A STRUCTURE FOR HEAT EXCHANGER AND VENTILATION APPLICATIONS

IITM Technology Available for Licensing

Problem Statement

- Generally, a **heat exchanger** is a device that transfer heat from one medium to another (i.e. fluid to fluid), and applicable in space heating, refrigeration/air conditioning, power stations, chemical plants, petrochemical plants/petroleum refineries, natural-gas processing, and sewage treatment, etc.
- Further, the heat exchangers are designed in such a manner for better performance but suffers due to induce **turbulence** other associated issues. Moreover, optimized heat exchangers are **complex** structure and **costlier** to manufacture including other factors.
- Prior art systems **fail in high thermal loads** within the limited space including other issues.
- Hence, it is a need to mitigate above challenges & provide **efficient solution.**

Technology Category/ Market

Technology: gyroid tube structure ;
Industry: Automotive, Clean Energy,
Applications: Waste management; ;
Market: The global heat exchangers market size is projected **$32.65B** at a **CAGR** of **6.53%** during period of 2023-**2030.**

Intellectual Property

IITM IDF Ref.:2278
Patent Application No. 202141058706

TRL (Technology Readiness Level)

TRL- 4, Proof of Concept, tested & validated

Research Lab

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Technology

- Present invention describes a **gyroid tube structure** for fluid-to-fluid heat exchange applications.
- Said structure consists of interconnected **unit cells arranged in three dimensions**.
- Each unit cell includes at least one **first channel** and at least **second channel**, separated by **a partition** wall structure.
- The partition wall structure is formed based on a **periodic curved surface**, specifically a **periodic minimal curved surface.**

FIG.1

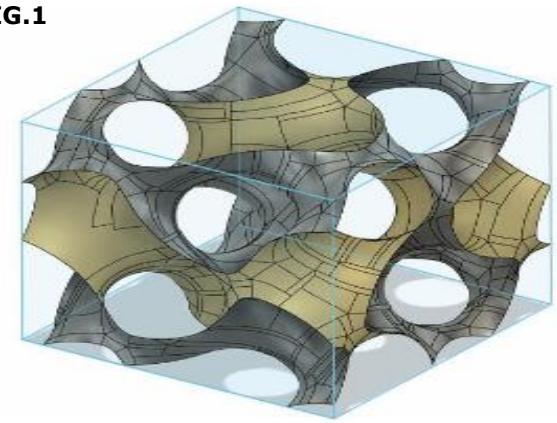

Fig.1: Illustrates a unit cell of the cylindrical structure;

- Multiple instances of the structure can be stacked to create a **heat exchanger** and **ventilation device**.
- First & second channels are perpendicular to each other, and the periodic minimal curved surface is **a triply periodic minimal curved surface.**
- Said Design allows for **efficient heat exchange** between **fluids flowing through the channels**.

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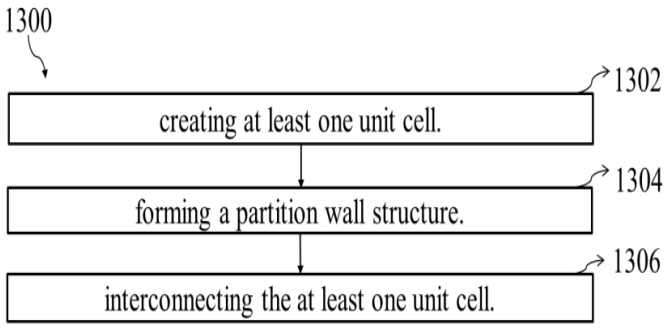
Images of Process for preparing Structure

Fig.4: Illustrates process for preparing a heat exchanger and ventilator structure



Key Features / Value Proposition

❖ *Technical Perspective:*

- Facilitates a **Gyroid tube structure**, specifically a **periodic minimal curved surface**, allowing for efficient fluid-to-fluid heat exchange.
- A triply periodic minimal curved surface (**TPMS**) is a surface created with the least amount of area while having a fixe boundary curve.
- The structure is in the form of a **cuboid** and/or **cylindrical shape** & is repeated and stacked one after another to **form** a **heat exchangers & ventilation device**.

❖ *Industrial Perspective:*

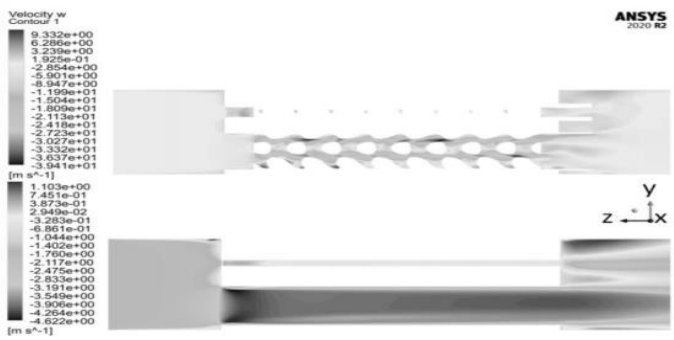
1. Provide a structure for a **heat exchanger & ventilation applications**.
2. Facilitates **higher heat transfer surface area**.
3. Facilitates **compact structure** including **lightweight**.
4. Provides **higher turbulence production**.

❖ *User Perspective:*

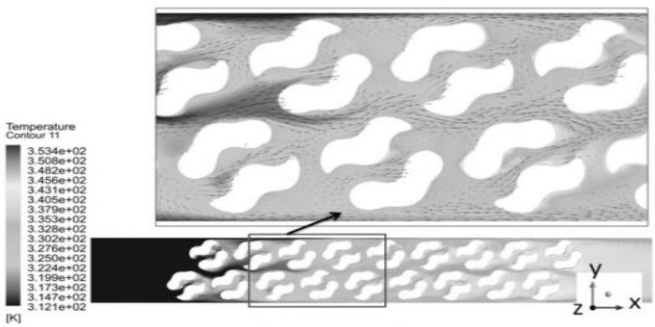
1. Ensures **more reliable & user-friendly apparatus for fluid –to-fluid heat transfer.**
2. **Induce internal mixing** within each fluid stream so that to promote **heat transfer.**

Experimental Results

Image of comparison of Z-velocity contours at a section of Cylindrical Gyroid tube and circular tube shown herein:



Temperature contours and Velocity vectors on cold side fluid flow of Cylindrical Gyroid tubes and magnified view shown herein:



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