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United States Patent [19]

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Sheldon

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[54] **MEDICAL SERVICE EMPLOYING MULTIPLE DC ACCELEROMETERS FOR PATIENT ACTIVITY AND POSTURE SENSING AND METHOD**

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

“Monolithic Accelerometer with Signal Conditioning”, Rev. O, published Jun. 1993 by Analog Devices, Inc.

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[22] Filed: **Mar. 30, 1995**

[51] Int. Cl.⁶ **A61N 1/365**

[57] **ABSTRACT**

[52] U.S. Cl. **607/19**

A method of and apparatus for determining the physical posture of a patient's body, having a superior-inferior body axis, an anterior-posterior body axis and a lateral-medial body axis, in relation to earth's gravitational field. A medical device having first, second and, optionally, third DC accelerometers having sensitive axes mounted orthogonally within an implantable housing is adapted to be implanted with the sensitive axes generally aligned with the patient's body axes. Each DC accelerometer generates DC accelerometer signals having characteristic magnitudes and polarities on alignment of the sensitive axis with, against or normal to earth's gravitational field and DC accelerometer signals of varying magnitudes and polarities when not so aligned. Body position may be determined through comparison of the magnitudes and polarities of the DC accelerometer signals with the characteristic magnitudes and polarities. A patient activity signal may also be determined from the frequency of body movements recurring over a time unit effecting magnitude changes in the DC accelerometer signals within a certain range of magnitude and frequency. The activity and body position signals may be stored and/or used to monitor and effect the delivery of a therapy to the patient, e.g. by controlling the pacing rate of a rate responsive pacemaker.

[58] Field of Search 607/2, 19, 18, 607/17

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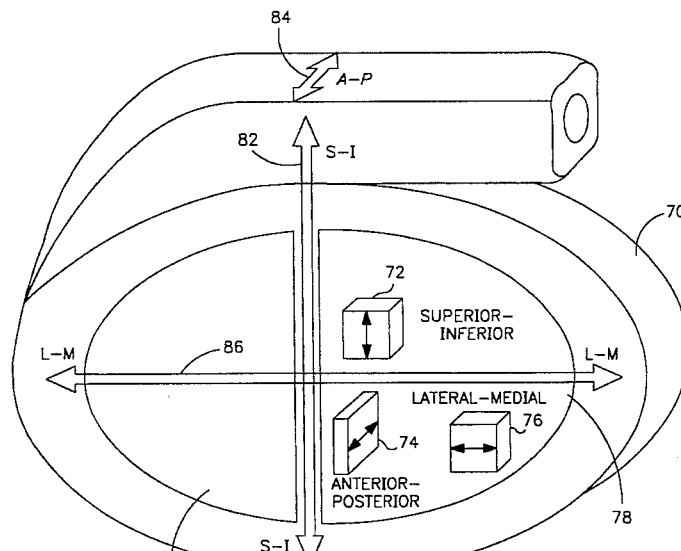
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Alt et al., “A New Mechanical Sensor for Detecting Body Activity and Posture, Suitable for Rate Responsive Pacing”, *PACE*, vol. 11, pp. 1875–1881, Nov., 1988, Part II.

