IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO - IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

MULTI-GASEOUS FUEL COMPOSITION INTERNAL COMBUSTION ENGINE SYSTEM, GASEOUS-FUEL DELIVERY SYSTEM AND METHOD OF OBTAINING COMPOSITION

IITM Technology Available for Licensing

Problem Statement

- The rising demand for Internal Combustion (IC) engines, coupled with the finite nature of fossil fuel resources, has given rise to significant concerns related to both energy security and environmental sustainability.
- At lower load, cycle-to-cycle combustion variations and brake thermal efficiency of the engine are deteriorated & high load is limited by the abnormal combustion; where challenge lies in optimizing the combustion process within IC engines.

Technology Category/ Market

Category –Energy, Energy Storage Applications
Applications –IC Engines, Automobiles
Industry – Automotive
Market -Internal Combustion Engine Market (ICE) was a volume of US$ 175.68 million units in 2021 and is expected to increase to US$ 266.56 million units by 2029 at a **CAGR of 5.35%.**

Key Features / Value Proposition

❖ ***Technical Perspective***

- ❑ Discloses an internal combustion engine system fueled by a multi-gaseous fuel composition, a gaseous-fuel delivery system and a method of obtaining **a user-defined composition of plurality of gaseous fuels**
- ❑ The controller is configured to **vary the compression ratio** even when the internal combustion engine is operational.

❖ ***User Perspective***

- ❑ Capable of preparing any gaseous fuel composition by mixing various gas constituents ,meter the fuel delivery to the engine by checking intake manifold pressure, provides flexibility to change the equivalence ratio, along with capability to vary the spark timing **for optimal performance**.
- ❑ Determines the compression ratio and equivalence ratio for a given speed and load required to **maximize brake thermal efficiency.**

Technology

The internal combustion engine system includes:

- ***Internal combustion engine***
- ***Intake manifold for air-fuel mixture induction***
- ***Exhaust manifold for burned gases discharge***
- ***Gaseous fuel delivery system with fuel delivery line***
- ***Valves for fuel flow control***
- ***Sensors for data acquisition***
- ***Controller with input/output interface and memory***

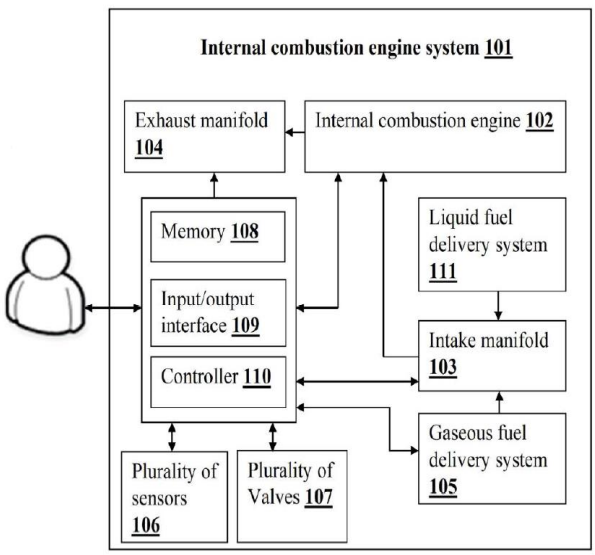

Fig. 1 shows an exemplary architecture of internal combustion engine system, fueled by multi-gaseous fuel composition

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The said internal combustion engine includes the **combustion chamber** comprises of :

a. a moving cylinder head and liner assembly;
b. a piston with a hemispherical cavity; and
c. a flat cylinder head

The gaseous fuel delivery system comprises:

- ✓ gas storage tanks
- ✓ mass flow controllers
- ✓ mixing chamber
- ✓ a delivery line pressure sensor

- ❑ The controller is configured to vary the compression ratio of the internal combustion engine by varying the clearance volume of the combustion chamber by moving cylinder head and liner assembly.
- ❑ The outlet of the exhaust manifold is connected to the inlet of the intake manifold through an exhaust valve to recirculate the exhausted gases
- ❑ Data acquisition system based on a crank angle degree resolution of the crank angle encoder gets triggered, collects the data from the plurality of sensors and stores them in a memory associated with the system
- ❑ The gaseous fuel delivery system further comprises of a fuel metering device connected to the gaseous fuel outlet delivery line to meter the fuel.

Images

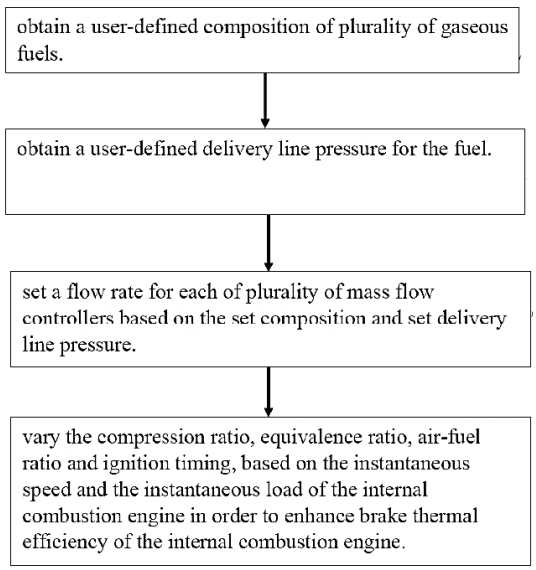

Fig. 2 shows a flowchart illustrating method of obtaining user-defined composition of plurality of gaseous fuels

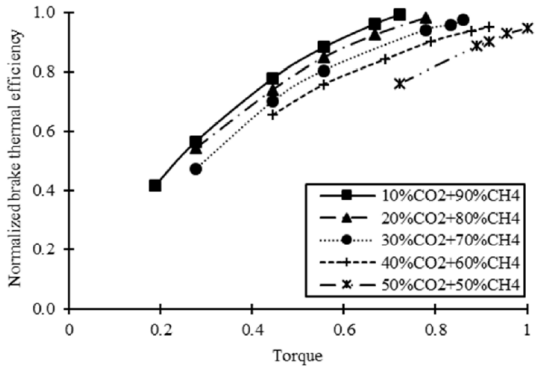

Fig.3 shows an illustrating the effect of gaseous fuel composition variation on the performance of the engine

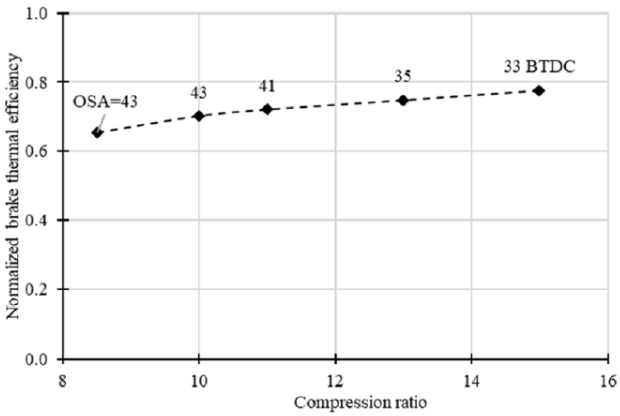

Fig. 4 shows a graphical representation illustrating the effect of compression ratio variation on the performance of an exemplified embodiment of the Engine operating under a biogas composition (i.e., a blend of 60% CH4 and 40% CO2 by volume)

Intellectual Property

- **IITM IDF Ref. 1926**
- **IN467393- Granted**

TRL (Technology Readiness Level)

TRL- 4, Technology Validated in Lab

Research Lab

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