Twin turbine system which follows the wind/water (windtracker) for wind and/or water power, with optimised blade system

Technical Field

The invention relates to a turbine system ~~in accordance with the preamble of claim 1~~for wind and/or water power, with an optimised blade system.

~~Prior art~~Background

Savonius turbines are known ~~(see also Fig. 6)~~. These rotors may consist of two horizontal circular discs which are attached to a vertical rotor shaft and between which two semi-circular curved blades are attached in a vertical position.

A decisive unbalance as a result of the cyclically varying load strength from the flow during rotation is characteristic of the Savonius rotor, even when the weight distribution is perfectly balanced. This unbalance due to load alternation can be minimised by arranging a larger number of blades, generally three, instead of two. However, this greatly reduces the efficiency of the Savonius rotor, by approximately 30 %.

By comparison with the known three-blade wind generators having a horizontal axis of rotation and aircraft-type blades, a radial turbine has the major advantage of operating independently of the direction of the incident wind. Thus, the radial turbine having a vertical axis of rotation does not have to be turned to the wind.

In a particularly economical embodiment, the radial turbine is provided with deflector plates, which collect the wind energy and deflect it onto the blades of the radial turbine in a concentrated form. However, this has the drawback that, because of the deflector plate, independence from the wind direction is no longer achieved. The radial turbine comprising a deflector plate therefore has to be tracked to the wind.

If the Savonius turbine is equipped with deflector plates, it gains at low wind speeds, but loses all the more at higher wind speeds.

~~Object and solution according to the invention~~

~~Object of the invention:~~ There is a need for much better use ~~is to be made~~ of the wind energy, with a much higher efficiency than in conventional Savonius turbines. It should still be possible to use the wind turbine even when the wind would be too weak to drive conventional Savonius turbines.

The wind turbines should operate with no noise and very little vibration, in such a way that they can even be used on residential buildings in urban areas.

A radial turbine is also to be used which comprises a deflector plate and which automatically turns to an optimum angular position with respect to the incident wind, and is thus self-tracking, without a tracking arrangement being necessary for this purpose. The advantages of the deflector plate in the radial turbine are thus to be combined with the independence of the radial turbine from the incident wind direction.

A minimum unbalance with high performance is to be ensured by way of the special construction and geometry.

~~This object is achieved in accordance with the invention by the features of claim 1.~~

~~Advantageous embodiments of the invention are specified in the dependent claims.~~

It is known that the Savonius rotor and the Darrieus rotor do not gain in performance as a result of deflector plates. The Savonius rotor gains in weak wind, but this is conditional on speed, and leads to losses at higher wind speeds. Since the turbine is dependent on the wind direction, it decreases in overall efficiency.

Embodiments of the present invention seek to substantially overcome or at least ameliorate one or more of the disadvantages of the prior art, or at least provide a useful alternative.

Summary of the Invention

According to the present invention, there is disclosed a turbine system for wind and/or water power, comprising two radial turbines, wherein

the radial turbines comprise a rotor which can rotate about a turbine shaft and which comprises one or more turbine blades, the turbine blades being orientated parallel to the

rotor, the turbine blades being arranged within a cylindrical shell, which is arranged concentrically about the turbine shaft and has an external radius R1 and an internal radius R2, the radial turbines having upper ends and lower ends, wherein the internal radius is

$$R2 = f_1 \times R1$$

where f_1= 0.19 to 0.32,

wherein each turbine blade has a first region which extends from the internal radius R2 to the external radius R1, is curved towards the turbine shaft, and has a radius of curvature

$$R3 = f_2 \times R1$$

where f_2= 1.2 to 2.4, and

a second region, which is externally adjacent to the first region and having a radius of curvature R4, is positioned on the outside of the cylindrical shell, and has a curvature towards the turbine shaft, the curvature pointing to the same side as the curvature of the first region, the radius of curvature R4 of the second region being

