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(54) Title: ROTOR BLADE WITH AERODYNAMIC FLOW STATIC DIVERTER, IN PARTICULAR BLADE FOR VERTICAL AXIS AEOLIC ROTOR, AND VERTICAL AXIS AEOLIC ROTOR WITH STATIC FLOW DIVERTERS

(57) Abstract: The present invention relates to a rotor (3) blade (2) with aerodynamic flow static diverter (1), in particular blade (2) for vertical axis aeolic rotor (3), characterised in that said aerodynamic flow static diverter (1) is fixedly coupled with said rotor (3) blade (2), said diverter (1) being positioned inside with respect to said rotor (3), close to the blade (2) leading edge, and having an aerodynamic shape extending substantially parallel with respect to the profile portion of said blade (2) corresponding, and faced toward, the same diverter (1).

ROTOR BLADE WITH AERODYNAMIC FLOW STATIC DIVERTER, IN PARTICULAR BLADE FOR VERTICAL AXIS AEOLIC ROTOR, AND VERTICAL AXIS AEOLIC ROTOR WITH STATIC FLOW DIVERTERS

The present invention relates to a rotor blade with aerodynamic flow static diverter, in particular blade for vertical axis aeolic rotor, and vertical axis aeolic rotor with aerodynamic static flow diverters, and particularly it refers to a blade of the above kind provided with an aerodynamic flow static diverter comprised of an auxiliary blade coupled with said rotor blade, so designed to permit self-starting of the aeolic rotor even with very low wind speed and with wind arriving from every direction.

Known vertical axis aeolic turbine are the most ancient conceived by mankind. They were exploited in Mesopotamia, mainly for watering fields, since the first civilization in that area. Forgotten for some years and replaced by blades which are typical in windmills, have been "discovered" again during XIX siècle.

In the last years, vertical axis aeolic turbines have arisen again interest of some firms and some researchers on many Universities all over the word. Aim of these searches is that of increasing turbine efficiency and permitting self-starting of the rotor even with very low wind speed, regardless its direction.

In order to obtain these results, aeloic turbines have been realised with a windscreen, protecting the passive part of the rotor, increasing efficiency of its active part - i.e. the part hit by wind - with the drawback of requiring precisely orienteering turbine according to main wind direction, loosing main advantage of the vertical axis turbine with respect to horizontal turbine, i.e. efficiency regardless wind direction.

Another solution realised in order to reduce resistance during counter wind action, provides adopting movable hemi-blades which open during the passive phase and close during the active phase; this system has problems for its activation when, stopped, must be started, in case wind arrives from a direction different wit h respect to the direction of orientation of the turbine.

Another known solution provides realisation of a fixed flow diverter, comprised of an circular structure, outside the turbine, comprising fixed blades conveying air flow within the turbine, increasing speed of entering wind; this system has the drawbacks of increasing dimensions of turbine, being subjected to speed reduction, and consequently power reductions, and of requiring a troublesome mounting.

Thus, object of the present invention is that of overcoming said drawbacks, realising a rotor blade with aerodynamic flow static diverter, and a vertical axis aeolic rotor with aerodynamic static flow diverters, which is silent, with reduced dimensions with the same efficiency, permits self-starting of the rotor even at very low speeds, regardless the wind direction, and is advantageous under an economic point of view.

It is therefore specific object of the present invention a rotor blade with aerodynamic flow static diverter, in particular blade for vertical axis aeolic rotor, characterised in that said aerodynamic flow static diverter is fixedly coupled with said rotor blade, said diverter being positioned inside with respect to said rotor, close to the blade leading edge, and having an aerodynamic shape extending substantially parallel with respect to the profile portion of said blade corresponding, and faced toward, the same diverter.

Further, according to the invention, length of cord between the two ends of said flow diverter is within the range of 1/2 and 1/10 of the length of cord between the two ends of said blade.

Preferably, length of cord between the two ends of said flow diverter is 1/4 of the length of cord between the two ends of said blade.

Furthermore, according to the invention, ratio between distance of said diverter and the leading edge of said blade and cord length between the two ends of said flow diverter is within the range of 0 and 1/2.

