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(12) **United States Patent**
Turcott

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(54) **METHOD FOR MONITORING PATIENT USING ACOUSTIC SENSOR**

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(73) Assignee: **Pacesetter, Inc.**, Sunnyvale, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 129 days.

4,446,873 A *	5/1984	Groch et al.	600/528
4,763,646 A	8/1988	Lekholm	128/419 PG
4,905,706 A *	3/1990	Duff et al.	600/514
4,989,611 A *	2/1991	Zanetti et al.	600/508
5,042,497 A	8/1991	Shapland	128/696
5,168,869 A	12/1992	Chirife	128/419 PG
5,404,877 A	4/1995	Nolan et al.	128/671
5,554,177 A	9/1996	Kieval et al.	607/17
5,862,805 A	1/1999	Nitzan	128/898
5,935,081 A	8/1999	Kadhiresan	600/513

(21) Appl. No.: **09/689,270**

(22) Filed: **Oct. 11, 2000**

* cited by examiner

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/543,394, filed on Apr. 5, 2000, which is a continuation-in-part of application No. 09/467,298, filed on Dec. 17, 1999, which is a continuation-in-part of application No. 09/438,017, filed on Nov. 10, 1999, now Pat. No. 6,409,675.

(51) **Int. Cl.**⁷ **A61B 5/04**

(52) **U.S. Cl.** **600/528**

(58) **Field of Search** 600/508, 514, 600/528

Primary Examiner—Carl Layno

(74) *Attorney, Agent, or Firm*—Steven M. Mitchell

(57) **ABSTRACT**

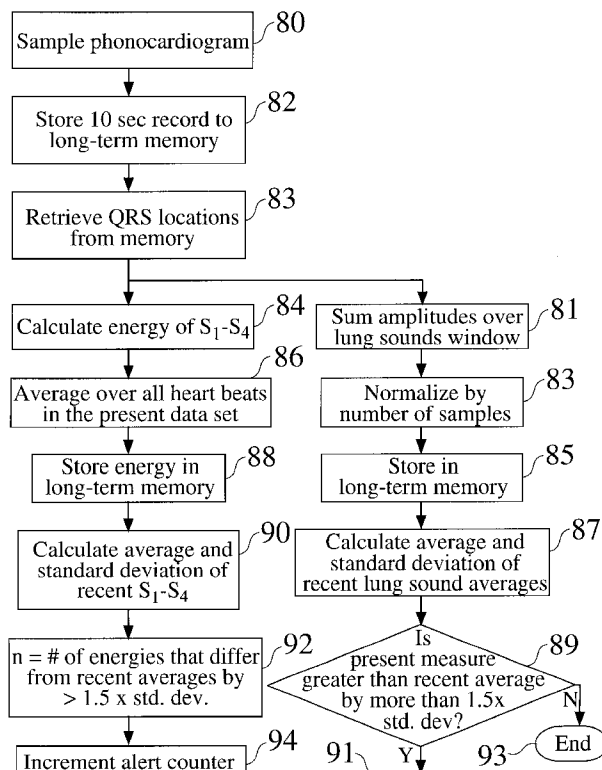
A method for monitoring the progression of the disease of a heart failure patient is provided. An implantable or other ambulatory monitor senses acoustic signals including heart and lung sounds within the patient. Significant changes in the energy content of either the heart or lung sounds is indicative of a heart failure exacerbation. This information may be used to warn the patient or healthcare providers of changes in the patient's condition warranting attention.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,985,121 A 10/1976 Hellenbrand 128/2 K