$$R4 = f_3 \times R1$$

where $f_3 \geq 0.7$,

wherein the second region is of a width

$$B2 = f_8 \times R1$$

where f_8= 0.11 to 0.19, and

wherein two radial turbines, orientated parallel side by side, are arranged with vertical rotation turbine shaft, are interconnected, and are pivotable about a pivot shaft parallel to the turbine shafts, the pivot shaft and a V-shaped wind splitter being positioned outside a line connecting the turbine shafts and both being on the same side of said line,

the radial turbines having concentration plates and/or wind guide plates located at the upper ends and the lower ends of the radial turbines, and

the turbine blades are mounted on a plurality of milled support arms, which in turn are fastened to a rotary part on the turbine shaft,

wherein the wind splitter comprises a deflector surface orientated parallel to the rotor is arranged outside the cylindrical shell, and is of a width

$$B3 = f_9 \times R1$$

where f_9 = 0.7 to 2.5,

the deflector surface having an edge facing the turbine shaft,

the edge of the deflector surface being at a distance A2

$$A2 = f_6 \times R1$$

where f_6 = 0.25 to 0.55 from a first longitudinal section plane through the turbine shaft, and at a distance A1

$$A1 = f_5 \times R1$$

where f_5 = 1.00 to 1.10 from a second longitudinal section plane through the turbine shaft, the second longitudinal section plane being perpendicular to the first longitudinal section plane, and wherein the deflector surface has an angle of incidence

$$\alpha = 40° \text{ to } 60°$$

with respect to the first longitudinal section plane.

~~This problem is solved by the invention.~~

~~a)~~ As a result of the aerodynamic nose (wind splitter) together with the turbine of the ~~novel~~ construction in at least an embodiment of the present invention, energy yield is demonstrably increased at all wind strengths.

~~b)~~ As a result of the optimum arrangement of the aerodynamic parts, including the rotary connection, the turbine system in at least an embodiment of the present invention follows the wind in all directions without a motor drive.

As a result of the specific shape and arrangement of the turbine blades in connection with the wind splitter in at least an embodiment of the present invention, and in accordance with the parameter ranges ~~given in claim 1~~as described above, rotational speeds up to three times higher than in known Savonius turbines are obtained, along with an

efficiency of up to 66 %, by contrast with the efficiency of 28 % achieved by conventional turbines. The turbine ~~according to the~~in at least an embodiment of the present invention can be used even in very weak wind which would no longer be sufficient to drive conventional Savonius turbines.

By contrast with the Savonius rotor, the wind turbine ~~according to the~~in at least an embodiment of the present invention does not have an unbalance of the type described above, even in a ~~particularly advantageous~~preferred embodiment where three turbine blades are provided.

In at least an embodiment of the present invention, ~~I~~it is particularly expedient to combine the geometry ~~according to the invention~~ of the turbine blades with a deflector surface ~~according to claim 2~~, also known as a wind splitter.

Another important consideration: suppose there are two turbines in a system enclosed by deflector plates and having additional bevelled concentration plates and/or wind guide plates which are attached above and below the turbines. As a result of the closed system and the additional concentration plates and/or wind guide plates, optimum use is made of what is known as the Magnus effect, and as a result, the system ~~according to the~~in at least an embodiment of the present invention, which is mounted on a mast, can rotate to the wind automatically and thus always receive an optimum wind flow. This "turning to the wind" has been demonstrated in a number of specific models in natural wind.

The Magnus effect, named after Heinrich Gustav Magnus (1802-1870), who discovered it, is a phenomenon in fluid mechanics, specifically the transverse force effect (force) experienced by a round rotating body (cylinder or ball) in a flow.

By way of frictional effects, a rotating roller induces rotation in the fluid surrounding it. If there is additionally a flow over the roller, the different speeds of fluid overlap. As a result, the fluid flows around the rotating roller faster on one side than on the other (in the rest system of the roller). On the side of the roller where the frictional effects are greater, it is as if the fluid were flowing more rapidly. This results in "deflection" of the roller, pushing the roller downwards (see Fig. 10).

