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**Panasik**

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(54) **MULTIPLE FREQUENCY ACOUSTIC REFLECTOR ARRAY AND MONOLITHIC COVER FOR RESONATORS AND METHOD**

(75) Inventor: **Carl M. Panasik**, Garland, TX (US)

(73) Assignee: **Texas Instruments Incorporated**,  
Dallas, TX (US)

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(58) Field of Search ..... **333/186-192; 310/311, 312, 321, 324; 29/23.35**

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,568,108 A	*	3/1971	Poirier et al.	333/187
4,166,967 A	*	9/1979	Benes et al.	310/338
4,348,075 A		9/1982	Gottlieb et al.	350/96.13
4,395,702 A		7/1983	Gottlieb et al.	340/347
4,502,932 A		3/1985	Kline et al.	204/192
4,556,812 A		12/1985	Kline et al.	310/324
4,785,269 A		11/1988	Adam et al.	333/188
4,988,957 A		1/1991	Thompson et al.	331/107
5,075,641 A		12/1991	Weber et al.	331/108
5,166,646 A		11/1992	Avanic et al.	331/107
5,233,259 A		8/1993	Krishnaswamy et al.	310/324

5,294,898 A	3/1994	Dworsky et al.	333/187
5,337,185 A	8/1994	Meier et al.	359/321
5,361,077 A	11/1994	Weber	343/846
5,367,308 A	11/1994	Weber	343/700
5,373,268 A	12/1994	Dworsky et al.	333/187
5,821,833 A	10/1998	Lakin	333/187
5,872,493 A	* 2/1999	Ella	333/191
5,873,154 A	* 2/1999	Ylilammi et al.	29/25.35
5,932,953 A	8/1999	Drees et al.	310/324
6,087,198 A	* 7/2000	Panasik	438/51
6,107,721 A	* 8/2000	Lakin	310/321

**OTHER PUBLICATIONS**

U.S. patent application Ser. No. 09/022,905 entitled "Low Cost Packaging for Thin-Film Resonators and Thin-Film Resonator-Based Filters", Feb. 12, 1998.

\* cited by examiner

*Primary Examiner*—Robert Pascal

*Assistant Examiner*—Barbara Summons

(74) *Attorney, Agent, or Firm*—Pedro P. Hernandez; W. James Brady, III; Frederick J. Telecky, Jr.

(57) **ABSTRACT**

A radio frequency filter system includes a first acoustic resonator (54, 56) for a first frequency and a second acoustic resonator (54, 56) for a second frequency. An acoustic reflector array (102, 152, 202) is coupled to an electrode of the first acoustic resonator (54, 56) and to an electrode of the second acoustic resonator (54, 56). The acoustic reflector array (102, 152, 202) includes a plurality of reflector layers (112, 152, 210). A first reflector layer (112, 152, 210) is operable to reflect a signal at substantially the first frequency. A second reflector layer (112, 152, 210) is operable to reflect a signal at substantially the second frequency.

**21 Claims, 3 Drawing Sheets**

