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# United States Patent [19]

[11] **Patent Number:** **5,503,016**

**Koen**

[45] **Date of Patent:** **Apr. 2, 1996**

## [54] VERTICALLY MOUNTED ACCELEROMETER CHIP

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WO91/11722	8/1991	WIPO .

[75] Inventor: **Edward F. Koen**, Danville, Calif.

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

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[21] Appl. No.: **189,948**

“NEC’s Automative Electronic Control Modules”, *NEC*, sales brochure, date unknown.

[22] Filed: **Feb. 1, 1994**

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

[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

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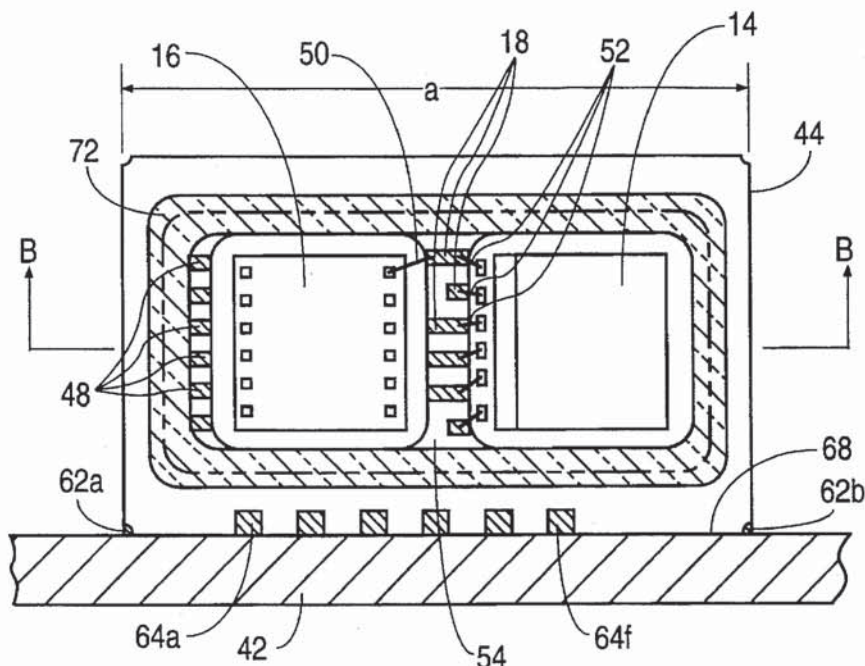
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### [57] ABSTRACT