Preferably, according to the invention, ratio between distance of said diverter and the leading edge of said blade and cord length between the two ends of said flow diverter is 1/6.

Still according to the invention, ratio between distance between said diverter with respect to the trailing edge of said blade and length of the cord between the two ends of said flow diverter is within the range between 1/10 and 1/2.

Preferably, according to the invention, ratio between distance between said diverter with respect to the trailing edge of said blade and length of the cord between the two ends of said flow diverter is 1/4.

Always according to the invention, angle between said blade axis and axis of said diverter is included within the range between 0° and 30°, preferably 15°.

Preferably, according to the invention, angle between said blade axis and axis of said diverter is 15°.

Finally, it is further specific object of the present invention a vertical axis aeolic rotor with aerodynamic static flow diverters, characterised in that it comprises a plurality of blades as defined in the above.

Present invention will be now described, for illustrative but not limitative purposes, according to a preferred embodiment, making particular reference to the enclosed figures, wherein:

figure 1 schematically shows a horizontal section view of the operation of a vertical axis aeolic turbine with diverter according to the invention;

figure 2 schematically shows a horizontal section view of a blade for vertical axis aeolic turbine with diverter according to the invention; and

figure 3 is a horizontal section view of a blade with diverter according to the invention.

Making reference to the figures, flow diverter 1 according to the invention is rigidly coupled with each blade 2 of an aeolic turbine 3. Blade 2 has an aerodynamic shape, having a variable profile, with a larger section in correspondence of its front end or leading edge, and decreasing up o zero in correspondence of its read end, or trailing edge.

Flow diverter 1 is positioned inside turbine 3, in front of blade 2, and has an aerodynamic shape with inner profile substantially equal to the inlet portion of the blade 2, corresponding to, and faced toward, the diverter 1, so as to create a wind flow channel with a substantially uniform amplitude. In any case, profile of diverter 1 with respect to profile of blade 2, as well as its extension, can be different with respect to those shown in the figures.

Observing now figure 3, length l_1 of the cord between the two ends of the flow diverter 1 is about one third of length l_2 of the cord between the two ends of blade 2, preferably 1/4.

$$l_1=l_2/4$$

Ratio between distance s of diverter 1 leading edge with respect to the leading edge of blade 2 and length l_1 of cord between the two ends of flow diverter 1 is included within the range between 0 and 1/2, preferably 1/6.

$s/l_1=1/6$

Ratio between distance Z of the diverter 1 trailing edge with respect to the blade 2 trailing edge and length l_1 of cord between the two ends of flow diverter 1 is included within the range between 1/10 and 1/2, preferably 1/4.

$z/l_1=1/4$

Angle □ between blade 2 axis and diverter 1 axis is included within the range between 0° and 30°, preferably 15°.

□=15°

Advantageously, thanks to the described shape of diverter 1 according to the invention, peripheral speed of turbine 3is almost equal to the inlet wind speed, regardless its direction, thus obtaining a high torque with a low number of revolutions.

Further advantage of the present invention is obtaining a self-starting of turbine 3 even with a very low wind, a high reliability of the system realised and easiness of realisation.

Present invention has been described for illustrative, but not limitative purposes according to its preferred embodiment, but it is to be understood that variations and/or modifications can be introduced by those skilled in the art without departing from the relevant scope, as defined in the enclosed claims.

CLAIMS

1. Rotor (3) blade (2) with aerodynamic flow static diverter (1), in particular blade (2) for vertical axis aeolic rotor (3), characterised in that said aerodynamic flow static diverter (1) is fixedly coupled with said rotor (3) blade (2), said diverter (1) being positioned inside with respect to said rotor (3), close to the blade (2) leading edge, and having an aerodynamic shape extending substantially parallel with respect to the profile portion of said blade (2) corresponding, and faced toward, the same diverter (1).

2. Blade (2) according to claim 1, characterised in that length (l_1) of cord between the two ends of said flow diverter (1) is within the range of 1/2 and 1/10 of the length (l_2) of cord between the two ends of said blade (2).

3. Blade (2) according to one of preceding claims, characterised in that length (l_1) of cord between the two ends of said flow diverter (1) is 1/4 of the length (l_2) of cord between the two ends of said blade (2).

