

**WIND TURBINE HAVING AXIAL INFLOW, RADIAL OUTFLOW
AND VARIABLE-GEOMETRY TURBINE BLADING, AND
PROJECTILES EQUIPPED WITH SUCH A WIND TURBINE.**

5 The invention relates to a wind turbine having axial inflow, radial outflow and variable geometry. It also relates to its application to projectiles.

A wind turbine is an element capable of converting the energy of hydraulic or aerodynamic flows into mechanical rotational energy.

10 Generally speaking, these elements may be classified into two categories depending on whether their geometry is fixed or, conversely, variable. Each of these categories has advantages and disadvantages.

15 Figure 1 illustrates diagrammatically a wind turbine of known type of the so-called variable-geometry category or, more precisely, deformable-blade category. In this figure arrows show the inlet flow (4), then the incident flow (5) onto the turbine blades (3) separated by the deflector (1), and the wind-turbine outlet flow (6). As this Figure 1 shows, the turbine blades (3) are connected to the support (2) only by their end, which has the effect, taking into account the elasticity of the material, of allowing an expansion of the turbine blades (3) when these are subjected to the centrifugal force and to the pressure of the incident flow (5). The result of this deformation is that, above a certain flow rate of the inlet flow (4), the rotational speed of the wind turbine tends to remain stable; a speed-regulating effect is thus obtained which can be very useful depending on the mechanism driven by the wind turbine.

30 However, this architecture has two major disadvantages. Firstly, a relative fragility of the turbine blades (3) due to the fact that these are fixed to their support (2) only by their end. The turbine blades, thus mounted in cantilever fashion, can be particularly vulnerable to axial forces such as, for example, the inertial forces in the case of a system propelled with a large acceleration. Secondly, a poor

low-speed efficiency due to the fact that the flow (5) has the tendency to flow out from the space lying between two turbine blades (3), as represented by the leakage flow (6').

5 Architectures exist in the field of variable geometries where the speed regulation is performed by limiting the air flow rate, as is the case for the turbine described in Patent US-A-2,766,964.

10 In this case, the turbine blades have a variable geometry, the to leave [sic] fixed and non-deformable of each turbine blade being located at the periphery of the turbine, the movable portion being deformed towards the outside under the effect of the centrifugal force, so that the air flow rate decreases when the rotational
15 speed of the turbine increases. The deformation of the turbine blades towards the outside actually restricts the passage of the air between them.

 Figure 2 illustrates diagrammatically a wind turbine of known type of the so-called fixed turbine-
20 blade category (non-deformable vane). In this figure also arrows show the inlet flow (10), then the flow (11) separated by the deflector (7), which is the incident flow onto the turbine blades (9), and finally the wind-turbine outlet flow (12). In this case, the turbine
25 blades (9) are fixed, along their entire length, to their support (8). This results in the element being very robust, due to its non-deformable nature and its increased efficiency relative to the previous case due to the fact that the leakage flow no longer exists. On the
30 other hand, it is not possible with such a wind-turbine structure to obtain a speed-regulating effect.

 The object of the present invention is to alleviate the disadvantages of both systems while preserving the advantages of each.

35 It relates more precisely to a wind turbine having axial inflow, radial outflow and variable-geometry turbine blades, of the type comprising an inlet flow, a deflector creating an incident flow, turbine blades, a

base integral with the assembly formed by the deflector and the turbine blades and covering the turbine blades in order to channel the leakage flows, each turbine blade consisting of a non-deformable portion fixed to the base
5 in order to protect mechanically the turbine blades, characterised in that the non-deformable fixed portion is integral with the deflector and is itself extended towards the periphery of the wind turbine by a movable and deformable aerofoil on this same base in order to
10 regulate the speed of the wind turbine.

The invention will be easier to understand with the aid of the explanations which follow and the attached figures among which:

- Figures 1 and 2 are illustrations of the known
15 art;

- Figure 3 shows diagrammatically an embodiment of an element of a wind turbine in accordance with the invention.

As Figure 3 shows, and according to one
20 characteristic of the invention, the turbine blades (15) or vanes of the wind turbine, comprise a non-deformable portion (15a) and a deformable aerofoil (15b).

The portion (15a) is integral with the deflector (13) or with a support (not visible in the figure) which
25 is itself integral with this deflector. The aerofoil (15b) is deformable, as shown by the dotted lines (x) symbolising the open position of one of the aerofoils (15b) of a turbine blade (15). The non-deformable portion (15a) and the aerofoil (15b) form but one and the same
30 turbine blade; they are connected together by a rounded portion (r) of thickness greater than that of the leakage edges of the aerodynamically profiled aerofoil.

According to another characteristic of the invention, a base (19) is positioned, beneath the set of
35 turbine blades (15), in an integral manner with the deflector (13), in such a way that it permits the deformation of the aerofoils (15b) whilst preventing leakage flows from occurring. The inlet flow (16) is

separated by the deflector (13) into an incident flow (17) onto the turbine blades (15) in order to give an outlet flow (18) without the risk of a leakage flow which would be prejudicial to the efficiency of the wind turbine since the base (19) acts as a screen.

The invention therefore makes it possible, jointly, to obtain:

- a channelling of the flow (17) between each turbine blade (15) limited by the base (19);
- a deformation of the aerofoils (15b) of the turbine blades (15) which ensures a regulating effect on the rotational speed for large inlet flow rates (16);
- a protection of the turbine blades (15) by the base (19) which provides the element with full resistance to the axial forces.

According to another characteristic of the invention, the base (19) accomplishes an additional function: indeed, it acts as an inertial flywheel. It is possible to adapt its density and even, depending on the case, its dimensions.

The wind turbine according to the invention can be produced by machining and assembling of parts, but can also be obtained by moulding processes from suitable moulds.

In a preferred application, a wind turbine according to the invention is integrated into the warhead fuse of a projectile. This wind turbine permits, for example, the delayed arming of the pyrotechnic chain of the projectile. The installation of this wind turbine in accordance with the invention is carried out in a conventional manner.



CLAIMS

1. Wind turbine having axial inflow, radial outflow and variable-geometry turbine blades, of the type comprising an inlet flow (16), a deflector (13) creating an
5 incident flow (17), turbine blades (15), a base (19) integral with the assembly formed by the deflector (13) and the turbine blades (15) and covering the turbine blades (15) in order to channel the leakage flows, each turbine blade (15) consisting of a non-deformable portion
10 (15a) fixed to the base (19) in order to protect mechanically the turbine blades (15), characterised in that the non-deformable fixed portion (15a) is integral with the deflector (13) and is itself extended towards the periphery of the wind turbine by a movable and
15 deformable aerofoil (15b) on this same base (19) in order to regulate the speed of the wind turbine.
2. Wind turbine according to Claim 1, characterised in that the fixed portion (15a) is connected to the deformable aerofoil (15b) by a rounded portion (r) whose
20 thickness is a maximum between the two portions.
3. Wind turbine according to one of Claims 1 and 2, characterised in that the deflector (13)/turbine blade (15)/base (19) assembly is obtained by moulding.
4. Projectile, characterised in that it includes a
25 warhead fuse equipped with a wind turbine, according to one of the preceding claims.