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**



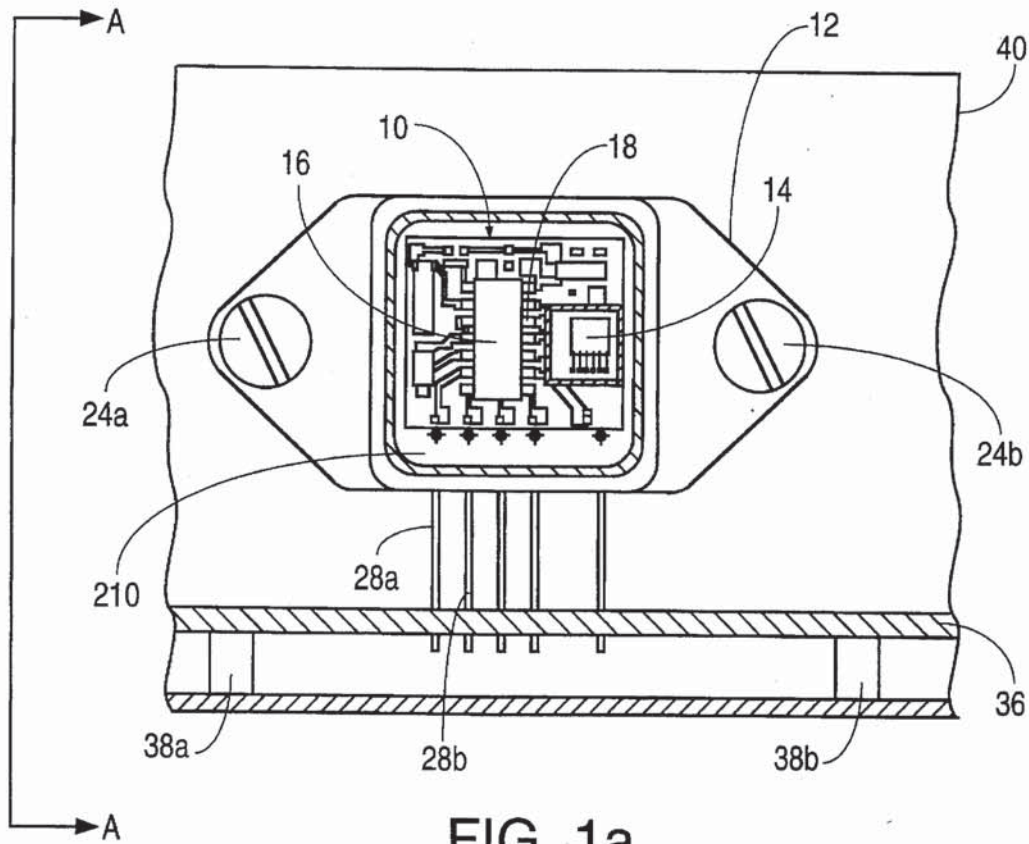


FIG. 1a  
(Prior Art)

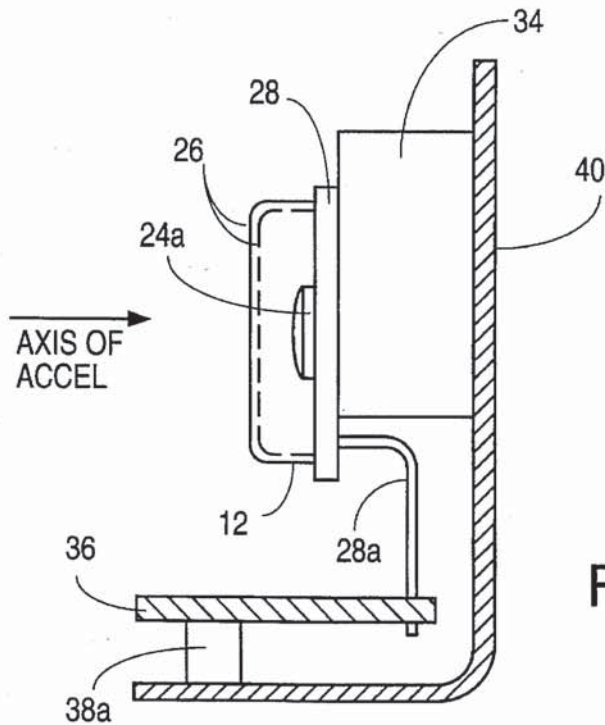


FIG. 1b  
(Prior Art)

