MAGNETO-ELECTRIC BASED MAGNETIC SENSOR AND METHOD THEREOF

IITM Technology Available for Licensing

Problem Statement

- Existing magnetic sensors are layered structures using epoxy bonding are limited in their ability to **sense magnetic fields only within their own plane**, and **epoxy properties degrade significantly at temperatures beyond 50°C.**

The present patent application aims to address these limitations by developing a **reliable and efficient magnetic sensor** that eliminates the issues associated with the traditional magneto-strictive materials.

Technology Category/ Market

Categories: Applied Mechanics & Mechanical Engineering | Electronics & Circuits

Technologies: Magnetoelectric (ME) & Sensor Technology, Transportation, Security, Industrial Manufacturing, Automation, R&D, Energy & Power Aerospace & Defense, Environmental Monitoring.

Application: providing epoxy-free magnetic sensors for elevated temperature detection, enabling multi-directional magnetic field sensing, enhancing output voltage, eliminating epoxy bonding, and extending the sensing range.

Market: The global magnetic sensor market was valued at **USD 4.43 billion in 2021** and is expected to reach **USD 8.02 Billion by 2030,** growing at **7.5% CAGR from 2022 – 2030.**

Technology

The present patent discloses **magneto-electric based magnetic sensor**. This technology is a **press-fit magnetic sensor** with a multi-directional detection capability, designed for reliable operation at **elevated temperatures**.

It eliminates the use of **epoxy bonding, ensuring high-temperature stability,** and offers customization options for industrial use.

The present patent discloses **methods of:**

1. ***Fabrication of Press-Fit Magnetic Sensor***
2. ***Detection of Magnetic Fields.***

Research Lab

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Key Features / Value Proposition

❖ ***User Perspective:***

- **Reliable in High Temperatures**: Users benefit from the sensor's high-temperature reliability.
- Versatile multi-directional magnetic field detection suits various applications.
- **Extended Range**: The extended sensing range is valuable for distant magnetic field detection.

❖ ***Technology Perspective:***

- **Epoxy-Free Design:** Epoxy-free design simplifies manufacturing and enhances longevity.
- Press-fit technology improves sensor robustness.
- **Customizable Dimensions:** Option of Flexible customization to adapt with various industry needs.

❖ ***Industrial Perspective:***

- **Improved Automation:** Enhanced reliability aids manufacturing and automation.
- **Cost Efficiency**
- Industries benefit from extended usability in elevated temperatures and longer distances.

Intellectual Property

IITM IDF Number: 2257
IN Patent number: 411667 (granted)

TRL (Technology Readiness Level)

TRL – 3; Proof of Concept

Images

FIG. 1 depicts an ME based press-fit magnetic sensor, in accordance with an embodiment;

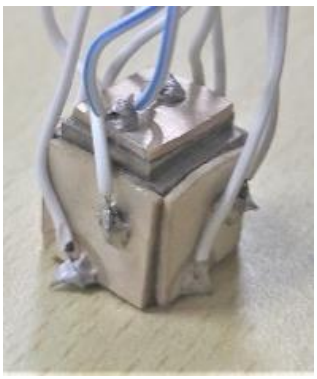

FIG. 2 depicts an exemplary conventional layered magnetic sensor

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Methods Disclosed in the Invention

❖ *Fabrication of Press-Fit Magnetic Sensor:*

1. •Sensor Structure Creation: Form a sensor structure with multiple faces using a magnetostrictive material, which can be shaped into various forms like cuboids or prisms.
2. •Slot Machining: Machine at least one slot in each face of the sensor structure to accommodate piezoelectric discs.
3. •Piezoelectric Disc Fitting: Fit at least one piezoelectric disc into each slot of the sensor structure to enable the detection of magnetic fields from different directions.
4. •Optional Auxiliary Top Plate: Fabricate an auxiliary top plate from the same magnetostrictive material and attach it to the sensor structure to create an additional face for enhanced sensor performance.
5. •Additionally, measure the direction and angle of the magnetic field by separately analyzing the output voltage generated by each piezoelectric disc (Soldering Wires: Solder wires to the positive and negative electrodes of the piezoelectric disc to facilitate the extraction of voltages generated during magnetic field detection.)

❖ *Detection of Magnetic Fields:*

1. •Sensor Placement: Place the press-fit magnetic sensor (100) in a location with at least one magnetic field source to be detected.
2. •Voltage Generation: As the sensor detects magnetic fields, one or more voltages are generated by the piezoelectric discs (108) within the sensor.
3. •Signal Transmission: Transmit the generated output voltages as signals through the soldered wires to an external system for further analysis.
4. •Analysis and Measurement: Analyze the generated output voltages to detect the presence of at least one magnetic field.
5. •Additionally, measure the direction and angle of the magnetic field by separately analyzing the output voltage generated by each piezoelectric disc (108).

FIG. 3 depicts an experimental setup for testing the ME based press-fit 30 magnetic sensor

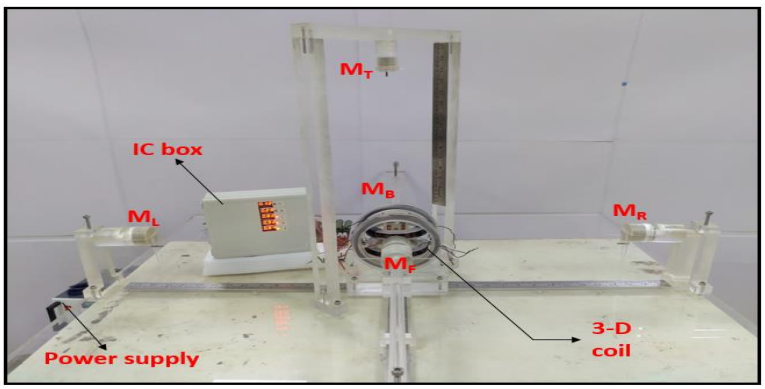
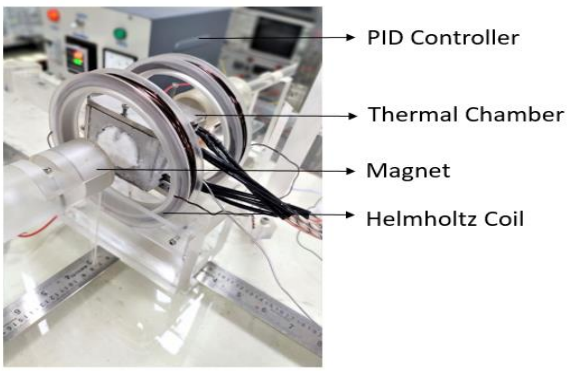


FIG. 4 shows an experimental setup for testing the proposed thermally stable press-fit magnetic sensor



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