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# United States Patent [19]

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**Koen**

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## [54] VERTICALLY MOUNTED ACCELEROMETER CHIP

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[73] Assignee: IC Sensors, Inc., Milpitas, Calif.

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[22] Filed: Feb. 1, 1994

[51] Int. Cl.<sup>6</sup> ..... G01P 1/02

[52] U.S. Cl. .... 73/493

[58] Field of Search ..... 73/493, 431, 777, 73/756, 866.5, 204.22, 856; 174/260

### [56] References Cited

#### U.S. PATENT DOCUMENTS

4,700,973	10/1987	Gademann	73/493
5,012,316	3/1991	Silvermint	257/417
5,043,791	8/1991	Stokes et al.	357/70
5,044,201	9/1991	Farace et al.	73/503
5,060,504	10/1991	White et al.	73/1 D
5,109,341	4/1992	Blackburn et al.	180/274
5,163,325	11/1992	White et al.	73/517 R
5,221,400	6/1993	Staller et al.	156/292
5,233,871	8/1993	Schwarz et al.	73/493
5,233,873	8/1993	Mozgowiec	73/493
5,233,874	8/1993	Putty et al.	73/517 AV
5,241,861	9/1993	Hulsing, II	73/505
5,249,465	10/1993	Bennett et al.	73/510
5,261,694	11/1993	White et al.	280/735
5,269,187	12/1993	Hanson	73/495
5,394,326	2/1995	Liu	364/424.05

#### FOREIGN PATENT DOCUMENTS

0557917A1 9/1993 European Pat. Off. .

2720484A1	11/1977	Germany .
60-12750	1/1985	Japan .
63-90774	4/1988	Japan .
WO91/11722	8/1991	WIPO .

### OTHER PUBLICATIONS

"NEC's Automotive Electronic Control Modules", NEC, sales brochure, date unknown.

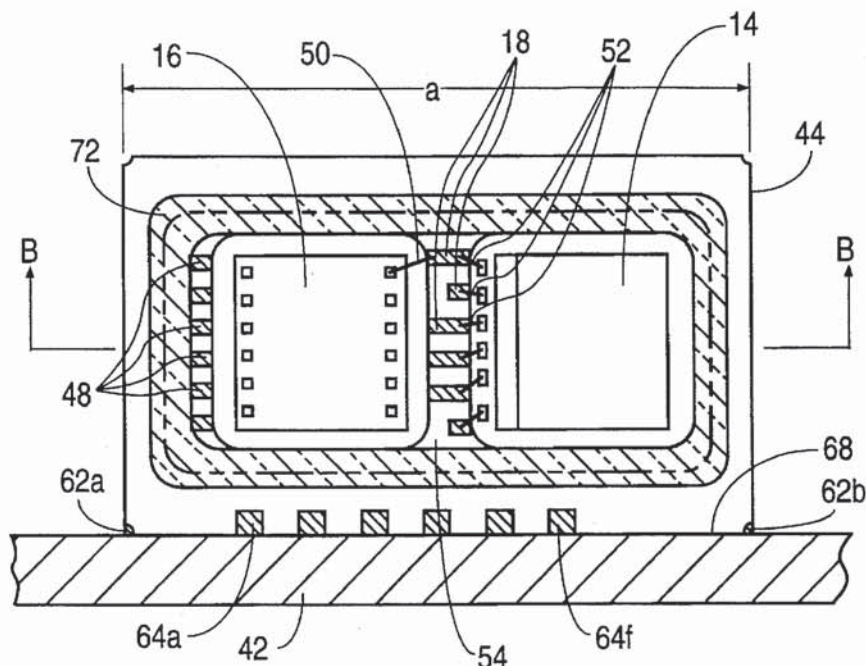
"Airbags Boom When IC Accelerometer Sees 50 G", by Frank Goodenough, *Electronic Design*, Aug. 8, 1991.

