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Kolosov et al.

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- (54) **MECHANICAL RESONATOR** 3,926,271 A 12/1975 Patashinck
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- Leonid Matsiev**, San Jose, CA (US); 4,145,922 A 3/1979 Estrada, Jr. et al.
- David Padowitz**, Mountain View, CA 4,282,499 A * 8/1981 DeFonzo 333/231
 (US) 4,302,694 A 11/1981 Fujishima et al.
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 CA (US) 4,342,936 A 8/1982 Marcus et al.

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FOREIGN PATENT DOCUMENTS

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OTHER PUBLICATIONS

Related U.S. Application Data
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Fisch, M.R., et al., "Improved Acoustic Viscosimeter Technique", J. Acoust. Soc. Am., Sep. 1976, pp. 623-625, v. 60, No. 3.

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- (51) **Int. Cl.**
G01N 29/036 (2006.01)
G01N 9/10 (2006.01)
- (52) **U.S. Cl.** **73/24.06**; 73/31.06
- (58) **Field of Classification Search** None
See application file for complete search history.

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(57) **ABSTRACT**

(56) **References Cited**
U.S. PATENT DOCUMENTS

- 3,273,377 A 9/1966 Testerman et al.
- 3,622,968 A 11/1971 Silverman
- 3,710,275 A 1/1973 Tanaka et al.
- 3,718,032 A 2/1973 Gray
- 3,762,197 A 10/1973 Roof et al.
- 3,778,757 A 12/1973 Houston
- 3,902,365 A 9/1975 Knauth
- 3,903,732 A 9/1975 Rork et al.
- 3,921,622 A 11/1975 Cole

A sensor and methods for making and using the same in which a mechanical resonator is employed, comprising a resonator portion for resonating in a fluid without the substantial generation of acoustic waves; and an electrical connection between the resonator portion for oscillating and a source of an input signal; wherein the portion for resonating, the electrical connection or both includes a base material and a performance-tuning material that is different from the base material.

26 Claims, 7 Drawing Sheets