4. Blade (2) according to one of preceding claims, characterised in that ratio between distance (s) of said diverter (1) and the leading edge of said blade (2) and cord length (l_1) between the two ends of said flow diverter (1) is within the range of 0 and 1/2.

5. Blade (2) according to one of preceding claims, characterised in that ratio between distance (s) of said diverter (1) and the leading edge of said blade (2) and cord length (l_1) between the two ends of said flow diverter (1) is 1/6.

6. Blade (2) according to one of preceding claims, characterised in that ratio between distance between said diverter with respect to the trailing edge of said blade and length of the cord between the two ends of said flow diverter is within the range between 1/10 and 1/2.

7. Blade (2) according to one of preceding claims, characterised in that ratio between distance (z) between said diverter (1) with respect to the trailing edge of said blade (2) and length (l_1) of the cord between the two ends of said flow diverter (1) is 1/4.

8. Blade (2) according to one of preceding claims, characterised in that angle (□) between said blade (2) axis and axis of said diverter (1) is included within the range between 0° and 30°, preferably 15°.

7. Blade (2) according to one of preceding claims, characterised in that angle (□) between said blade (2) axis and axis of said diverter (1) is 15°.

10. Vertical axis aeolic rotor (3) with aerodynamic static flow diverters, characterised in that it comprises a plurality of blades (2) according to one of the preceding claims.