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### [57] ABSTRACT

Micro-machined accelerometer chips have a sensitive axis perpendicular to the principle surface of the device. In an application where the desired sensing direction is in the plane of a supporting printed circuit board, the accelerometer cannot be mounted directly on the printed circuit board and instead is mounted on a wall perpendicular to the printed circuit board. This requirement to wall-mount the sensor is eliminated by using an accelerometer chip packaged with a signal conditioning circuit in a multi layer ceramic chip carrier. Electrical connections are contained within the layers of the ceramic and terminate at a side surface of the chip carrier. Thus the accelerometer chip sits perpendicular to the printed circuit board and the ceramic chip carrier is attached directly thereto.

18 Claims, 4 Drawing Sheets



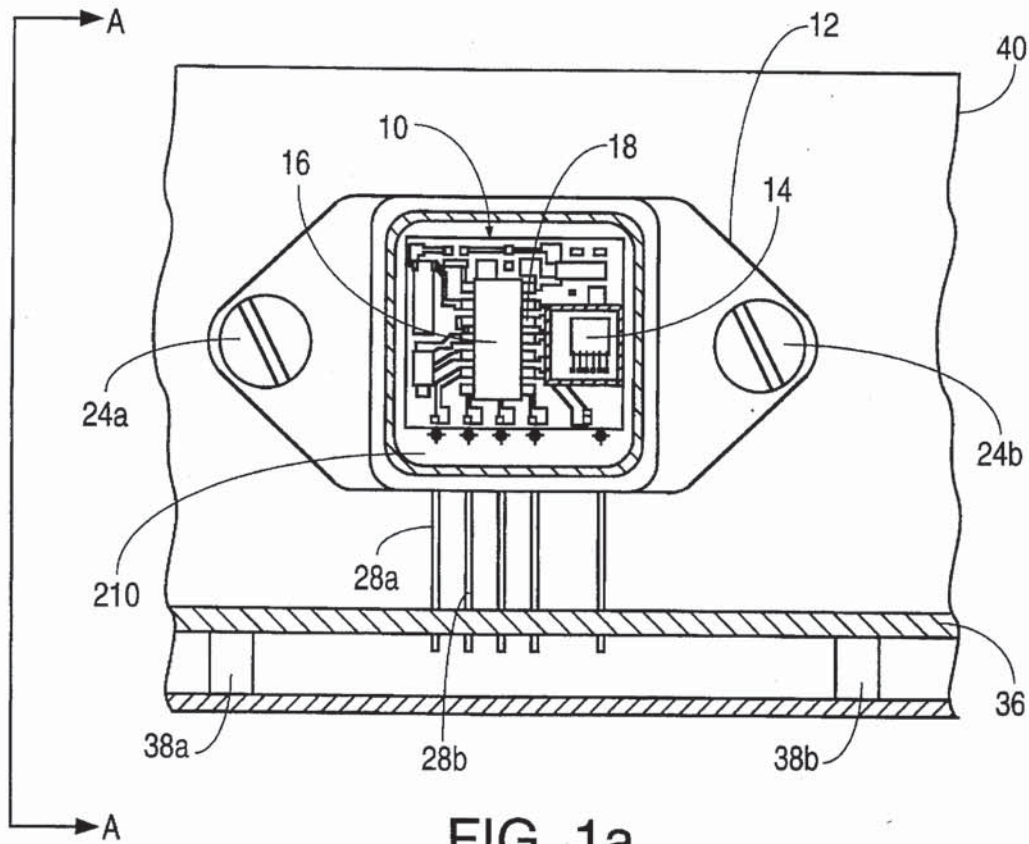


FIG. 1a  
(Prior Art)