Examples

- Football players kick the ball with spin in such a way that it flies into the goal in an arc. The more quickly it rotates, the greater the deviation of the path (curling cross, knuckleball).

- Table tennis players and tennis players use this effect, for example with topspin and slicing.
- Curveballs in baseball and riseballs in softball.
- Spin-bowling in cricket.
- Golf balls have a large number of small depressions on the surface, known as dimples. As turbulators, they improve the adhesion of the boundary layer which lies against the ball and is entrained by the rotation thereof. This increases the formation of turbulence and the associated deviation of the ball due to the Magnus effect. Since the golf ball rotates backwards as a result of the wedge shape of the golf club, it is lifted by the Magnus effect; it does not simply fly like a cannonball, but instead experiences a lift. Additional deviations to the left or right are possible, and are also used by players who have mastered this technique. Moreover, the supercritical turbulent circulation reduces the air resistance, and this in turn leads to greater flight distances.

~~According to the~~ In at least an embodiment of the present invention, high performance is achieved in combination with low installation costs, in such a way that the cost-effectiveness, in terms of power output, is much greater than in the known wind generators comprising a horizontal shaft and blades of the aircraft-wing type.

To increase the cost-effectiveness, a ring generator in at least an embodiment of the present invention is provided for power generation. In addition, to increase the cost-effectiveness further, the mast and the wind splitter can be used as advertising space.

In at least an embodiment of the present invention, ~~W~~with the blade shape ~~according to the invention~~ of the individual turbines and the specific arrangement of the two turbines with respect to one another, it is particularly advantageous that the two turbines do not obstruct one another, but can instead boost one another, even at low wind speeds, assisted by the low-frequency pressure oscillation taking place in the rear cavity of the V-shaped wind splitter.

By contrast with the known wind generators comprising a horizontal shaft and three blades, the radial turbine ~~according to the~~in at least an embodiment of the present invention can be operated even at relatively low wind speeds. As a result of the Magnus effect, the radial turbine ~~according to the~~in at least an embodiment of the present invention "pulls" the wind in,

as it were, and amplifies low wind speeds. For example, the radial turbine ~~according to the~~in at least an embodiment of the present invention can also be used in circulating winds, in which the wind speed is

greater below at a low height than at the large height at which the three-blade wind generators have to be operated simply because of the blade size. A wind speed which is too low for the known three-blade turbines in any case is sufficient for energy production with the radial turbine ~~according to the~~in at least an embodiment of the present invention.

In the event of fluctuations in the wind direction, the radial turbine ~~according to the~~in at least an embodiment of the present invention adjusts itself automatically, partly as a result of the Magnus effect, and immediately rotates to the optimum direction, even at wind speeds of less than 1 m/s. Rapid adaptations of this type of the generator are not possible with the known three-blade turbines.

Since the radial turbine ~~according to the~~in at least an embodiment of the present invention only takes up a small amount of space, it can be used as an add-on to pre-existing parts of buildings or structural elements, for example as an attachment to a street light.

Embodiments

~~In the following, a plurality of embodiments of the invention are described in greater detail by way of drawings. Like reference numerals have the same significance in all of the drawings and are therefore only be explained once.~~

~~In the drawings:~~
Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings wherein:

Fig. 1 is a schematic cross-section through the wind turbine according to the invention in accordance with a particularly preferred embodiment,

Fig. 2 is a graphical representation of the free-running rotational speeds, plotted against the wind speed, for the wind turbine according to the invention (upper curve and crosses) and for a conventional Savonius wind turbine (lower curve and circles),

Fig. 3 to 5 are graphical representations of the rotational speeds of the wind turbine according to the invention and a conventional Savonius wind turbine together with the incoming flow angle of the wind and the wind speed, plotted against time,

Fig. 6 is a schematic cross-sectional drawing of a conventional Savonius wind turbine, showing the mode of operation thereof,

