

WINGTIP DEVICE FOR THE TIP OF A WING, BLADE OF A WIND
GENERATOR OR MARINE GENERATOR FOR REDUCING OR EVEN
ELIMINATING MARGINAL SWIRL



159159

5 The previous French patent national patent register
N°0104998 publication N°FR2823541, PCT N°WO 02/083497 A1, and US
patent N°0195461 A1 of the applicant described a wingtip device
or more generally a device having an undersurface and upper
10 surface and the purpose of said device being to increase lift,
reduce induced drag and above all eliminate marginal swirl said
vortex an extremely dangerous phenomenon in the air traffic
context.

15 The above-mentioned patent explains that this device could
be applied to the wings of aircraft and blades of all sorts
including driven propellers such as the blades of wind or marine
generators thus making it possible to produce more energy.

20 This vortex effect behaves in a manner regarded as dangerous
and noisy known for its vorticity acting on the full extent of
the wingtip or blade where in the latter case, the intensity of
the vortex effect is linked to speed and angle of attack in
relation to the fluid in which the wing or blade is moving.

Adaptation of the device described in the initial patent has
already made it possible to obtain in the case of a standard
wind generator an increase in energy performance of about 14%
30 for a wind speed of 10 m/s with correlative attenuation of noise
however the increase in the performance targeted in particular
in view of the substantial increase in the number of wind
generators worldwide, requires more efficient adaptation of this
device in order to further increase energy efficiency, this
35 takes us into the context of this invention.

It has been observed that on the approach to compressible
speeds the device described in the previous patent created a
weak commencement of vorticity at the tip near the leading edge
40 and the overpressure, created by the undersurface which is more
virulent, extended beyond the inlet to the cylinder and tended



G00002

towards the upper surface and was thus driven towards the trailing edge.

The difference on the tip chord towards the trailing edge, creates a negative pressure which increases in proportion to this speed.

The combination of these two air flows which meet on the trailing edge, immediately creates a mini-vortex situated close to the cylinder and the helicoidal slot situated at this point at this speed, only accentuates the creation of this mini-vortex.

In other words and examining Figures 2 and 3 of this initial patent, the angles formed by leading edge (1) ovoid bevel (15) of wingtip cylinder (22) and the resultant angles of trailing edge (2) and cylinder walls (22), are slightly perturbatory when the point of compression is reached in proportion to flow speed and the curves proposed at this point by the present invention will reduce or even cancel these perturbation effects due to the COANDA effect thus obtained.

In more precise terms and insofar as wind generators are concerned in general whether two-bladed or three-bladed, and equipped with vertical or horizontal rotors, performance parameters depend essentially for example for a diameter of the order of 45 m, on wind speed in this respect we can observe here, that the power produced between 5 m/s and 15 m/s, is of the order of 8 KW to 650 KW bearing in mind that this diameter is not restrictive and can go as high at the present time as 80m for a power output of 2,500 KW and 126m for a power output of 6,000 KW, naturally using automatic stalling systems operating in the event of an excessive increase in wind speed.

This invention is aimed at wind or even marine generators but not exclusively, as the proposed device also applies to the wings of aircraft or any other profiles having a leading edge and trailing edge moving in a liquid or gaseous fluid which by the above-mentioned COANDA effect obtained in addition to the effect of the device itself according to the invention and located at the wingtip eliminates almost all the vortex.

Figure 1 according to the description, provides a perspective view of the device according to the invention identified as (1) for its entirety and the device being fixed to the wingtip or blade (2) at interface (3) and the leading edge of said device (4) is curved so as to terminate at the middle of the cylinder at point (7) and trailing edge (5) of said device also curved, terminates at point (6) corresponding to the radial half of this cylindrical part of said device also presenting in addition, a new aesthetic adaptation at the wingtip or blade tip.

The cylindrical part which is hollow, can include one or more helicoidal slots (8) and a profiled longitudinal opening (9) debouching to coincide with the decrease at point (7) of profile (4) of the leading edge.

According to the previous device and when we approach compressible speeds, a commencement of vorticity was created close to the leading edge and the more virulent overpressure effect created by the under surface extended beyond the inlet of the cylinder and tended towards the upper surface then being driven towards the trailing edge.

The combination of these two flows which then met at the trailing edge, instantaneously created a mini-vortex situated close to the cylinder at the same level.

To sum up and in accordance with the new device in accordance with the invention, the curve of leading edge (4) terminating at point (7), produces a COANDA effect at ram air which then penetrates the cylindrical part via inlet (9) and the curvature of trailing edge end (5) terminating at point (6) also produces a COANDA effect while the undersurface overpressures penetrate the cylindrical part via helicoidal slot or slots (8) for ejection to the exterior.

As regards attachment of the device to the wing or blade, it should first be noted that both are hollow and it is consequently possible to incorporate this device inside the wing

or blade without difficulty attaching the device by simple well-known means.

The figure shows the various forms that wing or blade tips can have:

- a) clean tip
- b) tip with tip fairing
- c) tip with winglet

In the two latter cases, the tip is cleaned by removing said tips fairing or winglets or by cutting and fitting the device in accordance with the invention, this can be done in various ways, presents no problem hence:

- d) tip equipped with device (1) in accordance with the invention.

Figure 3 shows in addition, another simple method of attachment among others by planning on the device in accordance with the invention, an internal indentation providing for fitting with the hollow wing or blade (2) in accordance with interface (3) and attachment to the device according to the invention by bonding, or using screws (11), thus providing for secure installation and eventual disassembly of said device for example for maintenance purposes.

In conclusion, almost all swirl said vortex is eliminated by application of this device which can be used with all types of wing profiles or blade whether wind or marine generator or indeed helicopters and by extension with all profiles situated in a liquid or gaseous fluid such among others as rudder blade or stabilisers for ships, submarine horizontal and vertical rudders, submerged tidal generator profiles, or front and rear stabilisers for Formula 1 racing cars or other vehicles.

Key to drawings and figures:

- 5 1 - Device
 2 - Wing or blade
 3 - Interface
 4 - Leading edge
 5 - Trailing edge
10 6 - Trailing edge end
 7 - Leading edge end
 8 - Helicoidal slot(s)
 9 - Cylinder form inlet
 10 - Indentation
15 11 - Screw

20

25

30

35

40

CLAIMS

5 1 - Wingtip or wind or marine generator blade tip device,
serving to reduce or even eliminate marginal swirl said vortex
with correlative enhanced aesthetic, characterised by the fact
that said device (1) has a cylindrical appearance merging with
its streamlined body with undersurface and upper surface and
10 that said device is secured to the tip of said wing or blade (2)
at interface (3) and curve (4) of the leading edge of said
device which induces the COANDA effect terminates at point (7)
which is substantially the middle of this device coinciding with
ovoid inlet (9) situated in the cylindrical channel while
15 helicoidal slot or slots (8) made in said cylindrical channel
are sufficient in number to allow total ejection of residual
fluid to the exterior.

2 - Device in accordance with claim 1 characterised by the fact
20 that it is simple to install on the tip of a wing or blade at
interface (3) by providing an internal indentation towards
interior (10) of said device (1) and that conventional
attachment systems can then be employed in particular by
recessing or bonding for example or by other means of attachment
25 such as by screws tightened interdependent with said device (1).

30

35

40