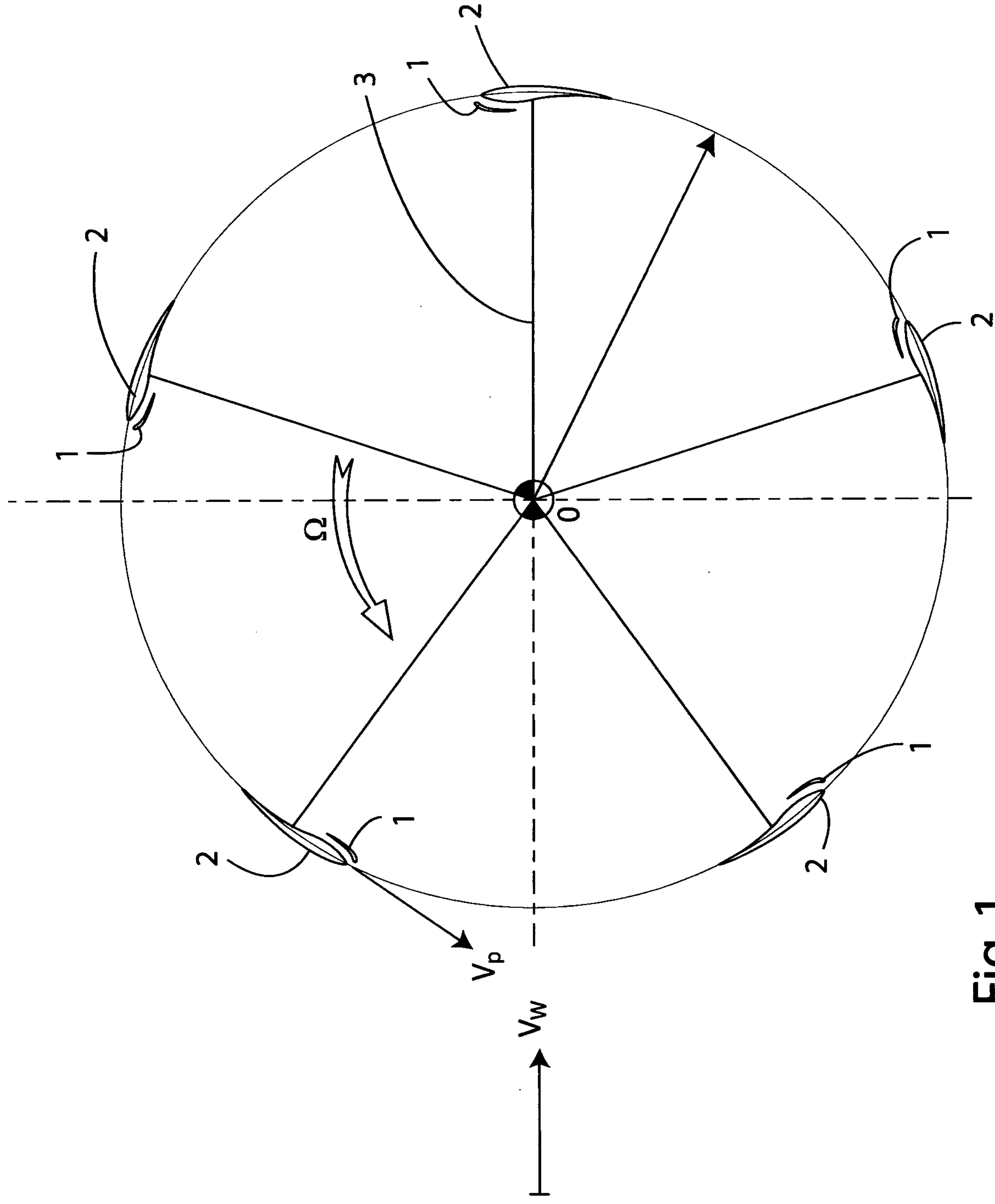

Fig. 1

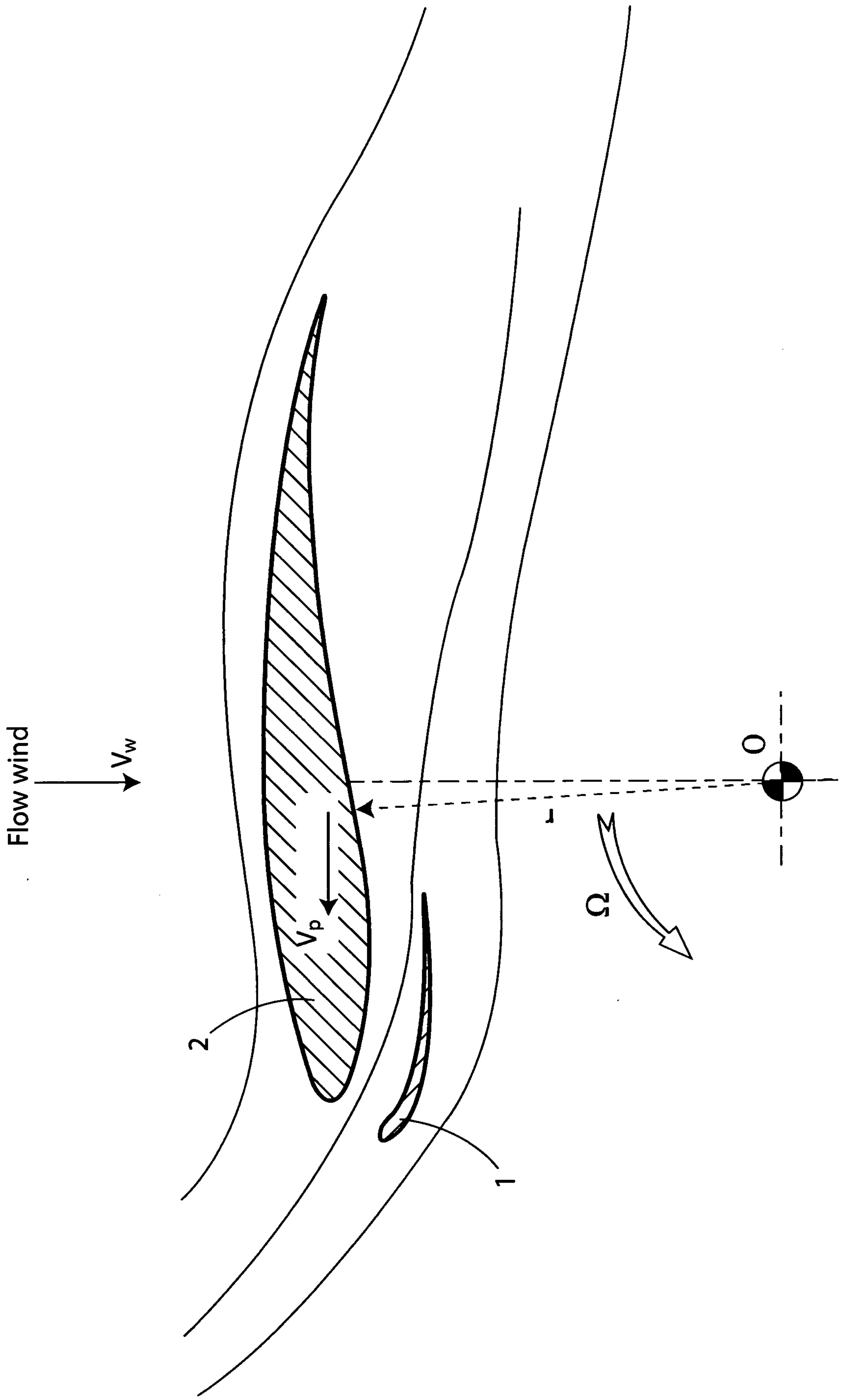

