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# United States Patent [19]

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Eckerle et al.

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## [54] PULSE RATE SENSOR SYSTEM

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[73] Assignee: **Colin Electronics Co., Ltd.**, Aichi, Japan

[21] Appl. No.: **502,028**

[22] Filed: **Mar. 30, 1990**

[51] Int. Cl.<sup>5</sup> ..... **A61B 5/02**

[52] U.S. Cl. .... **128/690; 128/672**

[58] Field of Search ..... 128/687, 722, 699, 689, 128/677, 681, 683, 690

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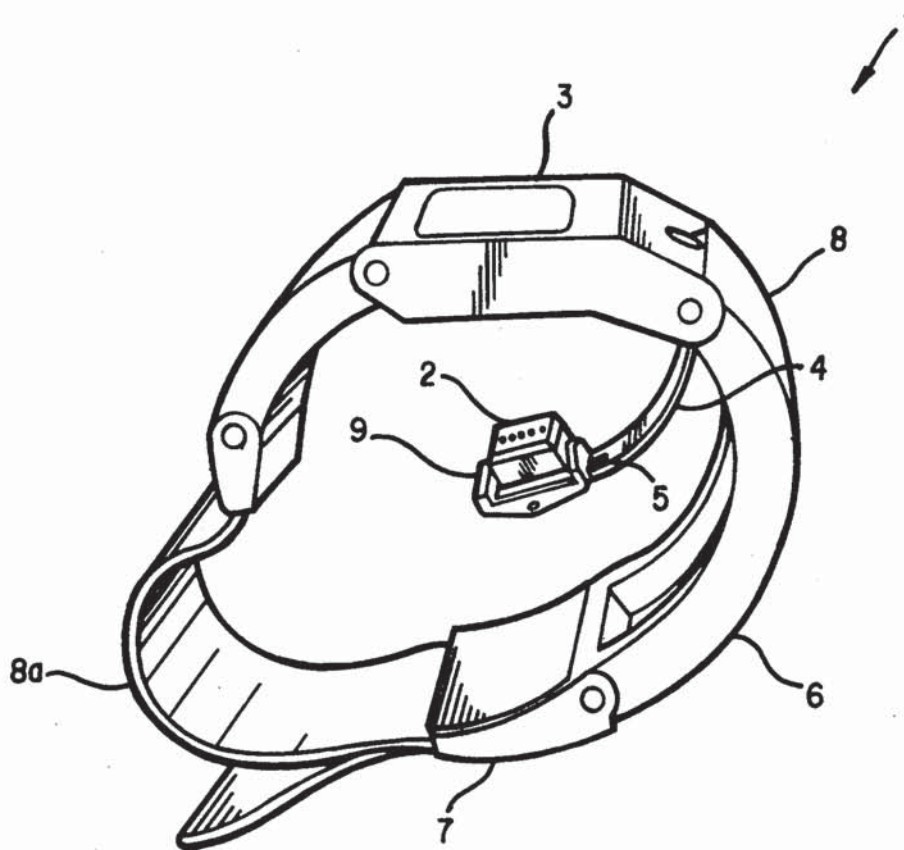
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*Attorney, Agent, or Firm*—Oloff & Berridge

## [57] ABSTRACT

A pulse rate sensor system is packaged in a wristwatch sized assembly and is worn by the user to provide an accurate determination of pulse rate. A tonometer sensor is provided to detect heartbeat pressure waves produced by a superficial artery. A microcomputer manipulates the unprocessed tonometer sensor element signals using multiple algorithms to determine an accurate pulse rate.

