Swirl Number Selection for Reduction of Various Forms of Jet Noise

IITM Technology Available for Licensing

Problem Statement

- High-speed jet flows, like those in jet engines, **generate excessive noise during take-off & landing** posing social, health, structural concerns.
- Existing noise reduction methods, including passive devices & active control, result in **thrust loss and provide limited noise reduction,** without effectively addressing the root cause.
- While prior art employs various devices, a comprehensive solution using **a co-axial swirler** is needed to balance noise reduction & thrust preservation.
- Hence, the present disclosure is in need to **effectively reduce jet noise**.

Technology Category / Market

Categories: Aerospace & Defense Technologies | Applied Mechanics & Mechanical Engineering

Industry: Aviation, Aeroacoustics, Aerospace, and Fluid Dynamics industries

Applications: Jet Engines, Aerospace, Pipe Jets, Non-circular Jets, Impinging Jets

Market: The global **Jet Engines** market size was **$76510 Mn** in **2021,** is projected to touch **$139852 Mn** by **2031**, growing at **6.2% CAGR** in the period of **2021-2031**. Further, the global **Aerospace** market size was estimated at **$322 Bn** in **2022** and is projected to reach around **$678 Bn** by **2032**, growing at **7.8% CAGR** in the period of **2022 to 2032**.

TRL (Technology Readiness Level)

TRL-4: Validated in Laboratory

Intellectual Property

IITM IDF No.: **1350** | IP No.: **454509 (Granted)**

Technology

The instant invention disclosed revolves around a novel approach to reducing noise in various jet applications, precisely:

A jet noise suppressor in a jet engine having a jet center longitudinal axis, comprising of a nozzle, a downstream end to discharge engine flow and **a co-axial vane swirler of a suitable swirl number** before the downstream end.

The **swirl number (S)** is determined by equation:

Where,

Ds- swirl jet diameter,

Dh- internal hub diameter,

θ - vane angle

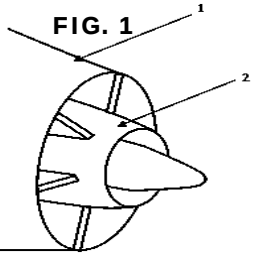
$$S = 2/3\left[\frac{1-\left(\frac{D_h}{D_s}\right)^3}{1-\left(\frac{D_h}{D_s}\right)^2}\right]\tan\theta$$

FIG. 1 shows the exit of the gas turbine engine with co-axial swirler device installed

FIG. 2A: front view of co-axial swirl device

FIG. 2B: shows the free jet or nozzle device

FIG. 3: Schematic view of co-axial swirler with nomenclature



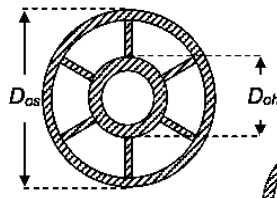
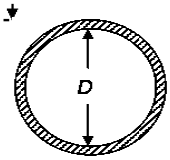
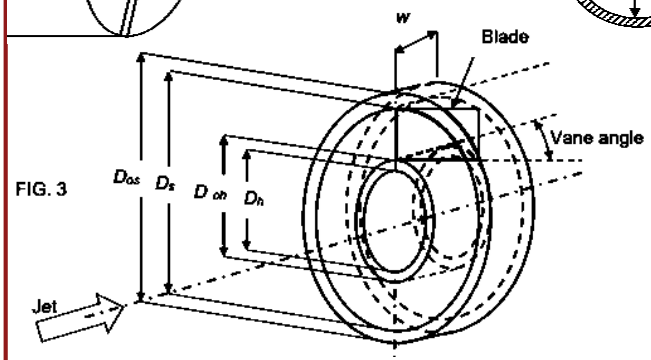


FIG. 2A

FIG. 2B





Key Features / Value Proposition

- Offers a **unique co-axial swirler design** with tailored vane configurations
- Enables **effective noise reduction** in jet engines and various fluid dynamics applications.
- **Versatile Applicability** provides solution for **noise suppression & enhanced mixing**.
- By emphasizing swirl number optimization, it strikes a **balance between noise reduction and engine performance**, ensuring efficient operations in various industries.

Research Lab

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