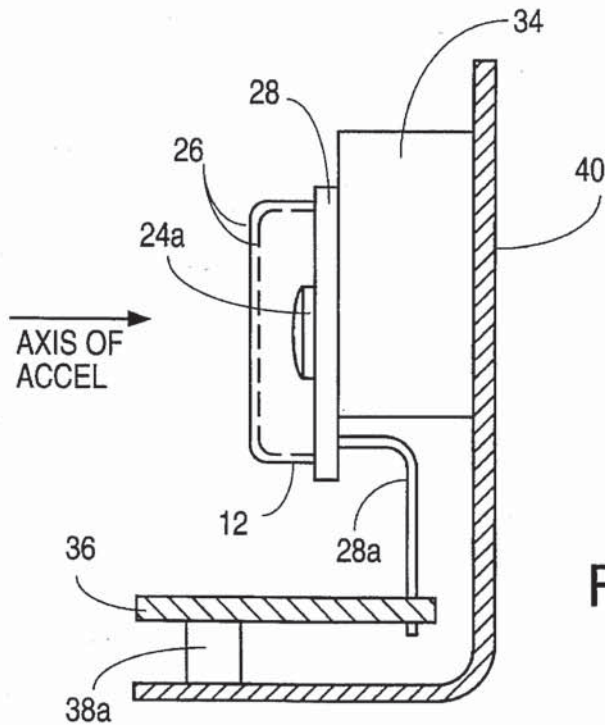


FIG. 1b  
(Prior Art)