Fig. 2

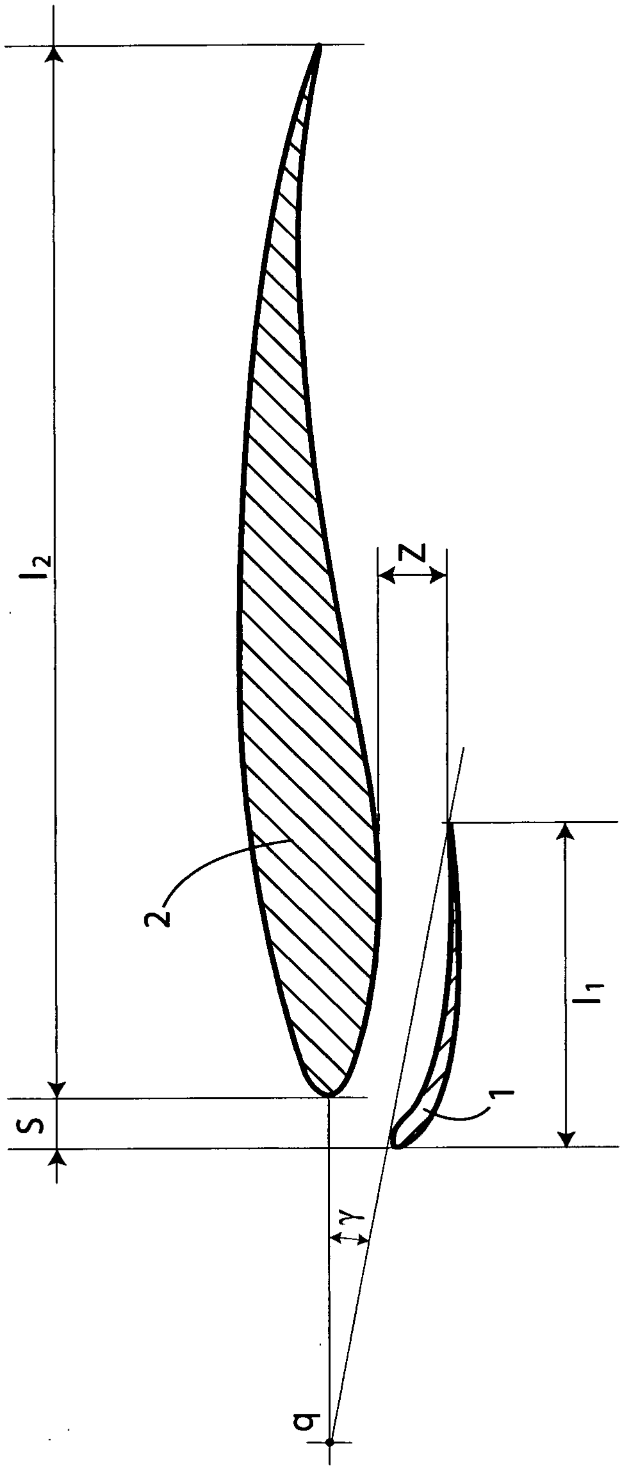

Fig. 3