INTRUDED CURVED NECK COMPACT HELMHOLTZ RESONATOR

IITM Technology Available for Licensing

PROBLEM STATEMENT

- Generally, a **Helmholtz resonator** is a **closed cavity** with minimum **one opening**.
- The opening may be as **short** as the **thickness** of the cavity wall or **long enough, called the neck**, to adjoin the cavity.
- A Helmholtz resonator is **described by the resonant frequency**, and it is associated with **four** geometric parameters; **cavity height, cavity diameter, neck length, and neck diameter.**
- Cavity dimensions and the neck length have an **inverse** relationship in the resonance frequency calculation, whereas **the neck diameter** has a **direct** relationship.
- There is a need to provide a method for compact resonator that overcomes the problems.

TECHNOLOGY CATEGORY/ MARKET

Category: Assistive, Test Equipment and Design Manufacturing

Industry: Building,Automobile,music industry

Application: In rooms, acoustic devices ,musical instruments.

Market: The global market size was valued at US$ 31717.46 million in 2022 and is expected to expand at a CAGR of 12.25% reaching US$ 63464.41 million by 2031.

INTELLECTUAL PROPERTY

IITM IDF Ref. 2478; Patent No:IN 533420;

TRL (Technology Readiness Level)

TRL-4, Experimentally validated in Lab;

Research Lab

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TECHNOLOGY

- The instant invention [Intruded bend neck in the Helmholtz resonator] **aiming to reduce the resonant frequency while maintaining the overall size unchanged.**

- A Helmholtz Resonator comprises of
  - ✓ **Resonator cavity**
  - ✓ **Intruded curved neck**

The **curved neck** is with at least **one bend,** which can be of various shapes, including **spiral**.

The **intruded bend neck allows for a longer neck within the** cavity, enabling tuning to **lower** frequencies **without altering the resonator's size**.

An array of identical resonators can be tuned to different frequencies across a band, enhancing absorption capability at low frequencies.

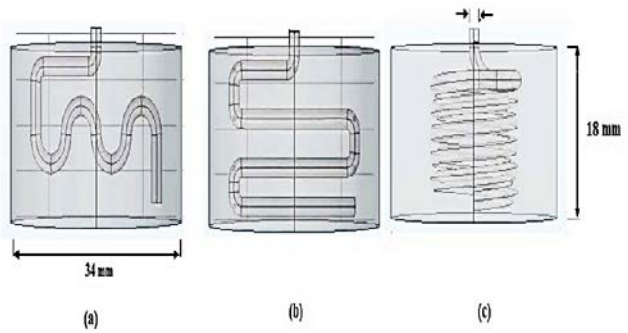

Figure 1 shows Helmholtz Resonators with the intruded curved neck of different dimensions and shapes.

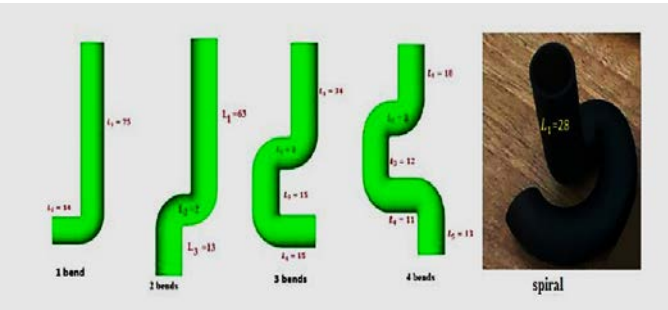

Figure 2 shows different shapes of the neck with bends.

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The spiral neck accommodates even a longer neck compared to a neck containing bends. Therefore, depending on the requirement, a resonator can be tuned to a low-frequency region

Ascertaining equivalent straight neck length for the curved neck Helmholtz Resonator, where the curved part of the neck is converted into an equivalent straight length

using the formula ($l = r \times \theta$) wherein r is the radius measured from the Centre, θ is the angle

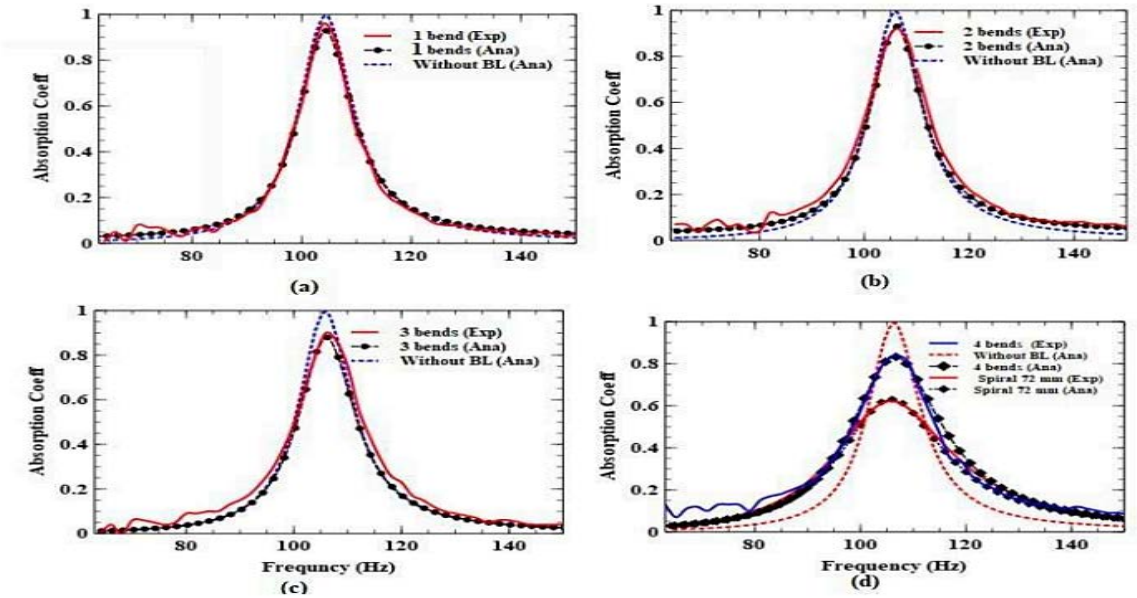

Figure 3 shows absorption curves for various necks.

Key Features / Value Proposition

- This model of resonator were **sketched as per ISO 10534 220 standards.**
- The resonator were fabricated using **a 3D Printer.**
- The material used is **Acrylonitrile-butadiene-styrene (ABS) plastic.**
- The mouth of the resonator is excited with a harmonically varying normal velocity input of **magnitude 1 mm/s** and the resulting pressure is measured on the mouth's surface.
- In this type of resonator, the neck has a constant cross-section throughout its length.
- **Light in weight & less cost** compared to other model of Helmholtz resonators.
- J,C,U are the available shapes in this model.
- Application in **building and room acoustics, the automobile industry, the space Industry, transportation, the music industry** etc.

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