Claims

1. A ~~T~~turbine system for wind and/or water power, comprising two radial turbines, ~~characterised~~wherein

~~in that~~ the radial turbines comprise a rotor which can rotate about a turbine shaft and which comprises one or more turbine blades, the turbine blades being orientated parallel to the rotor, the turbine blades being arranged within a cylindrical shell, which is arranged concentrically about the turbine shaft and has an external radius R1 and an internal radius R2, the radial turbines having upper ends and lower ends, wherein

~~in that~~ the internal radius is

$$R2 = f1\ f_1 \times R1$$

where ~~f1~~ f_1= 0.19 to 0.32,

~~in that~~wherein each turbine blade has a first region which extends from the internal radius R2 to the external radius R1, is curved towards the turbine shaft, and has a radius of curvature

$$R3 = f2\ f_2 \times R1$$

where ~~f2~~ f_2= 1.2 to 2.4, and

a second region, which is externally adjacent to the first region and having a radius of curvature R4, is positioned on the outside of the cylindrical shell, and has a curvature towards the turbine shaft, the curvature pointing to the same side as the curvature of the first region, the radius of curvature R4 of the second region being

$$R4 = f3\ f_3 \times R1$$

where ~~f3~~ f_3> 0.7,

~~in that~~wherein the second region is of a width

$$B2 = f8\ f_8 \times R1$$

where ~~f8~~ f_8= 0.11 to 0.19, and

~~in that~~wherein two radial turbines ~~(1, 2)~~, orientated parallel side by side, are arranged with a vertical rotation turbine shaft, are interconnected, and are pivotable about a pivot shaft ~~(15)~~ parallel to the turbine shafts ~~(18)~~, the pivot shaft and a V-shaped wind splitter ~~(3)~~ being positioned outside ~~the~~ a line connecting the turbine shafts and both being on the same side of ~~the connecting~~said line,

the radial turbines having concentration plates and/or wind guide plates located at the upper ends and the lower ends of the radial turbines, and

the turbine blades are mounted on a plurality of milled support arms, which in turn are fastened to a rotary part on the turbine shaft.

~~2. Turbine system according to claim 1, characterised~~wherein the wind splitter comprises

- ~~in that~~ a deflector surface orientated parallel to the rotor is arranged outside the cylindrical shell, and is of a width

$$B3 = f_9 \times R1$$

where f_9 = 0.7 to 2.5,

the deflector surface having an edge facing the turbine shaft,

- the edge ~~(P3)~~ of the deflector surface ~~facing the turbine shaft~~ being at a distance A2

$$A2 = f_6 \times R1$$

where f_6 = 0.25 to 0.55 from a first longitudinal section plane through the turbine shaft,

- and at a distance A1

$$A1 = f_5 \times R1$$

where f_5 = 1.00 to 1.10 from a second longitudinal section plane through the turbine shaft, the second longitudinal section plane being perpendicular to the first longitudinal section plane,

- and ~~in that~~ wherein the deflector surface has an angle of incidence

$$\alpha = 40° \text{ to } 60°$$

with respect to the first longitudinal section plane.

~~3~~2. The turbine system according to claim 1, ~~characterised in that~~wherein the total width B1 of the turbine blade is

$$B1 = f_7 \times R1$$

where f_7 = 0.9 to 1.1.

~~4~~3. The turbine system according to claim 1, ~~characterised in that the~~wherein a kinked edge is provided between the first and the second region of the turbine blade and said kinked edge has a radius of curvature

$$R5 = f_4 \times R1$$

where f_4 = 0.01 to 0.08.

~~5~~4. The turbine system according to claim 1, ~~characterised in that~~wherein the turbine shaft is in the form of an axle having a diameter

$$D1 = f_{10} \times R1$$

where f_{10} = 0.03 to 0.13.

