Elimination of blade tip vortices of wind turbines

The blade tip vortex is a powerful phenomenon that develops very quickly. Especially for horizontal-axis wind turbines a significant amount of blade tip vortices is generated.

The consequences of blade tip vortex include noise, structural vibrations, and reduced efficiency and performance. The detached vortex can damage the blade tip, which in turn decreases the lifespan of the blades, necessitating more frequent replacements

The technical solution provides an approach to eliminate blade tip losses. The elimination of turbulence causing energy loss on the blade tips means greater drag force, torque, and efficiency. Vortex interference is used to eliminate vortices and turbulence that cause losses at the blade tips.
The vibrations are reduced by widening the blade tips, the vibrations are greater than the land blade.
Blades are typically replaced every 12-15 years. Structural changes can increase their lifespan by approximately 2-3 years, representing a 10-15% increase. These self-supporting blades, which can reach lengths of 90-100 meters, experience an 8-10% increase in performance.

The structural changes in the blades result in greater efficiency and performance, reduced vibration and noise, and a longer lifespan

TECHNOLOGY/PRODUCT OVERVIEW

Blade tip vortex is a powerful phenomenon that develops very quickly. However, ‘widening’ the blade tips increases the possibility of greater power and performance, at the same time, the vortex losses generated at the blade tips increase drastically. The solution currently used to reduce the vortices of the blade tips is reducing the angle of attack close to the blade tip. This is how it tries to avoid significant losses. At the same time, naturally, the drag force or the transmittable power decreases. In the case of horizontal axis wind turbines, the classic, pointed shape has to be used in order to ensure, among other things, the noise level.

Eliminating or reducing blade tip losses (eliminating vortices around the blade tip) means significant energy savings and increased efficiency, especially when using wide blade tips.

The elimination of blade tip loss reduces vibrations, thus reducing internal friction of the structure’s material, thereby increasing lifespan. This results in significant financial savings, e.g. in the case of a modern wind turbine’s blade.

Due to centrifugal force, the “winglet” used on wings moving in a linear direction cannot be used in the case of a rotating system.

TECHNOLOGY/PRODUCT FEATURES, TECHNICAL DATA AND BENEFITS

These newly developed propellers eliminate harmful turbulence at the tip of the propeller blade.

- Why are the blades being changed?
  - Blades with greater performance are created
  - The tips of the blades become damaged
- Reduced noise
- The vibrations are reduced by widening the blade tips, the vibrations are greater than the land blade
- Greater efficiency and performance
- Longer lifespan: 2-3 years increase in lifespan (basically 12-15 years, 10-15% increase in lifespan)
- It is used for 90-100m long, self-supporting blades
- Performance increase: 8-10%
- Wind turbine blades are exposed to countless physical, mechanical and chemical stresses during operation.
- Wind turbine blades are currently dimensioned based on S. Goldstein's fluid mechanics theory. Therefore, the tip of the blades cannot be wide. They are relatively quiet, but the usable power is lower.
- The elimination of blade tip loss reduces vibrations, thus reducing internal friction of the structure's material, thereby increasing lifespan. This results in significant financial savings, e.g. in the case of a modern wind turbine's blade.

TECHNOLOGY/PRODUCT READINESS LEVEL

TRL 2-3

The test was completed in CAD.

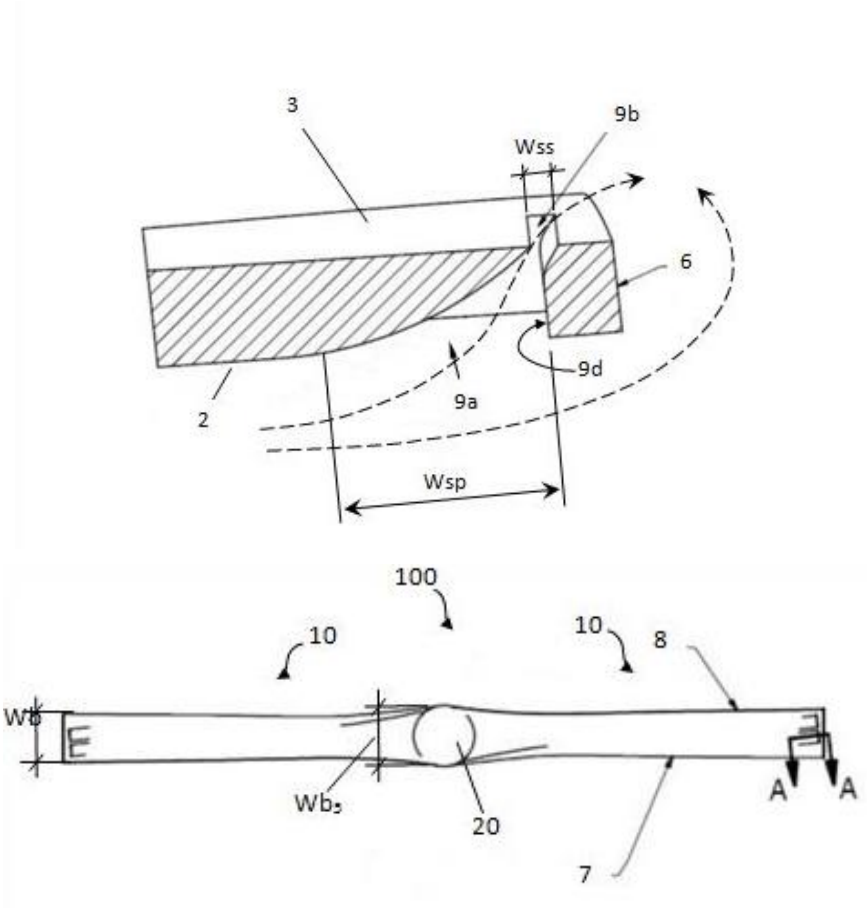
Comparative measurements were performed.

BUSINESS MODEL

The main target is licensing (license fee + royalty)

Joint R&D

IMAGE OF THE PRODUCT



If you are interested, please respond to:

Mr. Balázs Mogyorósi
Technology Transfer Manager,
Head of TT Department
LC Innoconsult International

innovacio@lcinnoconsult.com
www.lcinnoconsult.com