42 Claims, 21 Drawing Sheets



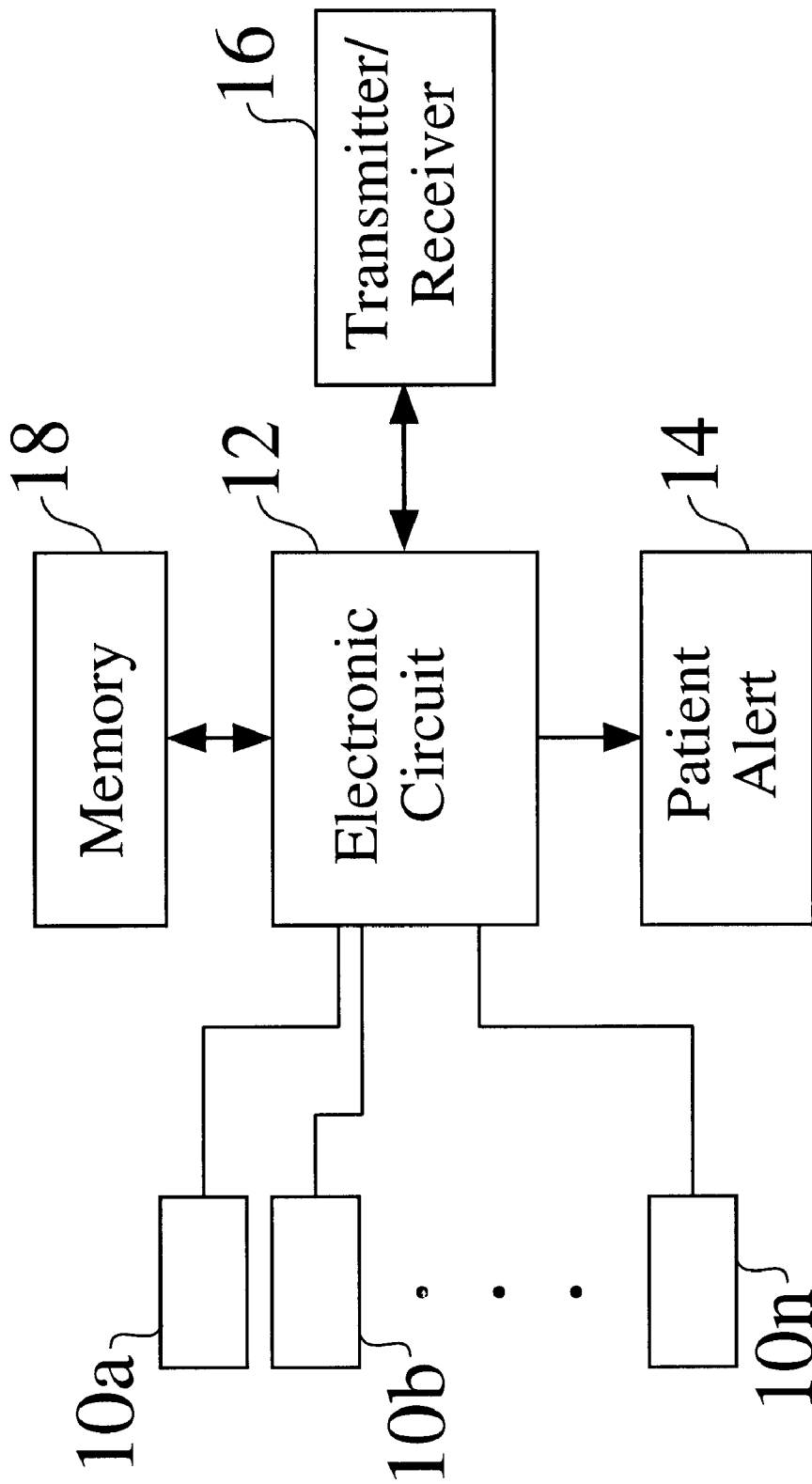


Fig. 1

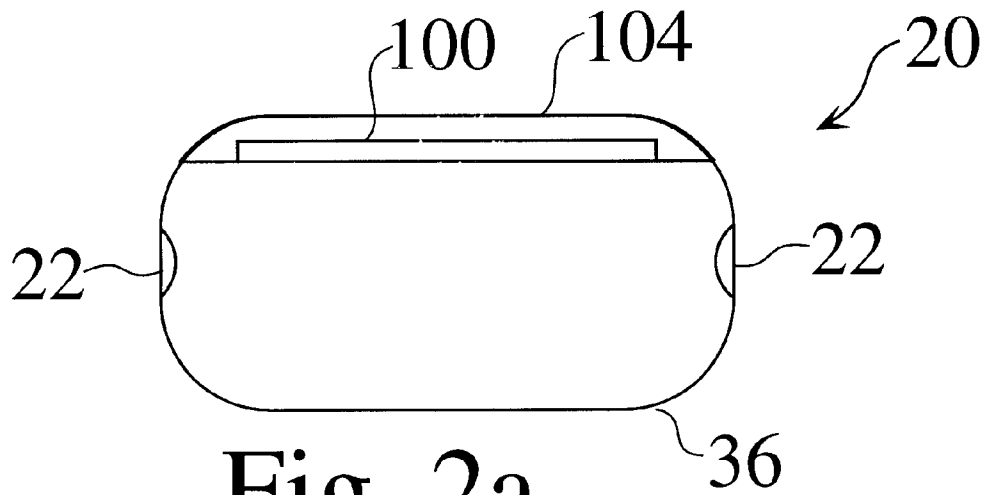


Fig. 2a