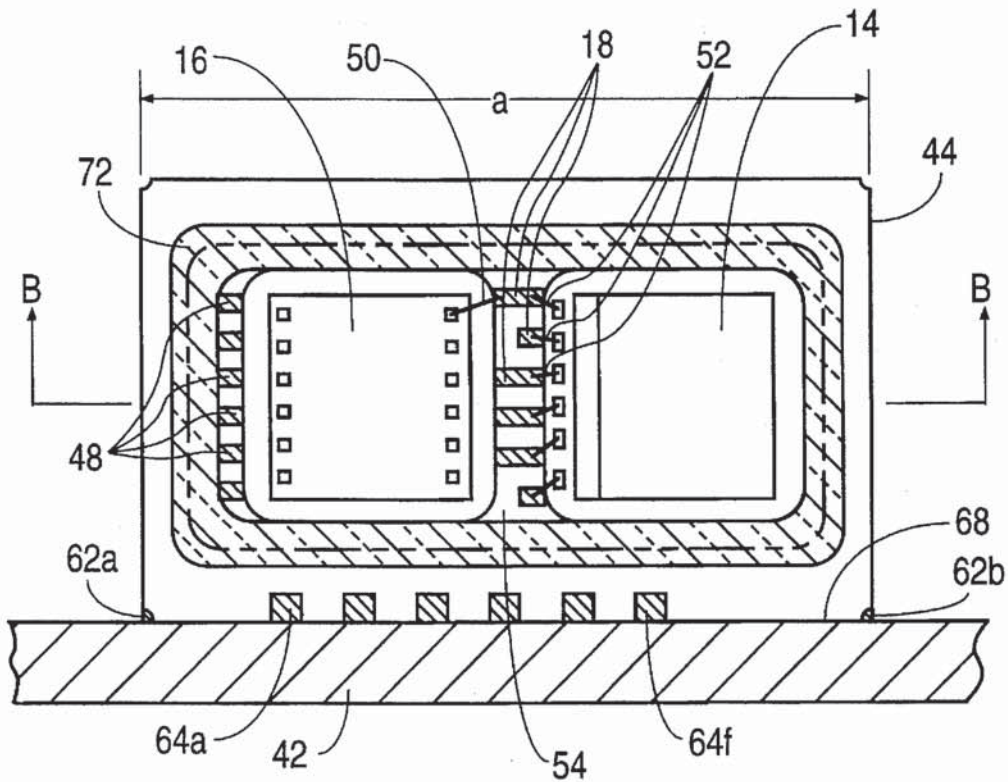


FIG. 2a

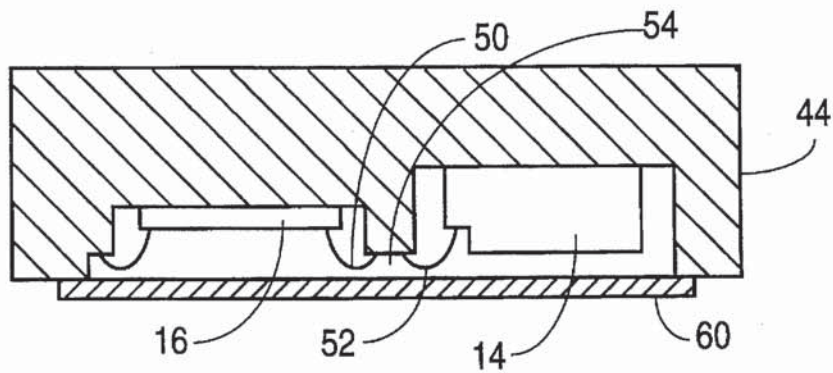


FIG. 2b

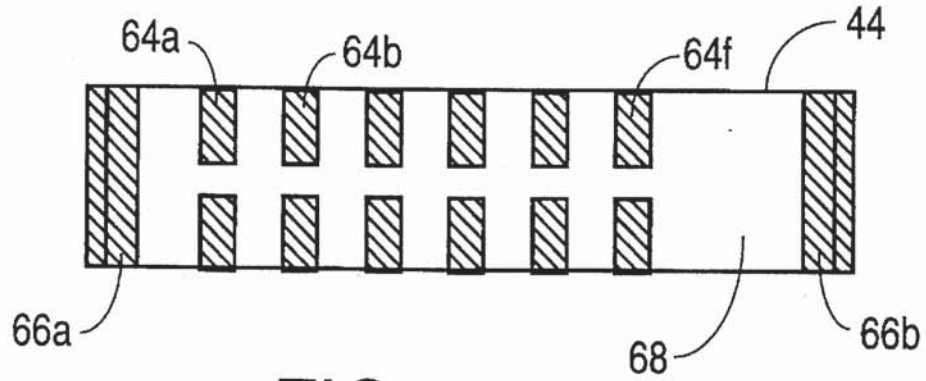


FIG. 2c