29 Claims, 15 Drawing Sheets



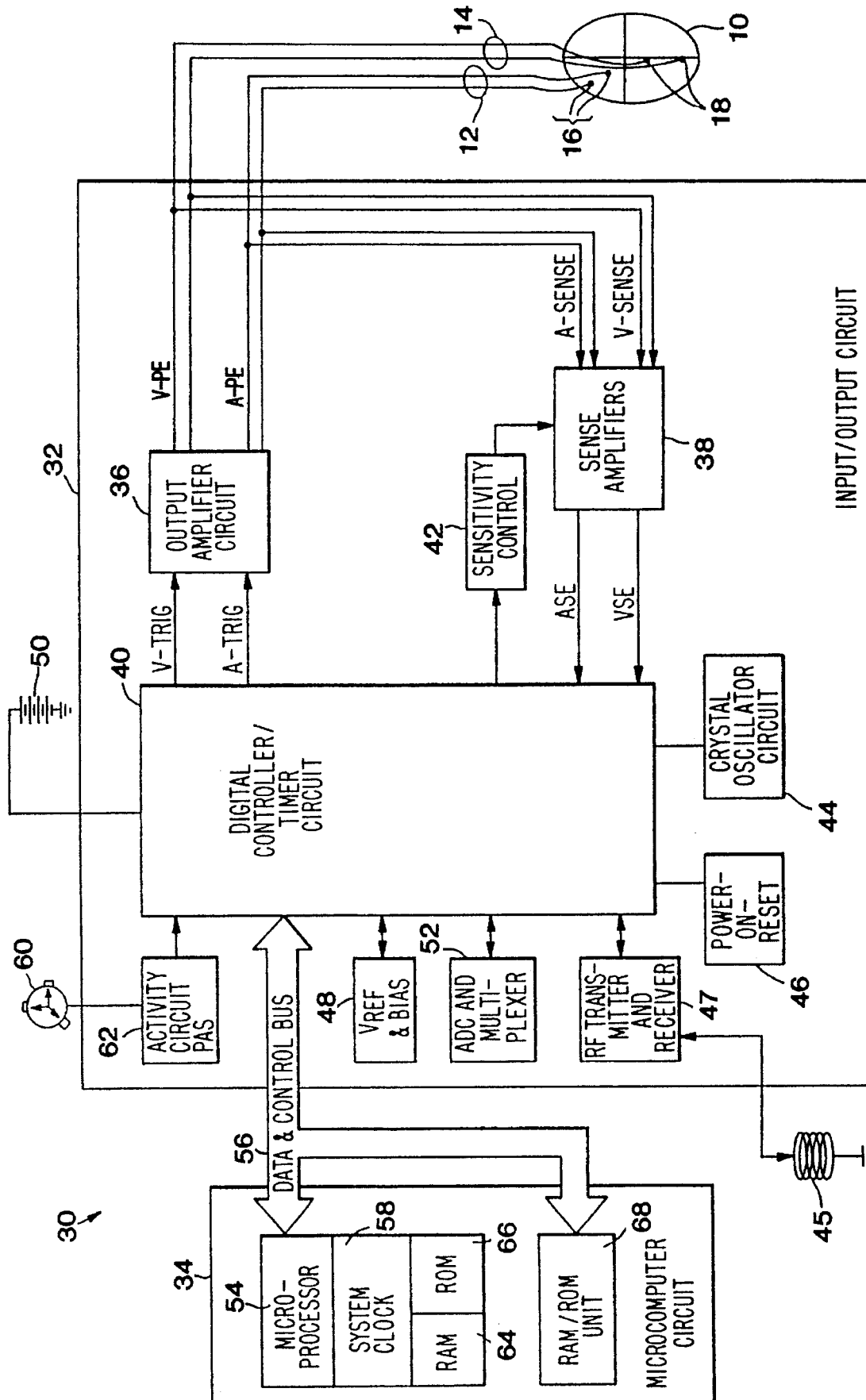
