

EXHIBIT 7

- [54] **CORIOLIS MASS FLOW RATE METER HAVING A SUBSTANTIALLY INCREASED NOISE IMMUNITY**
- [75] Inventor: **Paul Romano, Boulder, Colo.**
- [73] Assignee: **Micro Motion, Inc., Boulder, Colo.**
- [21] Appl. No.: **361,000**
- [22] Filed: **Jun. 2, 1989**
- [51] Int. Cl.⁵ **G01F 1/84**
- [52] U.S. Cl. **73/861.38; 364/510**
- [58] Field of Search **73/861.37, 861.38, 510**

References Cited

U.S. PATENT DOCUMENTS

Re. 31,450	11/1983	Smith	73/861.38
Re. 31,971	8/1985	Gold	73/462
2,635,462	4/1953	Poole et al.	73/32
3,456,491	7/1969	Brockhaus	73/32
3,527,103	9/1970	Hale et al.	73/462
4,093,988	6/1978	Scott	364/484
4,127,028	11/1978	Cox et al.	73/194
4,192,184	3/1980	Cox et al.	73/194
4,252,028	2/1981	Smith et al.	73/861.38
4,311,054	1/1982	Cox et al.	73/861.38
4,422,338	12/1983	Smith	73/861.38
4,445,389	1/1984	Potzick et al.	73/861.27
4,450,529	5/1984	Hill et al.	364/508
4,491,025	1/1985	Smith	73/861.38
4,660,421	4/1987	Dahlin et al.	73/861.38

FOREIGN PATENT DOCUMENTS

WO88/01205 3/1988 PCT Int'l Appl.

OTHER PUBLICATIONS

W. Steffen et al, "Direct Mass Flow Metering in Partic-

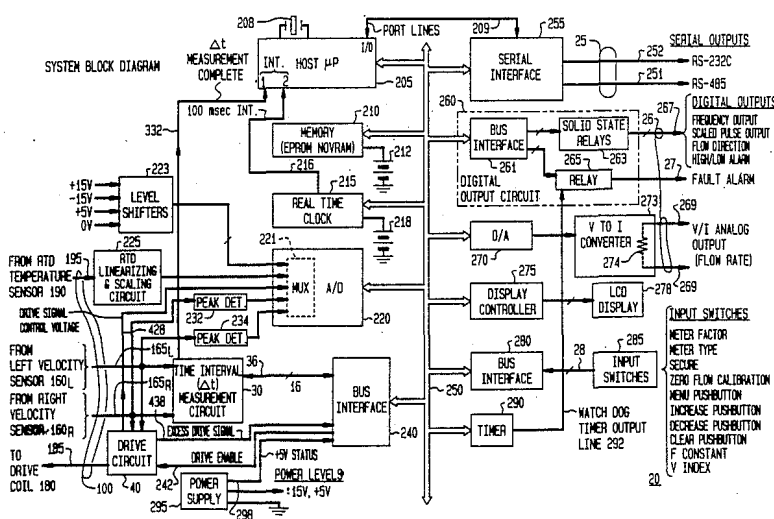
ular by Means of Coriolis Methods", OIM Seminar, Arles, France, May 11-15, 1987, pp. 1-24.

