Autopilot of traction sails

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The aim is to automate the steering of traction sails, such as those of kitesurfs.

To increase the power of such a wing, it is known to cause - by successive pulls on its traction lines - the lateral movement of the kite inside its flight window, alternately in a direction and in the opposite direction, so that the speed of its movement towards the air increases. The force generated by the wind on a kite is proportional to the square of its speed towards the wind, which increases its propellant force.

The pilot of such a machine thus spends his time shooting alternately on two lines of traction of the kite.

To adapt this system to the propulsion of cargo ships and other boats, it is known to use artificial intelligence in order to generate these successive pulls by one or more computer-controlled engines, taking into account the position of the kite, but this represents an energy expenditure that can be significant while it is possible to obtain the same result by a simple and cheap mechanism, which requires no motorization.

In a basic version, the autopilot device is installed on a boat, which it pulls by traction lines:

- **two of them control the kite's flight direction, each connecting a kite point to a "pull point" placed on the boat through the end of a mast that can rotate around its attachment to the boat,**
- **and a third, optional, controls its impact in relation to the wind.**

Innovation is that these pull points are mobile, and have at least two different stable positions separated by unstable positions.

The device automatically causes the pull points to move laterally through the lateral movement of the kite, which in turn causes the kite to move laterally at the end of the movement, and so on, which has the effect of moving the kite cyclically and making it perform "8" in the sky.

The mast, attached to the boat by a cardan, always aligns with the traction lines. As a result, it does not induce a heeling or a dive torque. However, before sailing, to remove the sail from its storage along the mast, it can momentarily be stuck in a position to deploy the kite and inflate its leading edge if it has such an enhancement.

The pull points move on an element called the "oscillator", which guides their lateral movement. This oscillator is guided by a wind vane to automatically place itself in the wind direction. The mechanism therefore automatically adapts to the boat's point of sail.

The position of the mast, which depends on the point of sail and the position of the kite, controls the position of the pull points and actually determines the entire operation of the piloting device.

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When sailing downwind, the kite travels its entire wind window through noticeably horizontal movements, but the closer it gets to beating, the more these movements tilt and decrease. When beating, the kite comes to rest at the edge of its flight window to optimize its efficiency. This is achieved by an automatic modification depending on the point of sail of the oscillator's tilt and the limitation of the possible displacement of the pull points. If the user attains an upwind direction to which it is impossible to sail directly, the kite automatically puts itself in the center of its flight window, but with a very low incidence relative to the wind so that the speed of the boat in reverse is as low as possible.

If the wind drops too much, the kite automatically puts itself in the center of its flight window, with an increased incidence in relation to the wind so that it does not descend to the point it would reach the water.

If the wind does not return, or at the end of navigation, the pilot wraps the traction lines on a winding drum, until the kite is suspended at the top of its mast, which then takes a vertical orientation to allow the kite to be stored in a sock.

Several superimposed kites, connected one to another by fixed-length traction lines, can be controlled by the same steering device.

It is also possible to juxtapose several devices each flying one or more kites, and tp synchronize them together to avoid kite collisions.

The piloting device may also be used to produce energy, both by using the kite used to propel a boat and by establishing fixed stations, on land or at sea.

The energy then obtained by the tension variation of the kite’s traction lines to train an alternator. The kite pulls less on its voltage lines when turning around, and this energy is increased by an automatic decrease in the kite's incidence relative to the wind at this stage of the cycle.

The advantages compared to rotating wind turbines are numerous:

- the simplicity of the mechanism placed at height, since the steering device and the alternator can be placed on land,
- the lightness of the mast, which works only on tension and not bending,
- benefit from stronger and more consistent winds at altitude, as well as greater lateral movement and therefore greater lateral speed of the kite,
- The very low cost of manufacturing and transporting a kite and its steering device, compared to that of a wind turbine,
- the absence of all nuisances that affect the development of wind turbine equipments in a territory.

The word "kite" has been used here, but all types of sails can be used. Similarly, the innovation applies to the traction of land and water vehicles of all sizes, from light leisure boats to cargo ships, as well as to the generation of electricity by the wind and water currents.

This project is protected by the FR2010011 patent application, which has a priority as of August 28, 2020 and will be extended internationally.