**36 Claims, 9 Drawing Sheets**



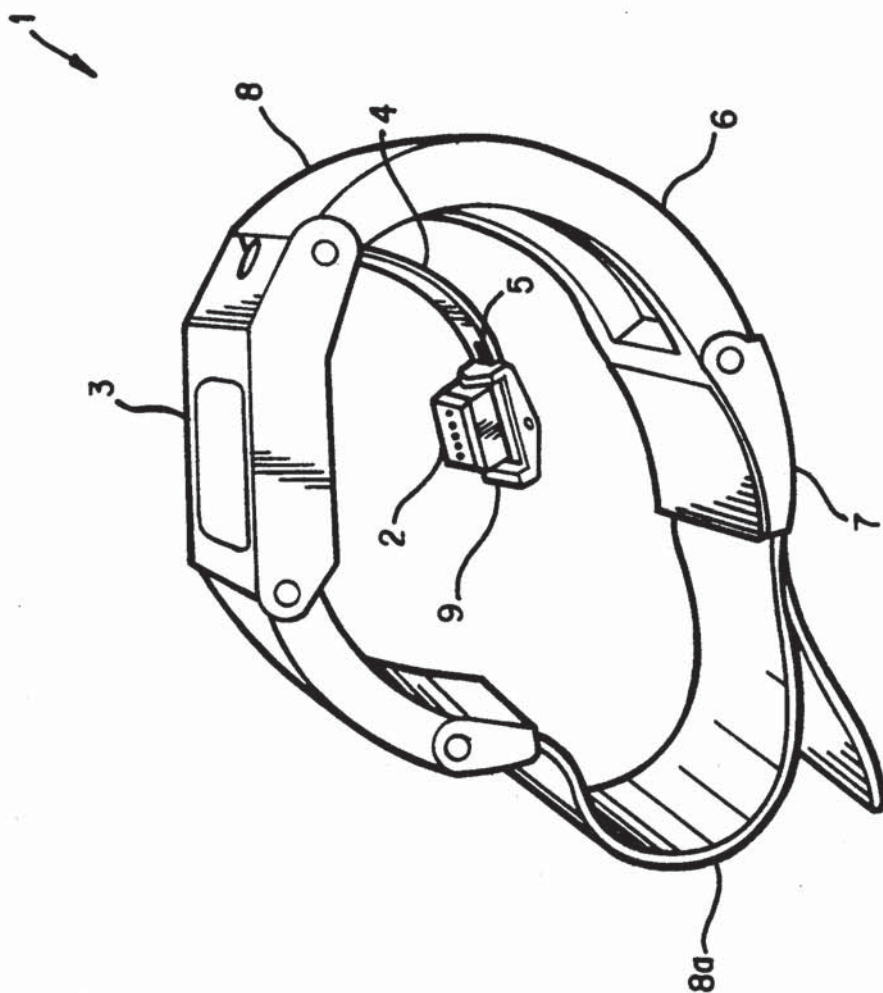


FIG. 1

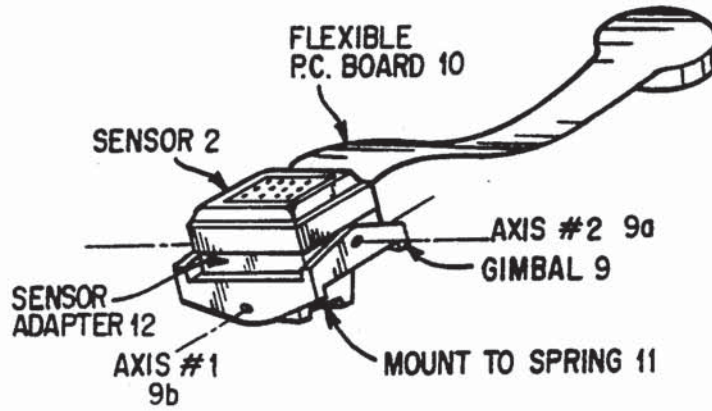


FIG. 2