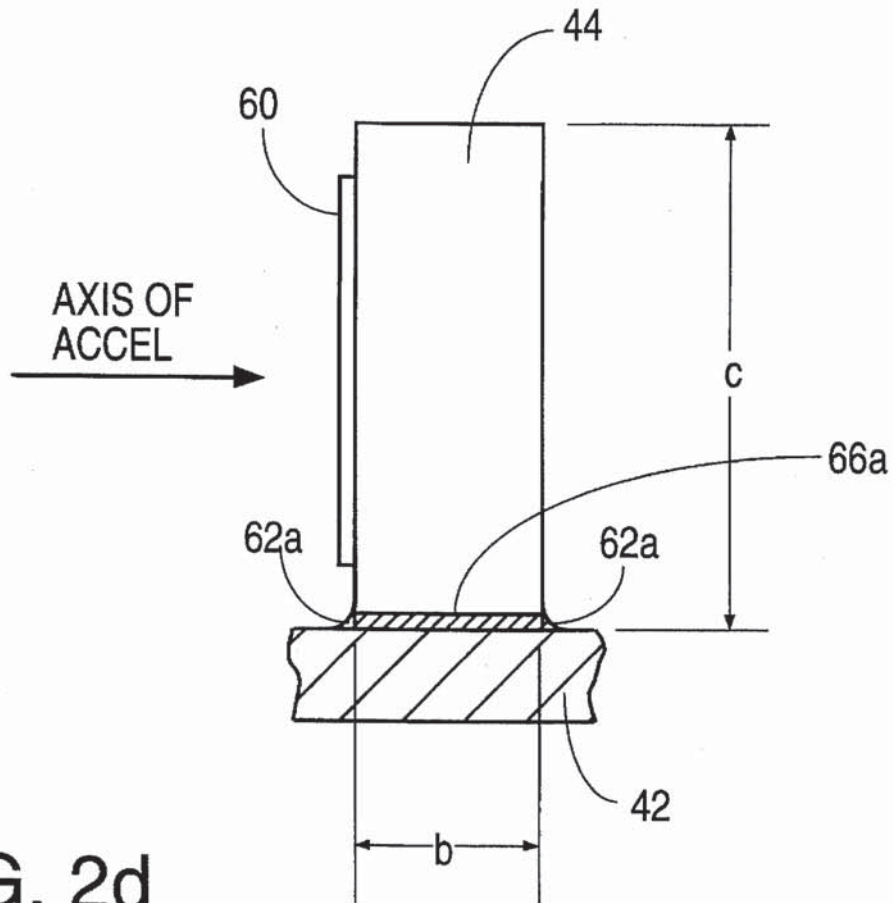


FIG. 2d

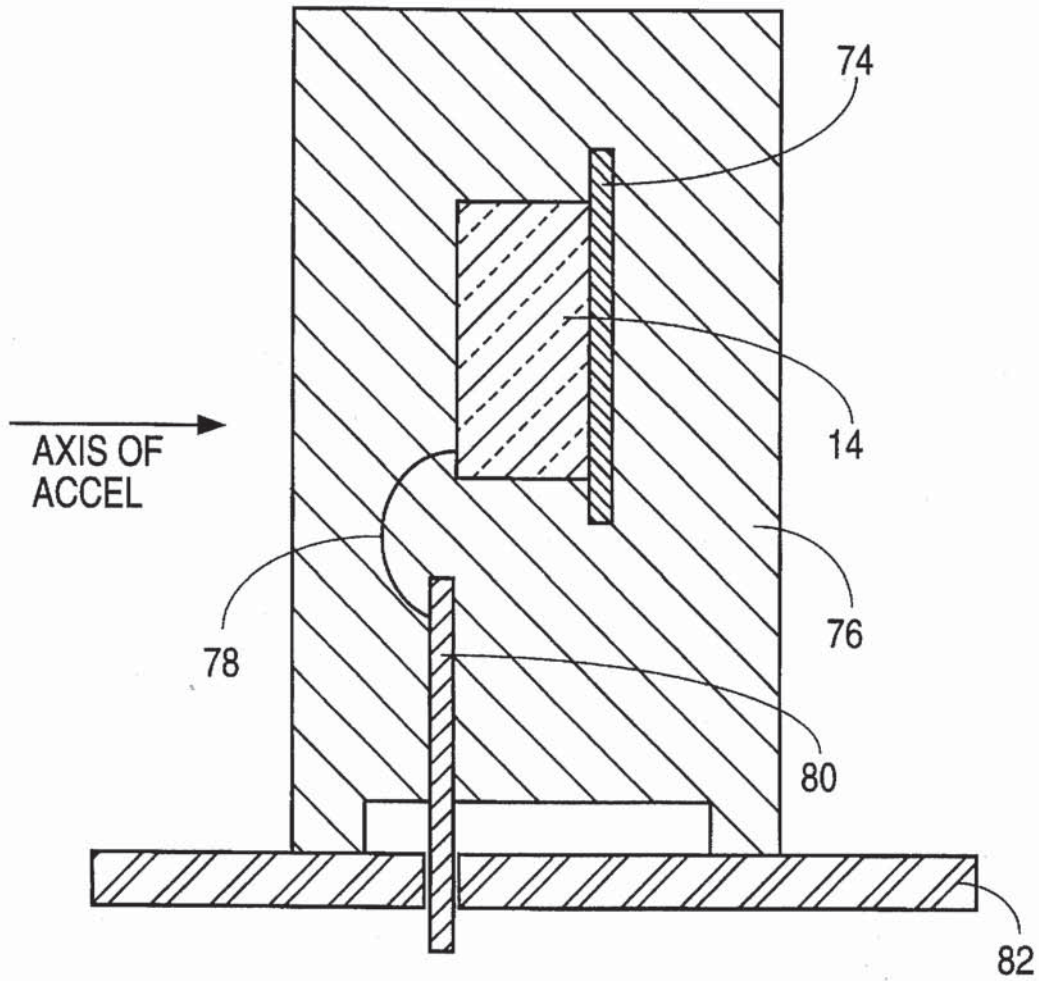


FIG. 3

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