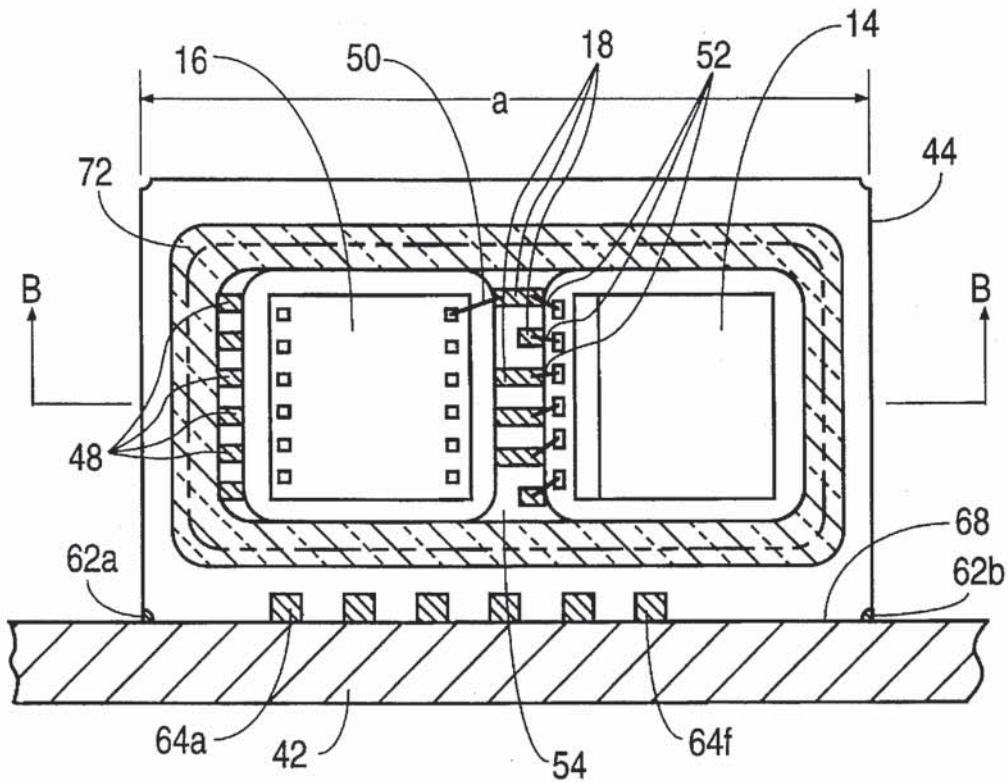


FIG. 2a

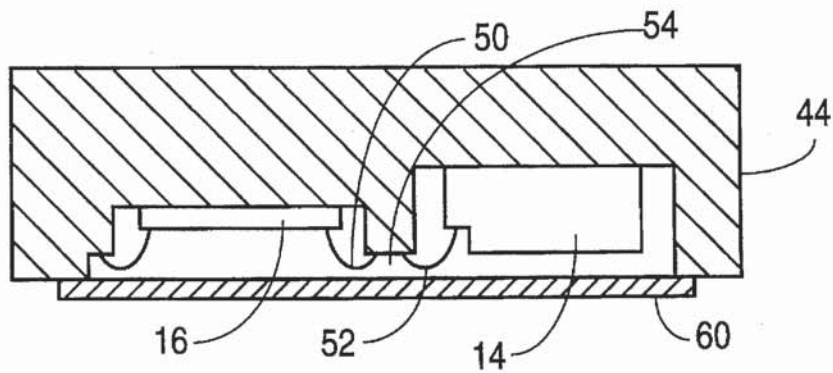


FIG. 2b

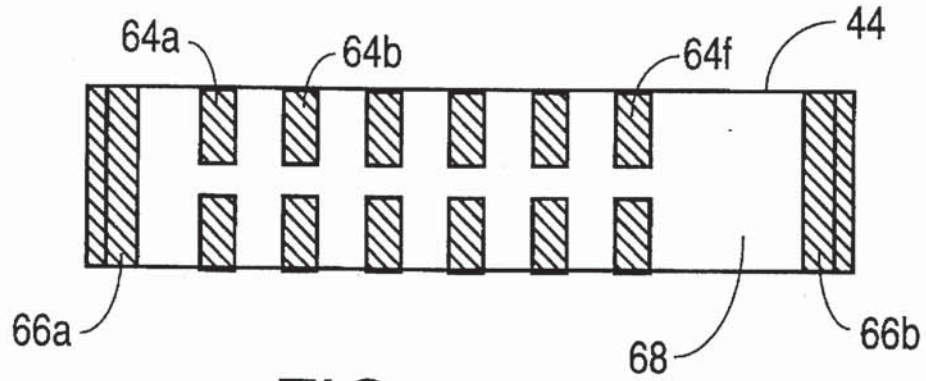


FIG. 2c

