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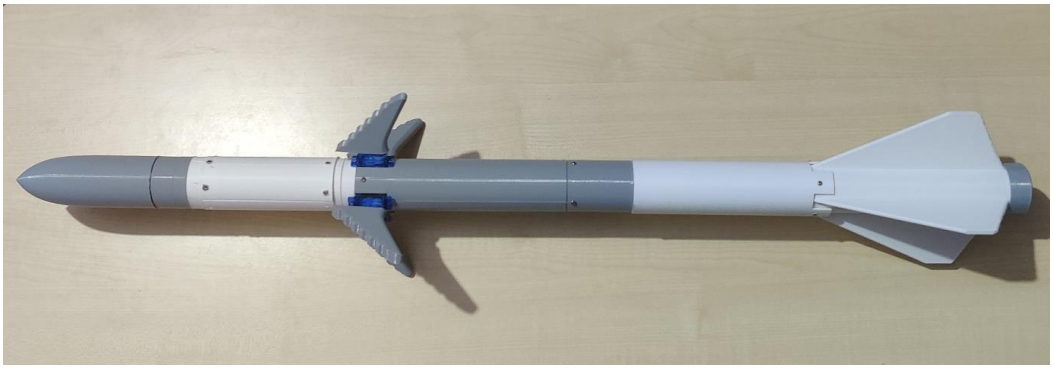
6366618733 | 9677928900
info@bnhpartners.com
432, 2nd Anganavadi Centre, Jakkur Layout,Jakkur Post, Bangalore 560064

PRIOR ART SEARCH REPORT

Invention Searched:

Bio-Inspired Whale Flipper Controlled low powered Rocket for Agile Flight Maneuvering



Client:

College of Engineering,
JSS Science and Technology University, Mysore

Database/Software Used in the Search:

inPASS, Patentscope, Espacenet, Sciencedirect.com, Research journals, Copyright office database

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About Prior Art Search Report

A Prior Art Search Report is an analysis of inventions that are similar to yours. Such similar invention(s)forms a part of what is technically known as "prior art" or knowledge already persisting in the public domain about your invention. To be granted a patent by the Controller General of Patents and Design and Trademark, the Examiner must determine if your invention meets the patenting criteria of novelty, non-obvious and usefulness or not.

The report enables you to get a wholesome knowledge about all prior art persisting in relation to your invention which assists you to take a reasonable decision before you file your application with the relevant authority. The prior art can be used by the authority's Examiner to access your application while processing the same. A Preliminary assessment can be thus made as to whether Patent Office will consider your invention novel, non-obvious and useful or not.

Prior art research is typically conducted on a global scale rather than being limited to a specific territory. The goal of a prior art search is to identify existing technologies, inventions, or ideas that may be relevant to a patent application. Patent offices and patent examiners aim to determine the novelty and non-obviousness of an invention by comparing it to existing prior art.

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While the search may involve databases and resources specific to a particular country or region, it is not limited to that territory. Patent offices and professionals conducting prior art searches often utilize international patent databases, scientific literature, conference proceedings, and other sources to identify relevant prior art from around the world.

This global approach helps ensure that the examination process considers a comprehensive range of existing knowledge and inventions, regardless of their origin. It's important for patent applicants to demonstrate that their invention is novel and inventive not just in the specific territory where they are seeking protection but also in the broader context of the global state of the art.

Report Date: 16th May 2025

Part-A

Patent Literature

Document Considered to be relevant

S.No	Patent/ Publication No.	Title of the Invention	Status	Relevancy
1.	US 11780580	Passive and active stability systems for ballistically launched multirotors	Granted	A
2.	US 2017/0137116	Efficiency Improvements for Flow Control Body and System Shocks	Published	A

**Note-*

X: Document of Particular relevance: The claimed invention cannot be considered novel or non-obviousness when the document is taken alone.

Y: Document of Relevance: The claimed invention cannot be considered novel or non-obviousness when the document is combined with one or more other documents, such combination being obvious to a person skilled in art.

A: General state of Art: Not consider to be of particular relevance.

Part–B

Non-patented literature

Products and articles considered to be relevant

1. Liu, Z., et al. (2014). Flow Control Using Tubercles on a Fin for Improved Stall Delay.
   Aerospace Science and Technology, 35, 33-41.

2. Gharib, M., et al. (2005). Bio-Inspired Flow Control: The Effect of Whale Flipper Tubercles on Lift and Stall.
   Bioinspiration & Biomimetics, 1(2), S89–S97.

3. Mao, Z., et al. (2012). Effect of Leading-Edge Tubercles on the Aerodynamic Characteristics of Airfoils at Low Reynolds Numbers.
   Experimental Thermal and Fluid Science, 45, 150-157.