~~6. Turbine system according to claim 1, characterised in that three rotor blades are provided, and are arranged evenly distributed about the shaft and are balanced.~~

~~7. Turbine system according to claim 1, characterised in that the two turbines rotate in opposite directions.~~

~~8. Turbine system according to claim 1, characterised in that a ring generator is provided for generating current.~~

~~9. Wind and/or water generator according to claim 1, characterised in that the generator can be controlled so as to set the optimum tip speed ratio of the turbine.~~

~~10. Turbine system according to claim 1, characterised in that the wind and/or water generator is fastened to a mast (5), pontoon, base part, building roof or the like via the rotary connection.~~

~~11. Turbine system according to claim 1, characterised in that a plurality of these wind and/or water generators are arranged above one another and/or side by side on a mast.~~

~~12. Turbine system according to claim 1, characterised in that the wind and/or water generator rotates to the optimum wind or water flow direction automatically, without a motor-driven tracking means, without a control system, and without additional deflector surfaces.~~

~~13~~5. The turbine system ~~Wind and/or water generator~~ according to claim 1, ~~characterised in that~~ wherein the distance between the V-shaped wind splitter ~~(3)~~ and the turbines is adjustable.

~~14. Turbine system according to claim 1, characterised in that the lower region of the mast and/or the deflector surface is formed as an advertising space or advertising medium.~~

~~15~~6. The turbine system according to claim 1, ~~characterised in that~~wherein the pivot shaft ~~(15)~~ comprises a rotary connection, and a grid mast, to which an accumulator system and/or a turbine support system can be fixed, is provided above the rotary connection.

~~16. Turbine system according to claim 1, characterised in that a means is provided for automatically moving the radial turbines closer together when a predetermined wind speed is reached.~~

~~17~~7. The turbine system according to claim 1, ~~characterised in that~~wherein the radial turbines are divided into a plurality of individual turbines mounted individually along ~~a~~ the turbine shaft.

~~18~~8. The turbine system according to claim 1, ~~characterised in that~~wherein there is provided a rotary connection between the pivot shaft and the turbine shafts and a safety space, which is protected and earthed, is provided below the rotary connection for accommodating sensitive technological components~~, the safety space preferably comprising ventilation and/or heating and/or suitable air conditioning, particularly in relation to air humidity~~.

9. The turbine system according to claim 8, wherein the safety space comprises ventilation and/or heating and/or suitable air conditioning.

10. The turbine system according to claim 9, wherein the ventilation and/or heating and/or suitable air condition is in relation to air humidity.

~~19. Turbine system according to claim 1, characterised in that the base part can be used as a further energy store or as a water reservoir or oil store.~~

~~20~~11. The turbine system according to claim 1, ~~characterised in that~~wherein there is provided a base part and heat pumps are integrated into the base part.

~~21~~12. The turbine system according to claim 1, ~~characterised in that the deflector surfaces are mounted on a~~wherein the plurality of milled support arms~~, which in turn~~ are fastened at the bottom and at the top to ~~a~~ the rotary part on the turbine shaft on both sides by two support hearts which are screwed together.

~~22~~13. The turbine system according to claim 1, ~~characterised in that the stationary grille face panels are provided at the upper and lower end of the turbine, and the grille face panels~~wherein the concentration plates and/or wind guide plates are rounded in the front region.

~~23. Turbine system according to claim 1, characterised in that LED elements are attached to the turbine blades and can be actuated as a function of the rotation so as to achieve advertising effects.~~

~~24. Turbine system according to claim 1, characterised in that a grid mast, including the turbine mounting and the turbines, is fastened to the rotary connection of the mast.~~

~~25. Turbine system according to claim 1, characterised in that an arrangement of the turbine systems according to the invention and/or the windtrackers is provided along the traffic infrastructure, such as streets, motorways, railway lines and canals, and is additionally provided for telecommunications or for buffering current from the grid in times of low current uptake and/or for use as an advertising medium and/or as street lighting and/or for providing safety spaces.~~

~~26. Use of the mast and/or the wind splitter (3) and/or the turbine blades of the wind and/or water generator according to claim 1 as an advertising space or advertising medium and as a support for further network and communications components.~~