Besides having a novel transverse curvature, the vane is preferably cambered lengthwise or curved very slightly on its longitudinal axis. As shown in the drawings, the longitudinal curve is preferably uniform from top to bottom. I prefer to dish the sail lengthwise to the extent of one inch in a sail 29 inches in length. This curve can, however, be varied within substantial limits. By this construction I have attained a requisite degree of strength and rigidity without the use of extra reinforcing or stiffening ribs, and without corrugation for strength. The latter is an objectionable expedient for strengthening, on account of the bad surface effect of corrugations in a wind sail.

There have been various attempts in the past to construct a wheel, sails or vanes having a cross-section similar to the blade of an airplane propeller or other airfoil. This involves the use of an element of appreciable thickness, greater expense of manufacture, with at least one, perhaps more joints in the sail, where metal is the material employed.

Instead of proceeding along these lines, I have attained practically the same results by using a metal sail curved transversely and longitudinally, substantially as indicated in the drawings. I have attained the requisite strength in a single thickness of material through the slight longitudinal camber, instead of using a two-wall element.

The nature of my wheel-sail will be readily apparent from a reference to the drawings, in which Fig. 1 represents a plan of a preferred form of sail; Fig. 2 indicates a transverse section taken along X—X at the inner or small end of the sail, nearest the hub of the wheel; Fig. 3 shows a transverse section taken along Y—Y at the tip of the sail, at the periphery of the windshield and indicates a preferred lo-

cation of the sail relative to the plane of rotating of the wheel, and to the air stream; Fig. 4 is a diagrammatic indication of the longitudinal curvature along line 4—4, the outer or peripheral end of the sail being at the top of the figure, and Fig. 5 is a projection of the sail after forming. In the drawings, the proportion of the parts has been preserved throughout, but certain of the sections shown on a different scale, in the interest of convenience of illustration.

Referring by letters to the drawings, A indicates the leading or entering edge of the sail and D its trailing edge. The curve A—B—C—D indicates a preferred transverse cross section, in which the section A—B has preferably the shortest radius, B—C, a somewhat greater radius and C—D, a comparatively large radius of curvature. It will be understood that I am not limited to the exact location of points B and C, as shown, as either or both of these points may be shifted between reasonable limits without substantially affecting results. My preference is to locate point B substantially one-tenth the chord distance between points A and D, and point C at substantially one-third the chord distance between these points. A suitable means of securing the sail at the hub end is provided in ears or projections E. The same or other suitable means (not shown) may be provided at the opposite extremity of the sail. The plane of rotation of the windwheel is indicated by $b-g$, and the direction of air current by arrow $k-j$. X denotes the inner extremity of the sail and Y the outer or peripheral extremity thereof.

The description herein is applicable to the outer surface of the sail. I prefer to use a sheet metal for this sail, say a galvanized sheet steel of about number twenty U. S. S. gauge. The particular curves illustrated as examples have a chord length equal to .96 π arc length; this proportion is subject to some slight variation. The preferred curve form of the transverse sections may be constructed from a plurality of circles of different radii; preferably the composite curve comprises at least three different curves. By the use of only two different curves I am able to obtain results approximating experimental results with the sections shown in the accompanying drawings.

An experimental comparison of wheels equipped with the usual older type of sail, with the new equipment shows that the new sail requires a much lower velocity of air current to overcome friction at rest and start the apparatus; further, that it provides a higher starting torque. The older types of wheel show marked differences in efficiency through a range of wind velocities and speed of rotation of the wheel. A wheel using the new sails shows of course some differences in efficiency with different air velocities, but the

results obtained are much more in conformity with the wind-speed.

In practice I prefer to roll or die-stamp the vanes in quantities; obviously any of the other usual means for shaping sheet metal, may equally well be employed.

I claim:

1. In a windwheel, a blade element of trapezoidal shape and formed of a substantially uniform thickness of sheet material, said element being transversely curved and having a progressively decreasing curvature from the leading edge toward the trailing edge of said element, and being longitudinally dished, on a substantially uniform radius.

2. In a windwheel, a pressed sheet metal blade element of substantially rectilinear outline and substantially uniform thickness throughout, having a transverse cross-section in the nature of a composite curve, the parts of which bear like proportions at different points along the blade, said curve comprising a plurality of arcs of different radii, the arc of shortest radius being adjacent the leading edge, and the arc of greatest radius being adjacent the trailing edge of said element, said element being tapered in width between its inner and outer ends, and cambered longitudinally.

3. In a windwheel, a pressed sheet metal vane of trapezoidal outline and substantially uniform thickness, throughout its width and length, said vane being cambered transversely and having a progressively increasing radius of curvature from the leading edge to the trailing edge thereof, the transversely curved portions being similarly proportioned at different points along the vane, said vane also being cambered longitudinally.

4. In a windwheel, a metal pressed sheet vane of trapezoidal outline and substantially uniform thickness, said vane being cambered transversely so as to provide a gradually increasing radius of curvature from the leading edge to the trailing edge thereof, the transverse curvature being of substantially identical proportions at all points along the vane, said vane being cambered longitudinally on a uniform radius, and disposed at such an angle to the plane of rotation of said windwheel, that the leading edge, being the portion of greatest transverse curvature, is first presented substantially edgewise to the air-stream.

5. In a windwheel, a pressed sheet metal vane of trapezoidal outline and substantially uniform thickness, said vane being cambered transversely so as to provide a gradually and progressively increasing radius of curvature from the leading edge to the trailing edge thereof, the different parts of the transverse curve being of like proportion to each other at all points along the vane, said vane being curved longitudinally on a uniform radius, and adapted to be disposed at an angle to the

plane of rotation of said windwheel, and positioned at such an angle that the leading edge extends directly into the air stream, first presenting the portion of greatest transverse curvature edgewise into such stream, the vane
5 being provided with integral, supporting extensions.

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