•TSVLS - US Pat Pend -US Copyrights ABSTRACT 12.30.24

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The TSVLS represents a breakthrough in the challenge of torque control for vertical flight or lifting systems. Traditionally, managing the torque generated by a lift rotor has been a significant engineering obstacle, as it seemed impossible to counteract 100% of the torque without sacrificing useful downdraft, which is essential for lift. This limitation had stalled the development of more advanced and versatile torque control mechanisms.

However, the TSVLS overcomes this by using a clever design that places a lift rotor above a set of vertical airfoils within a shroud. The airfoils create horizontal lift in the opposite direction of the rotor's torque, thus balancing the forces generated. This configuration allows the system to maintain stability and control over 100% of the torque without losing efficiency in terms of lift. As power is increased, the downdraft and anti-torque forces both increase proportionally, ensuring that the system remains stable across a range of operating conditions.

One of the key advantages of the TSVLS system is its simplicity and low reliance on complex hardware, which reduces both the cost and potential failure points compared to other systems. This makes the TSVLS a practical and safe solution for personal vertical flight, allowing users to take off and land in confined spaces like driveways and fly safely at low altitudes. The potential applications for this technology are vast, from unmanned aerial vehicles to military platforms, commercial lifting solutions, and even consumer-grade hobby aircraft.

The TSVLS system is not only highly efficient in terms of torque control, but it also enhances the lift and thrust produced by the rotor. The use of a "type B" shroud is particularly noteworthy, as it increases lift by up to 40%. Furthermore, the airfoils within the system are capable of generating significant lift in relation to the drag they produce, meaning the TSVLS can provide comparable lift to traditional rotor-only designs while managing torque effectively. This energy-efficient design makes the TSVLS one of the most promising systems for a wide range of vertical flight applications.

Key Advantage

1. **Wasted Swirl Energy**: When a rotor spins, it naturally creates a downdraft of air beneath it, which includes a swirling motion. This swirl, or vortex, is often considered wasted energy in conventional systems because it doesn't contribute directly to lift or thrust.

2. **Airfoils Positioned Beneath the Rotor**: The TSVLS system harnesses this wasted energy by positioning nearly vertical airfoils beneath the rotor. These airfoils are not aligned with the flow of air; instead, they are placed at an angle (approximately 7 degrees from vertical) to intercept the swirling downdraft. The motion of the air relative to the airfoils creates lift.

3. **Lift Generation**: As the swirling air meets the airfoils, it is deflected in both horizontal and vertical directions. This results in horizontal lift—lift in a direction opposite to the torque being generated by the rotor. The creation of this anti-torque lift helps balance the forces acting on the system.

Torque Balance: In conventional rotor systems, torque generated by the spinning rotor is typically countered by a tail rotor or other mechanisms. In the TSVLS system, the anti-torque lift produced by the angled airfoils provides a natural way to counteract this torque. When the airfoils are set at an optimal angle (7 degrees from vertical), the system can potentially achieve a balance of forces that eliminates the need for additional anti-torque mechanisms.
The Key Advantage

The main advantage of the TSVLS over other torque control systems is its ability to make use of energy that would normally be wasted (the rotor's swirl), thereby improving efficiency. Instead of relying on an additional mechanism (like a tail rotor or complex control system) to balance the torque, the TSVLS leverages aerodynamic forces generated by the interaction of the airfoils with the rotor's downdraft.

This system could potentially reduce the complexity and weight of the vehicle by eliminating the need for traditional anti-torque systems, as well as improving overall aerodynamic efficiency. It also highlights a novel way of extracting useful lift from a rotor system's existing flow characteristics, rather than requiring additional power input.