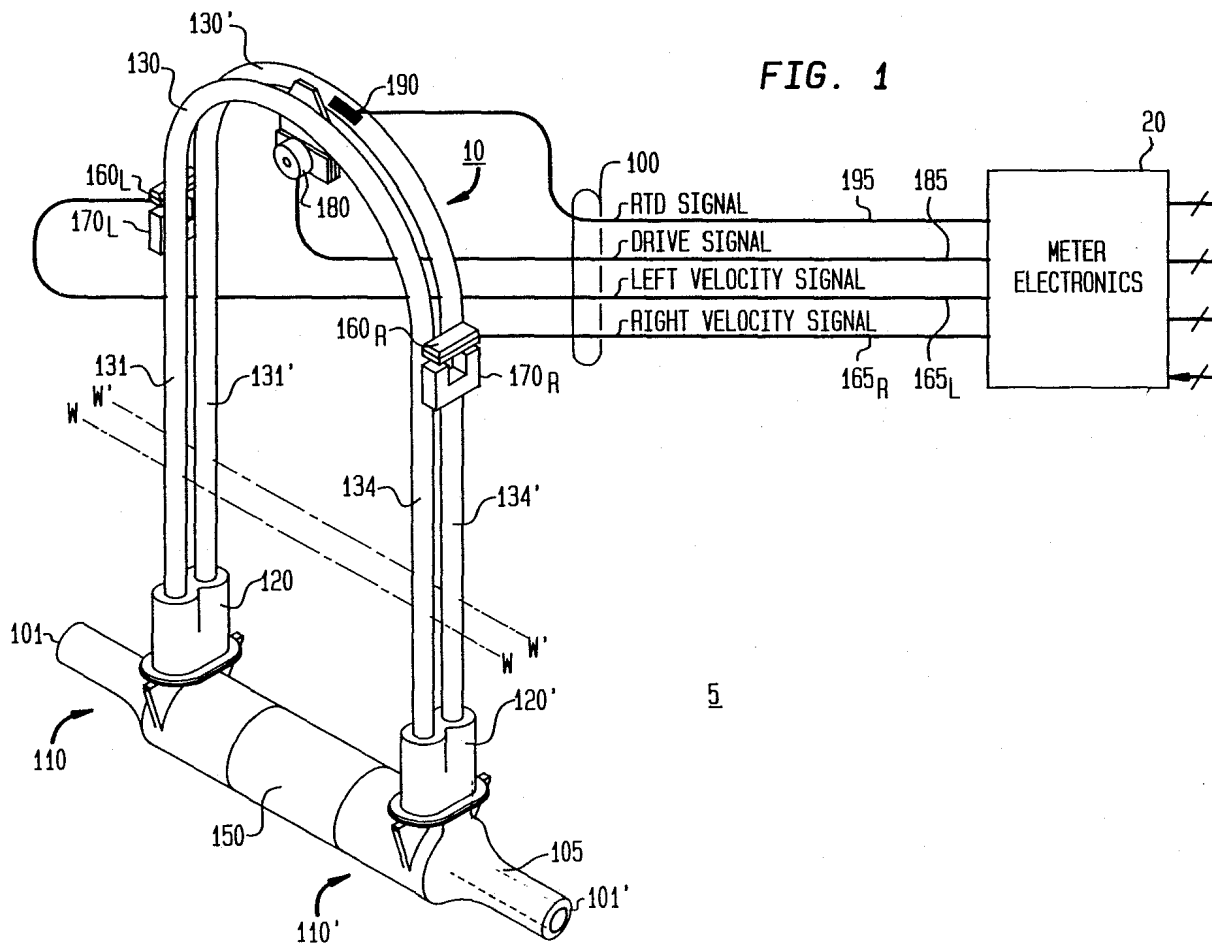
Primary Examiner—Herbert Goldstein
Attorney, Agent, or Firm—Peter L. Michaelson