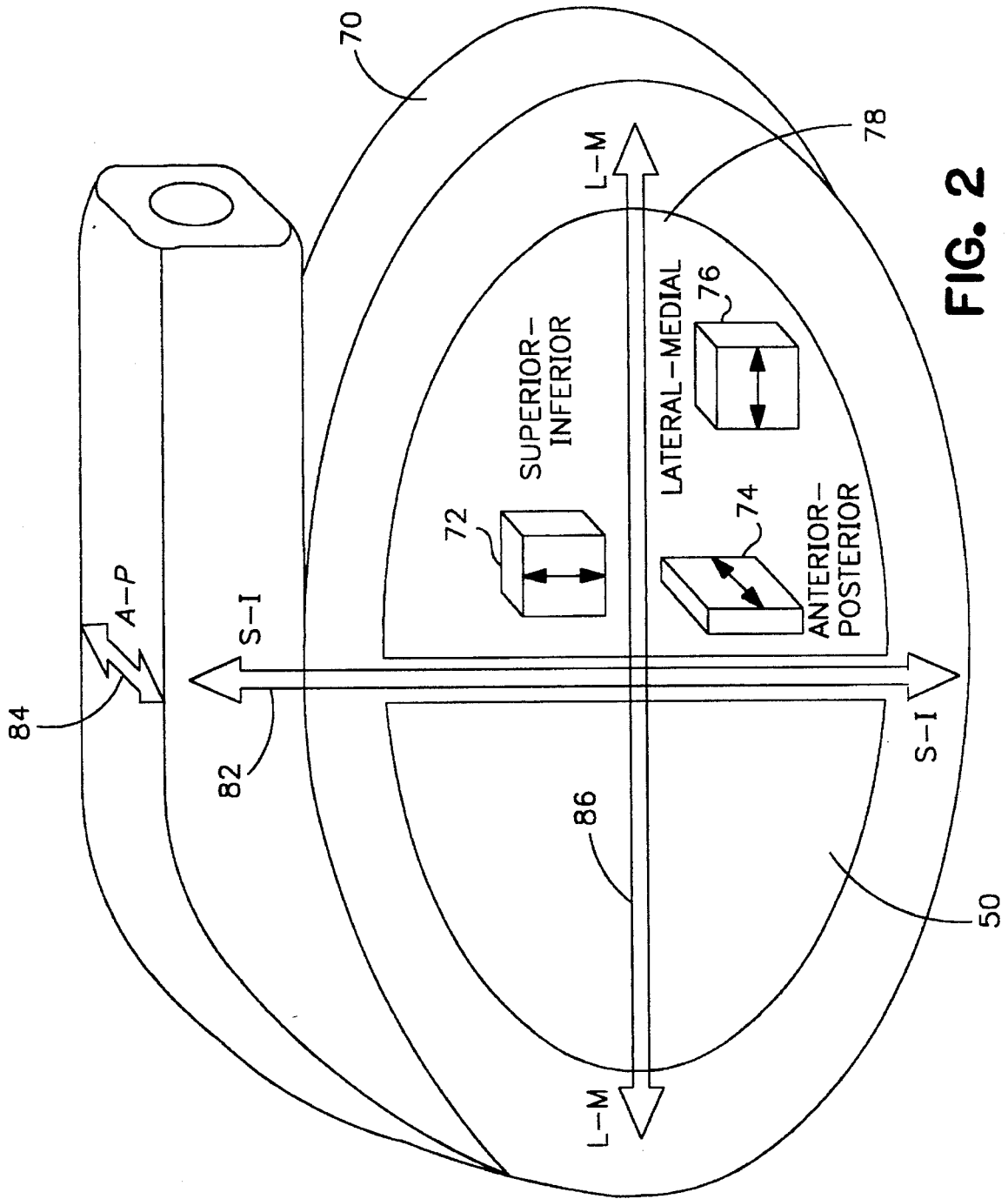