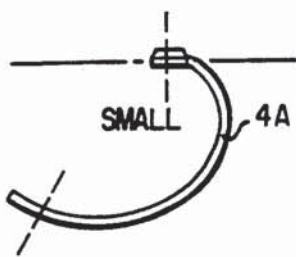


FIG. 3A

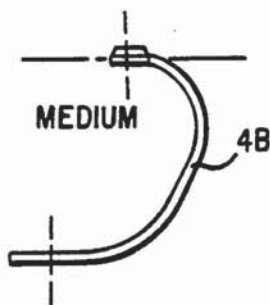


FIG. 3B

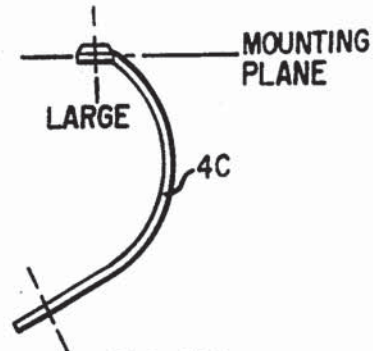


FIG. 3C

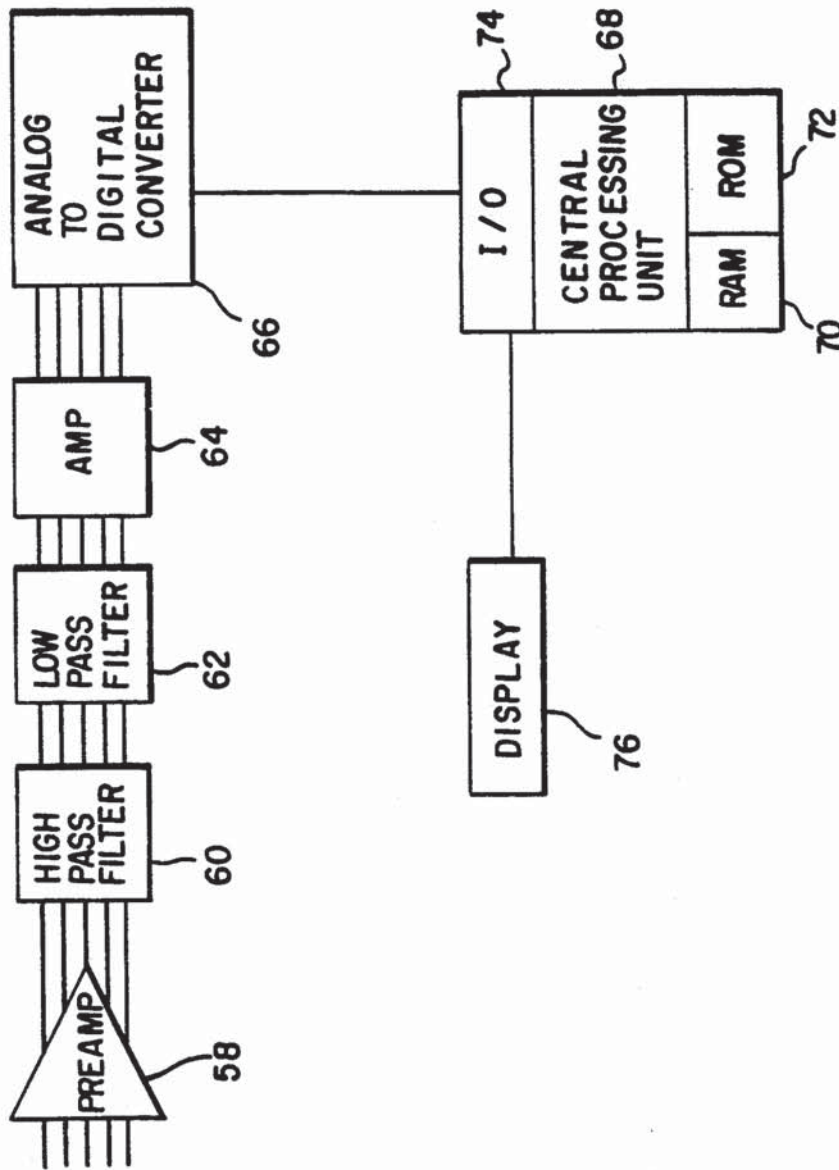


FIG. 4

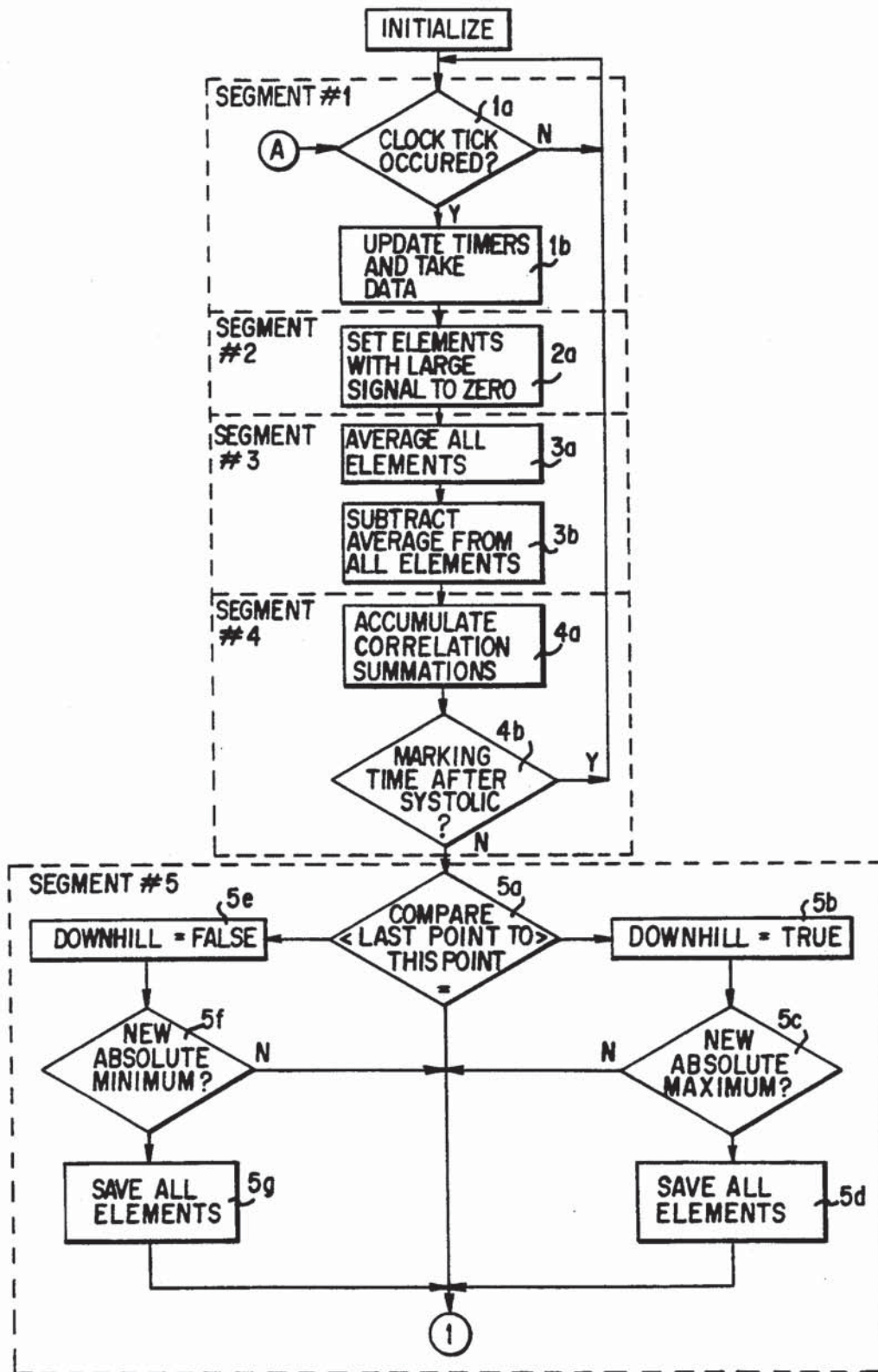


FIG. 5A

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