4. Liu, S., et al. (2017). Bio-Inspired Tubercles on Wings and Fins for Stall Delay and Lift Enhancement.
   Progress in Aerospace Sciences, 91, 1-12.

Report Summary and Observation

On the basis of aforementioned search results extracted after conducting thorough search of granted as well as published patents by all major and minor jurisdictions of the world, it can be concluded that your invention at its current stage, in its entirety, is not part of the 'prior art' or the 'prior knowledge'. This means that if an application is made in the current form, it might likely to be objected but still with eminent prosecution from our side we can dodge the grounds of prior Knowledge or prior usage as few listed above.

The present invention addresses a bio-inspired flow control mechanism utilizing leading-edge tubercles—protrusions modeled after whale flippers—to enhance aerodynamic and hydrodynamic performance. The primary objective is to delay flow separation, reduce drag, and improve lift or propulsion efficiency in aircraft, marine vessels, or related applications. The design involves the strategic placement of tubercles on the leading edge of wings or fins, leveraging natural flow control mechanisms observed in marine mammals.

The concept of bio-inspired tubercles is not entirely new; similar concepts have been documented in prior art, notably in studies on whale flippers (e.g., Liu et al., 2014; Mao et al., 2012). The specific design, placement, and application of tubercles in this invention should be carefully analyzed to determine if they present an inventive step beyond existing designs.

Prior research and patents have demonstrated the benefits of leading-edge tubercles in flow control, such as NASA’s work on bio-inspired wing designs and academic research (Gharib et al., 2005; Liu, 2017). Existing patents and literature may disclose similar

configurations, which could impact the novelty claim. Given the natural inspiration from whale flippers—a well-known bio-inspiration—the inventive step might be challenged unless the specific implementation shows significant and unexpected advantages. If similar tubercle designs have been previously disclosed in academic publications or patents, the invention may be considered obvious to those skilled in the art.

Focus on unique features such as the shape, size, placement, or integration method that distinguish your invention from existing tubercle-based flow control devices. The inventor should emphasize specific design elements, configurations, or application methods that distinguish this invention from existing technologies. Complementing this, CFD modeling should be undertaken to simulate flow behavior, validate experimental results, and optimize design parameters. Detailed records of simulation setups, boundary conditions, mesh details, and results—such as vortex shedding and turbulence characteristics—are vital. Quantitative data demonstrating performance improvements, such as percentage increases in lift or stall delay, across different operational conditions, will substantiate the invention’s benefits.

Highlighting any unexpected performance improvements or unique structural aspects will strengthen the patent application's prospects. Providing empirical evidence demonstrating significant benefits—such as improved lift, stall delay, or efficiency—will support claims of inventive step and non-obviousness.

Suggested Course of Action

Based on the existing search results, to prepare a comprehensive and water-tight patent specification for your bio-inspired leading-edge tubercle invention, it is essential to first thoroughly document the structural and design details of the tubercles. This includes capturing precise geometrical parameters such as shape, dimensions, spacing, pitch, and arrangement patterns, along with detailed material specifications and surface finishes. It is important to furnish specific information, including the type of surface where the tubercles are installed, the installation techniques, and fixation methods.

Further, conducting and recording extensive experimental and testing data is crucial. This involves performing hydrodynamic or aerodynamic tests—either physically in water or wind tunnels or through computational fluid dynamics (CFD) simulations—to measure key performance metrics such as lift, drag, stall angle, flow separation points, and pressure distributions under various flow conditions. Visualizations like flow patterns and vortex formations should be documented with images or videos. Comparative analysis of results with and without tubercles, along with variations in design configurations, will strengthen the inventive aspects of the invention. Moreover, it is advisable to explore different embodiments and configurations, including variations in shape, size, arrangement, and scalability, to highlight the versatility and robustness of the design. Environmental durability data—such as resistance to corrosion, fatigue, and wear. Overall, if the above points are carefully addressed and the invention is drafted to highlight its unique aspects and advantages, there is potential for a prospective patent grant. It is recommended to proceed with the patent filing process, ensuring that all novel aspects are thoroughly documented and supported.

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DISCLAIMER

The Search Report may contain information procured through Patent Records of different databases of several countries. B&H Partners has taken all reasonable steps to make sure that the information is procured via authentic sources and is correct in its very essence. However, patent search is a subjective exercise which requires huge reliance on numerous third-party sources which are subject to periodical updates. Therefore, we do not warrant that the report is absolutely accurate or is completely error free or is comprehensive in nature.

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