FIG. 1



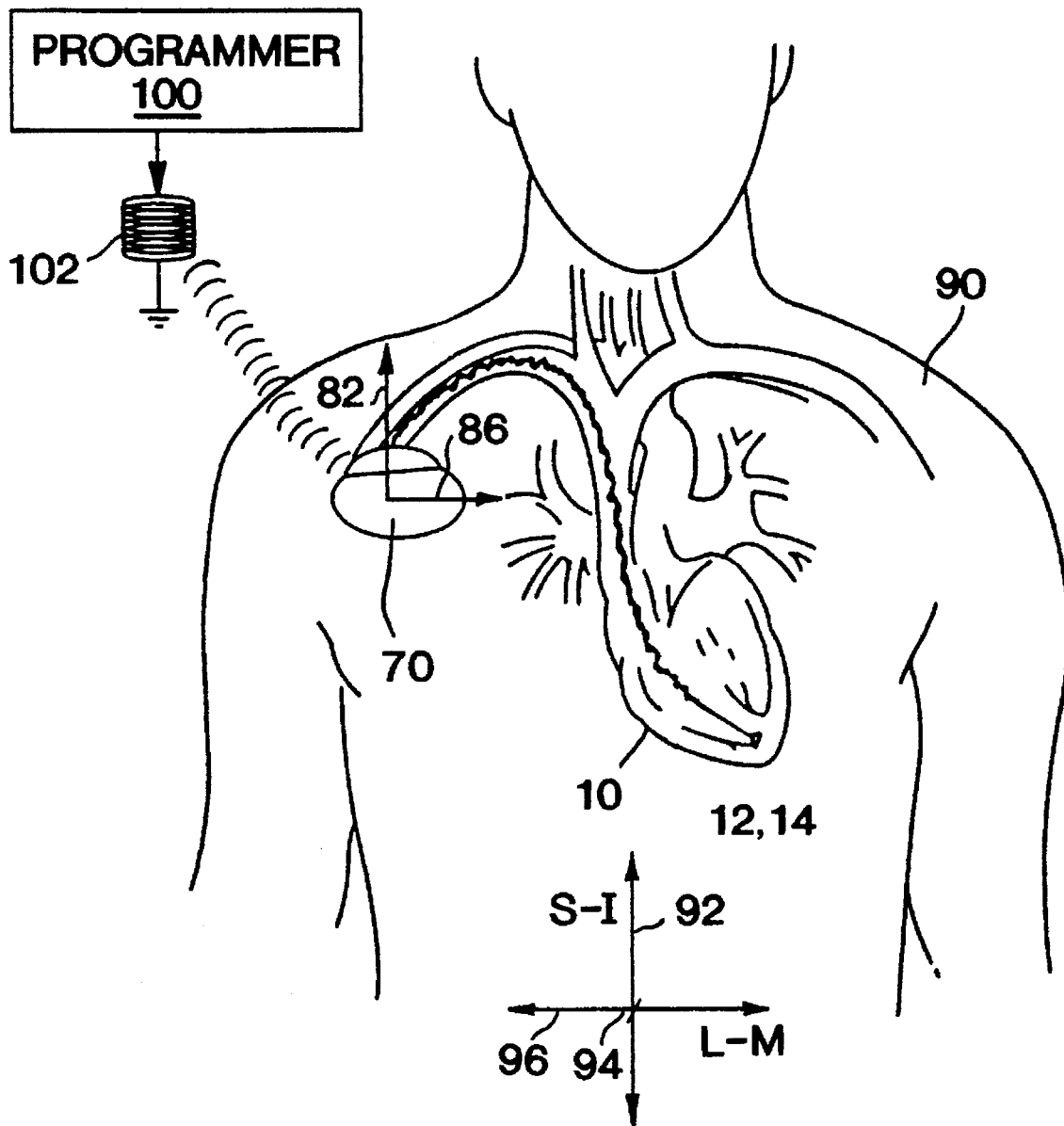


FIG. 3

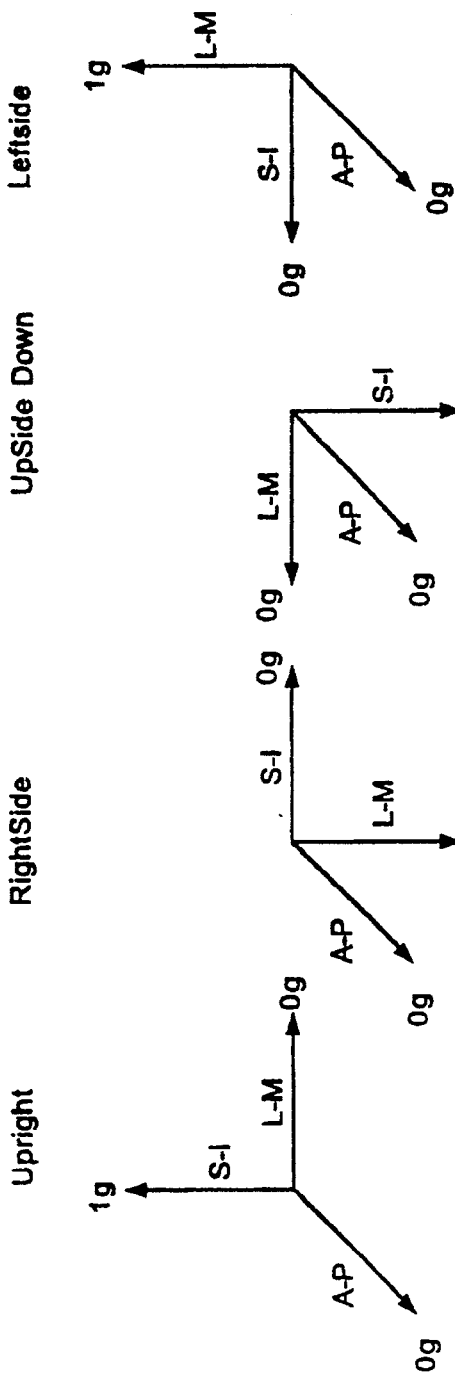


FIG. 4a

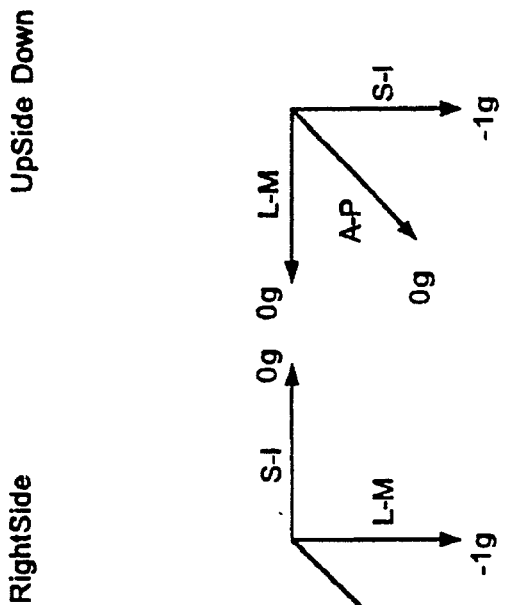


FIG. 4b

Prone

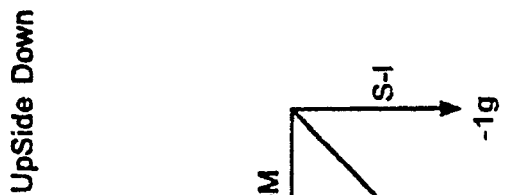


FIG. 4c

UpSide Down