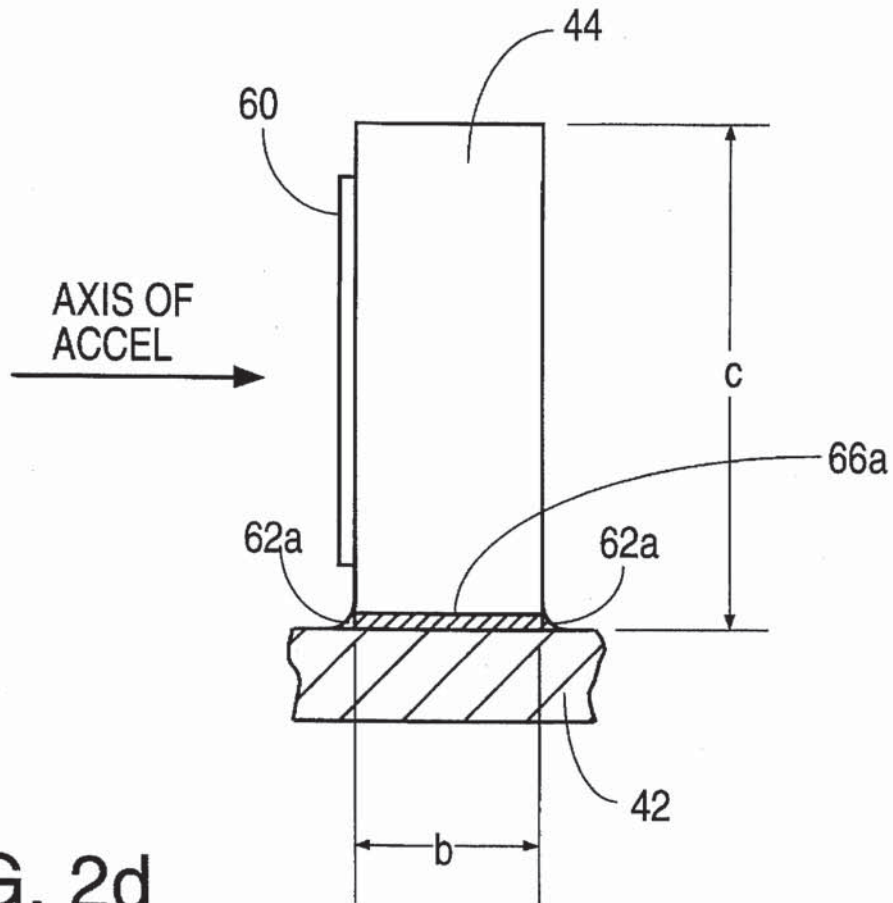


FIG. 2d

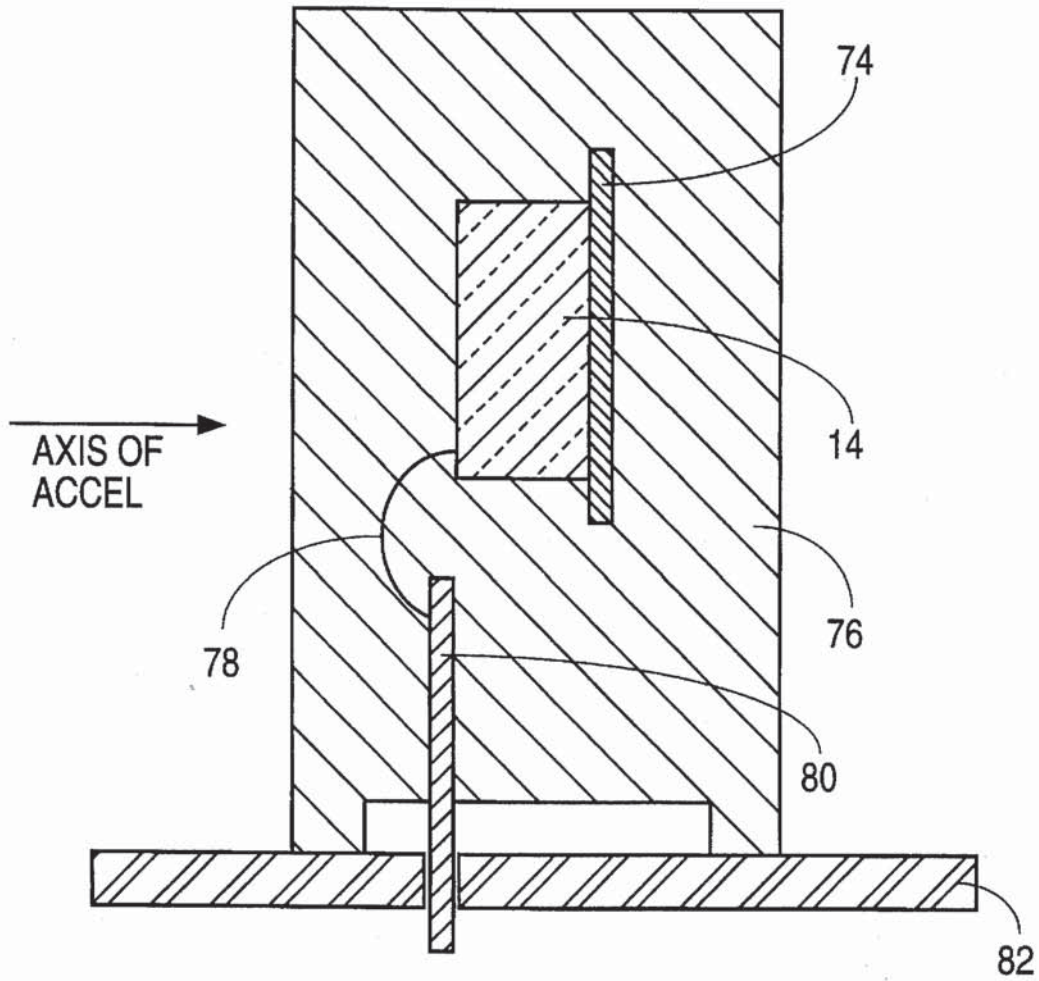


FIG. 3

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