[57] ABSTRACT

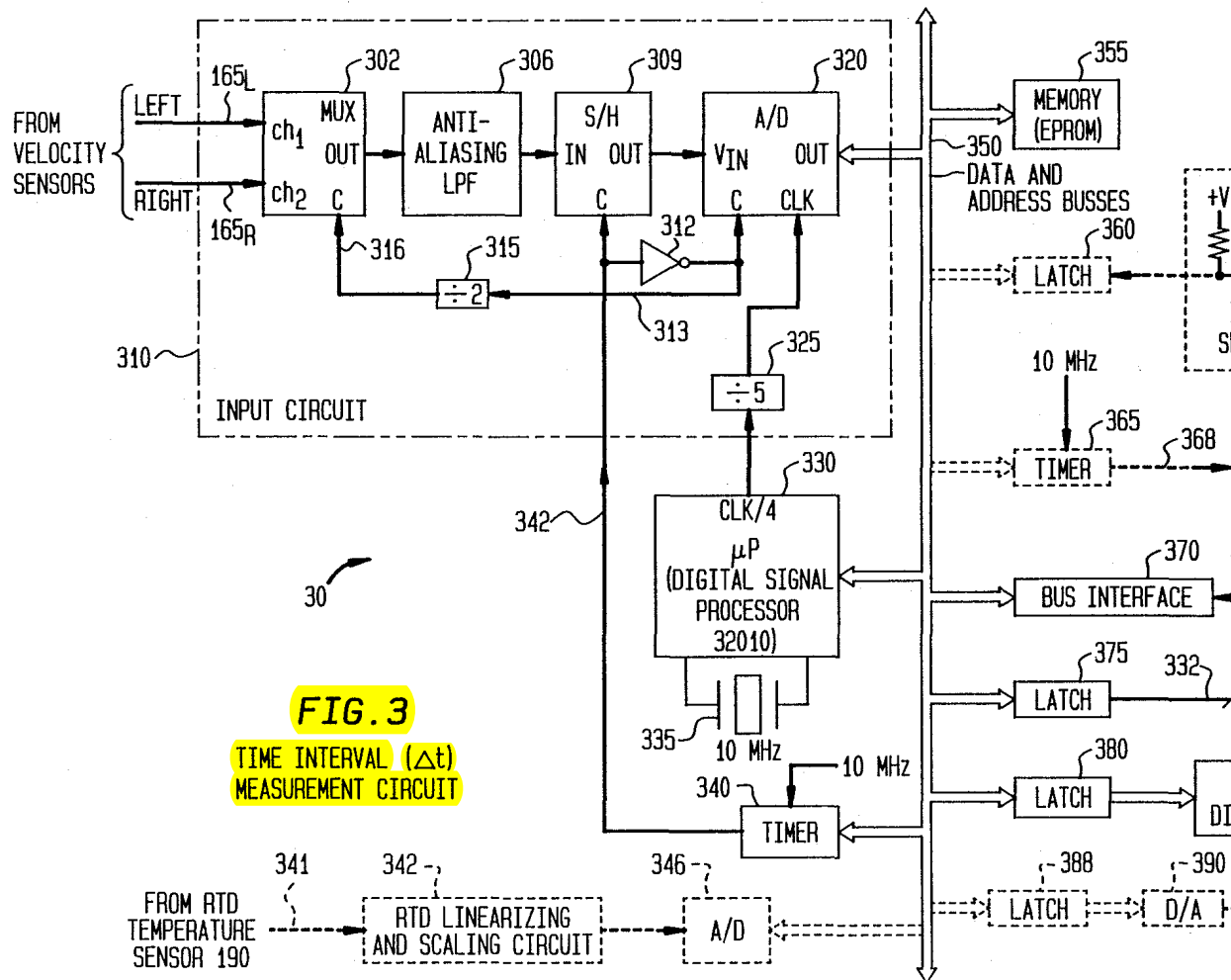
Apparatus and accompanying methods for use therein for a Coriolis mass flow rate meter which is substantially immune to noise, and more particularly, to such a meter that is substantially unaffected by noise that occurs at substantially any frequency different from a fundamental frequency at which the flow tube(s) in the meter vibrate. Specifically, the meter relies on measuring mass flow rate by determining the phase difference that occurs between real and imaginary components of the discrete fourier transform (DFT) of both the left and right velocity sensor waveforms evaluated at the fundamental frequency at which the flow tubes vibrate. The fundamental frequency is located, during an initialization operation, by providing a power spectrum, determined through use of the DFT, of one of the sensor signals and then selecting that frequency at which the magnitude of the power spectrum reaches a maximum value. In addition, the frequency at which both velocity sensor signals is sampled is readjusted in response to any change in the phase of one of the velocity sensor signals, as transformed using the DFT, in order to assure that the sampling frequency always remains substantially equal to a pre-defined integer multiple of the fundamental frequency. Furthermore, the meter, through use of the numerical value of any such phase change, also provides a density indication which is also substantially immune to such noise.

39 Claims, 35 Drawing Sheets





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