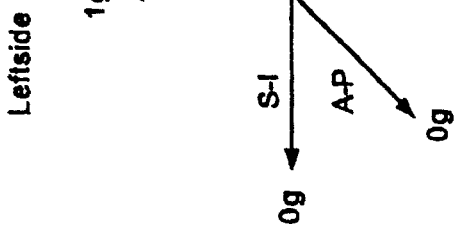


FIG. 4d

Supine

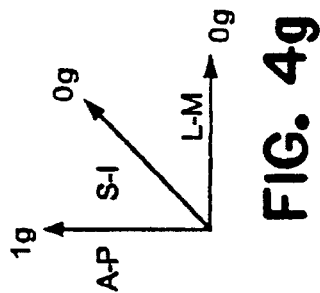


FIG. 4g

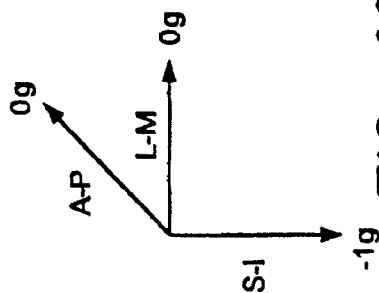


FIG. 4f

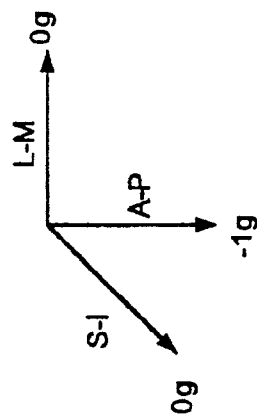


FIG. 4e

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