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Ferran

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(54) **METHOD AND APPARATUS FOR DAMPING DIAPHRAGM VIBRATION IN CAPACITANCE DIAPHRAGM GAUGES**

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,667,786	A	2/1954	Spaulding
4,823,603	A	4/1989	Ferran et al.
5,396,803	A	3/1995	Ferran
5,515,711	A	5/1996	Hinkle
6,734,659	B1	5/2004	Fortner
6,837,112	B2	1/2005	Ferran et al.
7,308,830	B2	12/2007	Harasyn et al.
2010/0198545	A1	8/2010	Berg et al.
2011/0056302	A1	3/2011	Lutz
2011/0239773	A1	10/2011	Koslinski et al.
2011/0271764	A1	11/2011	Lee
2013/0233086	A1	9/2013	Besling et al.

OTHER PUBLICATIONS

Thomas, Shane, Authorized Officer, Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, May 27, 2014, (1 page), with International Search Report (2 pages) and Written Opinion of the International Searching Authority (6 pages), 9 pages total.

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(57) **ABSTRACT**

A system and method mitigate the effects of these external vibrations on a capacitance diaphragm gauge by sensing the motion of the diaphragm at the first natural frequency of the diaphragm of the CDG. The presence of the natural frequency signals superimposed on the pressure signal is determined by sensing variations in the output of a sensor at or near the known natural frequency of the diaphragm and filtering that known low frequency from the output. The filtered signal is used in a feedback circuit to impose electrostatic forces on the diaphragm. The imposed electrostatic forces oppose the motion created by the external vibration to suppress the effects of the vibration on the pressure measured by the CDG.

3 Claims, 3 Drawing Sheets

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G01L 23/125; G01L 27/005

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See application file for complete search history.

