

## Industrial Consultancy & Sponsored Research (IC&SR)

### An Internal Combustion Engine Combustion Chamber with Baffles to Control In-Cylinder Flows IITM Technology Available for Licensing

#### PROBLEM STATEMENT

- Global efforts are being made to enhance the performance and emission characteristics of internal combustion engines, a crucial tool in the automotive industry.
- The **combustion system**, influenced by **in-cylinder fluid dynamics**, affects performance, emission control, and fuel economy.
- Techniques include **directed and helical ports, valve shrouding, and piston profile** modifications.
- However, these methods can **increase manufacturing costs, reduce efficiency, and increase emissions.**
- The goal is **to improve performance and reduce engine knock without increasing costs.**

#### TECHNOLOGY CATEGORY MARKET

**Technology:** Addition of Baffles to the combustion chamber of an IC engine.

**Category:** Automobile & Transportation

**Industry:** Automotive

**Application:** IC Engine

**Market:** The global market size of (IC) engine was valued at **USD 321.6 Billion in 2023** and is expected to reach **USD 485.1 Billion by 2032** at a **CAGR of 4.7%**.

#### INTELLECTUAL PROPERTY

IITM IDF Ref. 2594;

Patent No: IN 533958;

#### TRL (Technology Readiness Level)

TRL-4 Technology validated in Lab;

#### Research Lab

Prof. J. M. Mallikarjuna,

Dept. of Mechanical Engineering, IIT Madras.

#### TECHNOLOGY

- An internal combustion engine consists of a cylinder and piston, with a **combustion chamber shaped by baffles** that **divide in-cylinder flow into multiple zones, each with a separate vortex.**

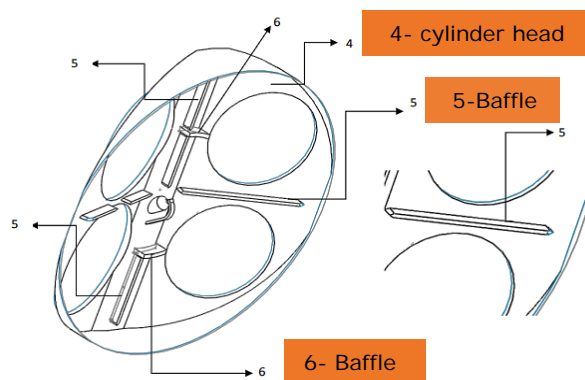


Figure 1 shows a Schematic diagram showing 3D view of the baffles inside the combustion chamber

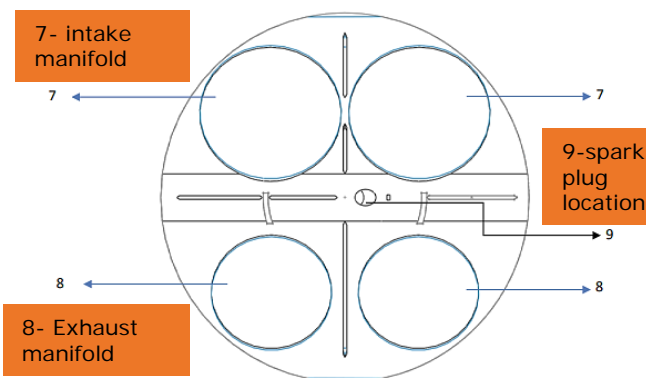


Figure 2 shows a Bottom surface of the cylinder head showing the position of the baffles

#### Baffles

- Structure : **Fin Type**
- Types : **Radial** and **circumferential.**
- Function: Divide the entire in-cylinder flow into **four regions**, each with its own in-cylinder flow.

#### CONTACT US

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### Combustion Chamber

- ❖ During combustion, the baffles - fin-like structures **steer the combustion waves** in the **longitudinal direction** by dividing the global flow into zonal-wise flows.
- ❖ During the compression stroke, **baffles partition a single tumble**, confining the air-fuel combination in the combustion chamber regions.
- ❖ By **rerouting radioactive combustion waves** in a longitudinal direction, they improve the efficiency of internal combustion engines.
- ❖ Combustion chamber baffles **stratify the dispersion of the air-fuel mixture** and lessen wall wetness.

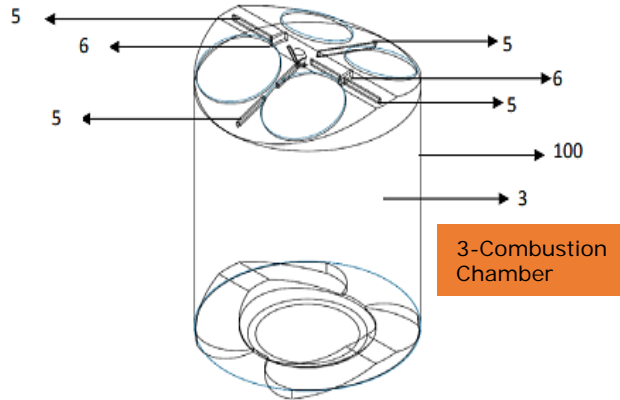


Figure 3 shows a Isometric view of the model of the engine

### Key Features / Value Proposition

- ✓ **Reduce engine knock in petrol, diesel, gasoline direct injection**, homogeneous charge compression ignition, and all other types of internal combustion engines.
- ✓ **Enhancement of in-cylinder flows in an internal combustion engine**, improving air-fuel mixing and mixture distribution, and reducing spark ignition engine knocking.
- ✓ It **does not affect combustion chamber space** because of its compact size and shape.
- ✓ **Increased air-fuel mixing** and mixture distribution, lessen spark ignition engine knocking, and improved in-cylinder flows in internal combustion engines.
- **Increases the efficiency of combustion**, which boosts engine performance.
- The baffles also divide a **single tumble** during the compression stroke into many, limiting the air-fuel mixture distribution.
- At **1000 rev/min** and **30 bar fuel injection pressure**, EWB's thermal efficiency and effective pressure improve by 9.1% and 3%, respectively, while CO and HC emissions decrease by **38.5% and 85%**.
- ✓ It helps **possibility of combustion even at lower engine speeds**.

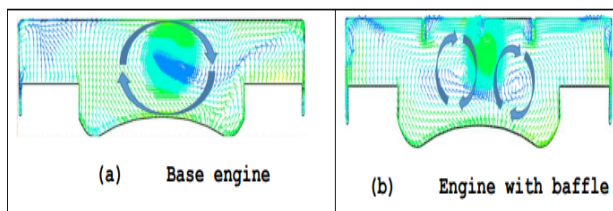


Figure 4 shows a Comparison of in-cylinder velocity vectors on a vertical plane located at the distance of 5 mm from the axis of the engine

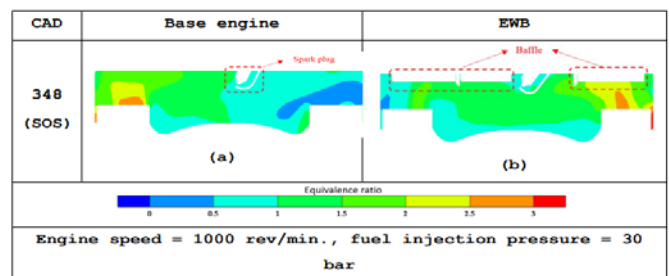


Figure 5 shows a Comparison of equivalence ratios on a vertical plane through the axis of the engine

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