



CONTROLLING ADMISSION VOLUME OF INLET GAS FOR FIXED RPM OPERATION OF ROTARY OR RECIPROCATING EXPANDER

IITM Technology Available for Licensing

Problem Statement

- Due to process compulsions, to **reduce boiler size and piping, steam generation** normally happens at high pressure whereas usage happens at low pressure.
- The reduction of this pressure is done using a pressure reducing valve (PRV). The process in a **PRV is isenthalpic and irreversible**.
- The economic implication will be limited to **brake efficiency** and additional mass flow of steam which is proportional to work done. This typically works out to be **Rs1 to 1.2/KWH generated**.
- The isentropic efficiency will not affect the generation cost since the outlet of the expander is going to process.
- However, **lower the isentropic efficiency lower the power generated** and hence longer the return on investment.
- The present available technology cannot give high isentropic efficiency for the entire range of operation. However, it provides a useful alternative.

Technology Category/ Market

Category - Clean Energy, Energy Storage

Applications - Energy storage, renewable energy generation, diesel generators

Industry - Power, Energy storage systems

Market - The global advanced energy storage system market size accounted for USD 19.0 Billion in 2022 and is estimated to achieve a market size of **USD 48.5 Billion by 2032** growing at a **CAGR of 9%** from 2023 to 2032.

Key Features / Value Proposition

- Increase in **peak isentropic efficiency**.
- Can avoid using expensive control valve for throttling.
- Increase in **totalised power output**.

Intellectual Property

- IITM IDF Ref. 1760
- IN 201841038051**
- PCT/IN2019/050728 - Published**
- US11448073 - Patent Granted**
- EP3847359 - Published**

Technology

- The present invention relates to a **mechanism for controlling admission volume (as shown in Fig. 1) of inlet gas for a fixed revolutions per minute (RPM) operation** of a rotary or reciprocating expander.

System

- The system has a **boiler for generating a steam** at a higher pressure for heating application in a process.
- A **pressure reducing valve (PRV)** controls a boiler pressure to process pressure.
- Inlet ports and exhaust ports** are configured by intersection of opening on a rotor housing and opening on a rotating valve.
- The inlet ports are designed in such a way that a port opening duration can be controlled to admit required volume of a steam corresponding to a mass flow requirement of the process.
- A port capable of changing the area and timing of opening in such a way that the duration and starting of exhaust can be controlled.
- Higher part load efficiencies, the variation in isentropic efficiency in the **entire range of operation can be within 10%**. The pressure v/s rotation angle of Wankel expander (Fig. 2) demonstrates this.

TRL (Technology Readiness Level)

TRL - 3, Proof of concept stage

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FIG.1. A schematic view of a system for controlling admission volume of an inlet gas for fixed RPM operation in an apparatus.

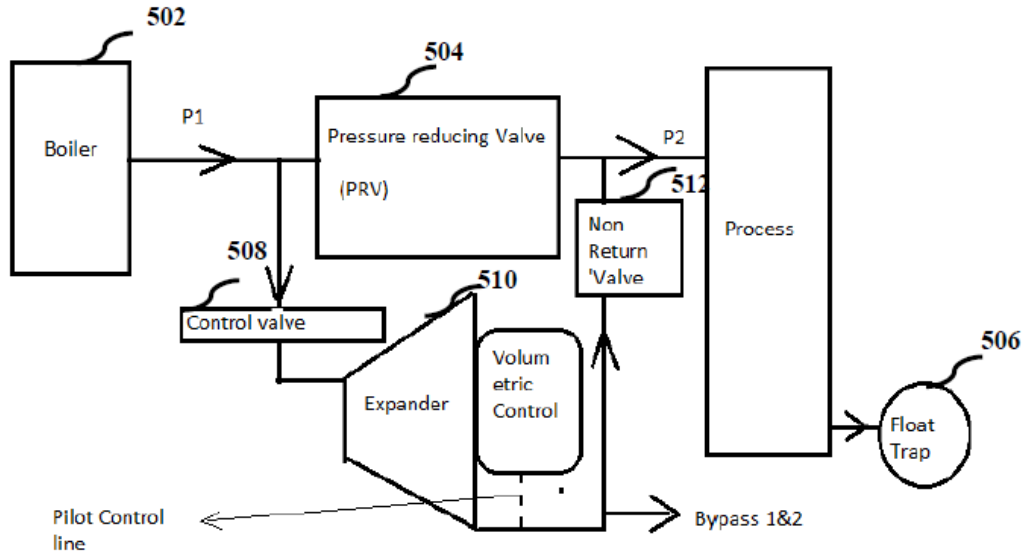
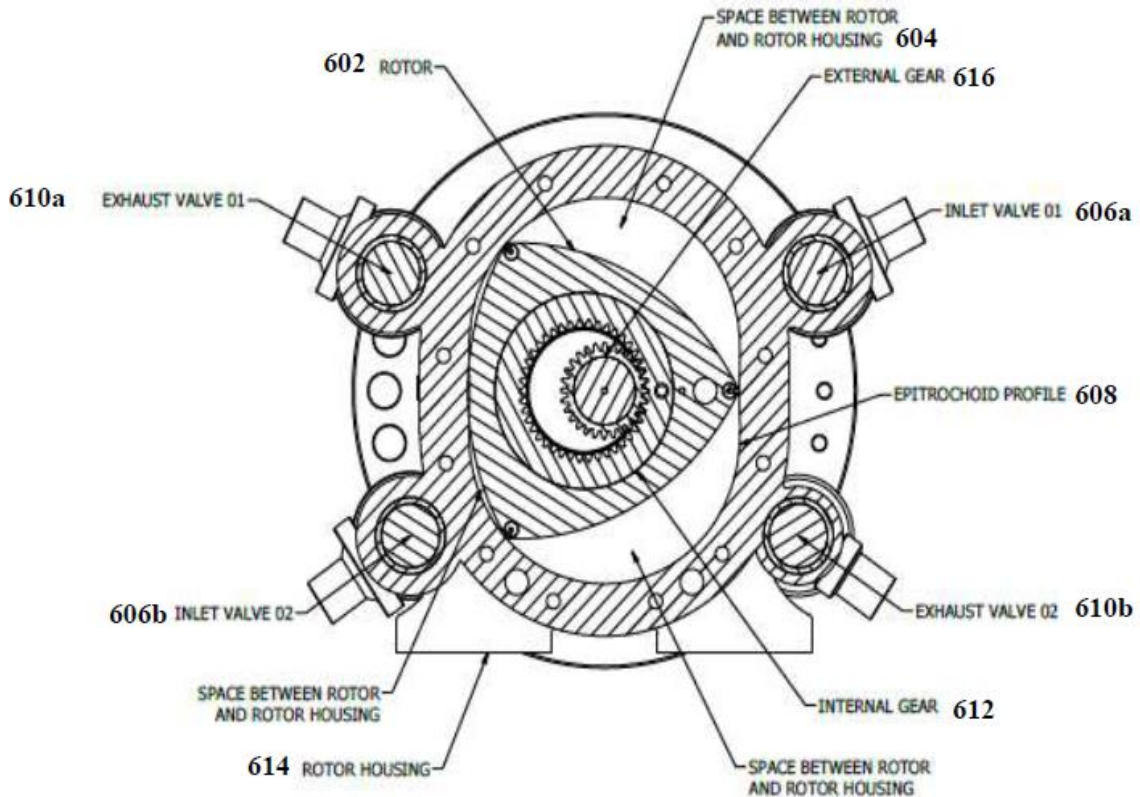


FIG.2. A cross section of wankel expander depicting different components.



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