US005856722A

United States Patent [19]

Haronian et al.

[11] **Patent Number: 5,856,722**

[45] **Date of Patent: Jan. 5, 1999**

[54] **MICROELECTROMECHANICS-BASED FREQUENCY SIGNATURE SENSOR**

[75] Inventors: **Dan Haronian**, Efrat, Israel; **Noel C. MacDonald**, Ithaca, N.Y.

[73] Assignee: **Cornell Research Foundation, Inc.**, Ithaca, N.Y.

[21] Appl. No.: **771,681**

[22] Filed: **Dec. 23, 1996**

Related U.S. Application Data

[60] Provisional application No. 60/009,553 Jan. 2, 1996.

[51] **Int. Cl.**[6] **H01L 41/08**

[52] **U.S. Cl.** **310/321**; 310/331; 310/309

[58] **Field of Search** 310/311, 312, 310/321, 322, 329–332, 309

[56] **References Cited**

U.S. PATENT DOCUMENTS

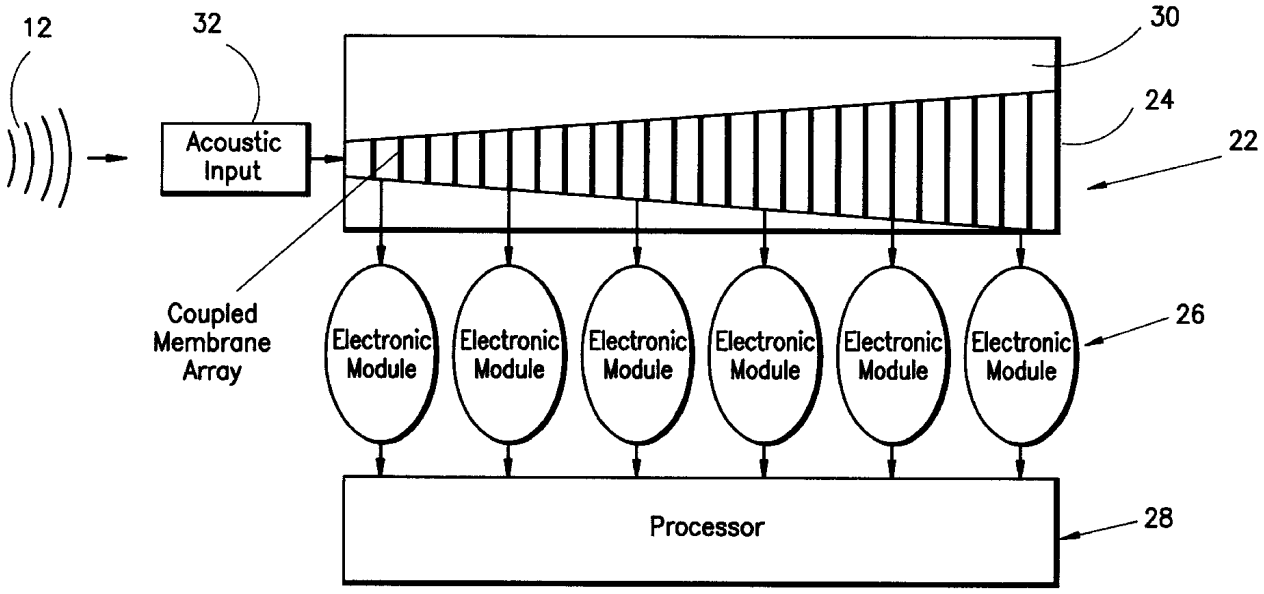
1,806,871	5/1931	Bower	310/321 X
2,769,867	11/1956	Crownover et al.	310/331 X
3,336,529	8/1967	Tygart	310/331
3,457,463	7/1969	Balamuth	310/330 X
3,566,166	2/1971	Borner	310/321
3,634,787	1/1972	Newell	310/330
3,686,593	8/1972	Zakaria	310/331 X
4,012,648	3/1977	Engdahl	310/332 X
4,517,486	5/1985	Andrews	310/331
4,711,128	12/1987	Boura	73/517 B
4,736,629	4/1988	Cole	73/517 R
4,764,244	8/1988	Chitty et al.	156/630
5,023,503	6/1991	Legge et al.	310/311
5,049,775	9/1991	Smits	310/328
5,072,288	12/1991	MacDonald et al.	437/203
5,162,691	11/1992	Mariani et al.	310/321
5,175,521	12/1992	Larson	333/235
5,179,499	1/1993	MacDonald et al.	361/313
5,198,390	3/1993	MacDonald et al.	437/390
5,235,187	8/1993	Arney et al.	250/306
5,245,245	9/1993	Goldenberg	310/330
5,316,979	5/1994	MacDonald et al.	437/203
5,393,375	2/1995	MacDonald et al.	156/643
5,399,415	3/1995	Chen et al.	428/209
5,515,725	5/1996	Tabota et al.	310/321 X
5,563,343	10/1996	Shaw et al.	73/514.18
5,610,335	3/1997	Shaw et al.	73/514.36

OTHER PUBLICATIONS

"Micro Electromechanical Filters for Signal Processing" Lin, et al.; Feb. 1992; pp. 226–231.

Primary Examiner—Mark O. Budd
Attorney, Agent, or Firm—Jones, Tullar & Cooper, PC

[57] **ABSTRACT**

An acoustic filter array of microelectromechanical beams each having a characteristic resonance frequency response to mechanical and/or acoustical vibration. The array divides incoming acoustic signals into a plurality of discrete spectral components, each of which may be separately detected and converted into corresponding electrical signals. The acoustic filter may be integrated onto a single crystal silicon substrate with electrical circuity for performing acoustic signal processing functions required for applications such as speech processing and simulating the physiological function of the ear.

27 Claims, 10 Drawing Sheets