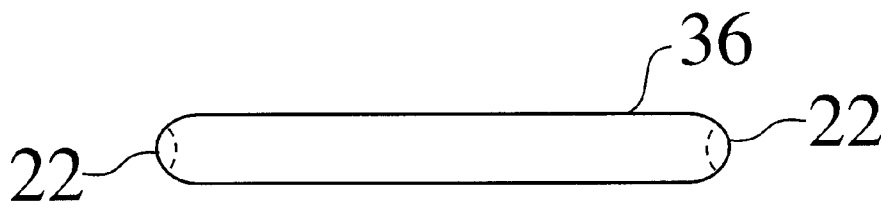


Fig. 2b

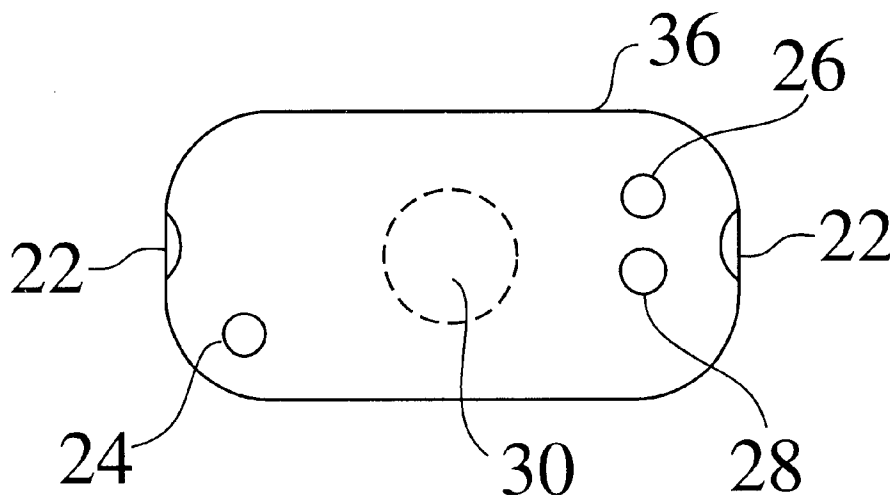
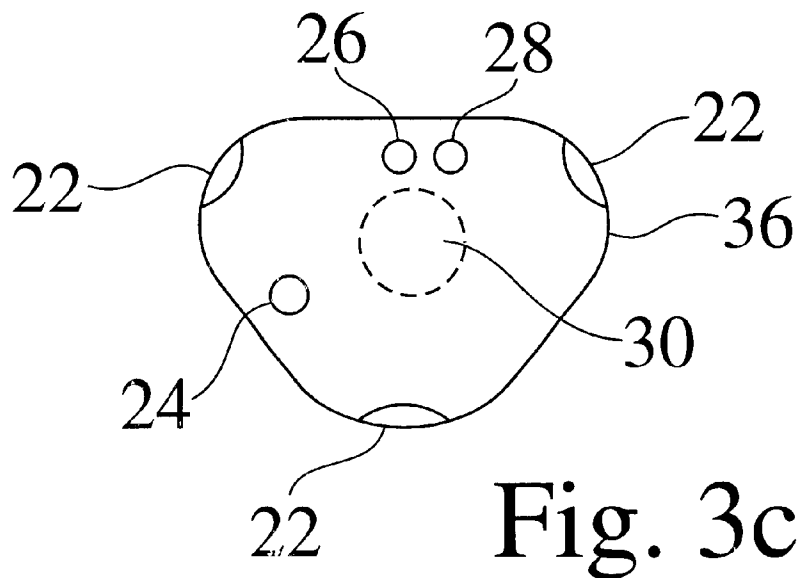
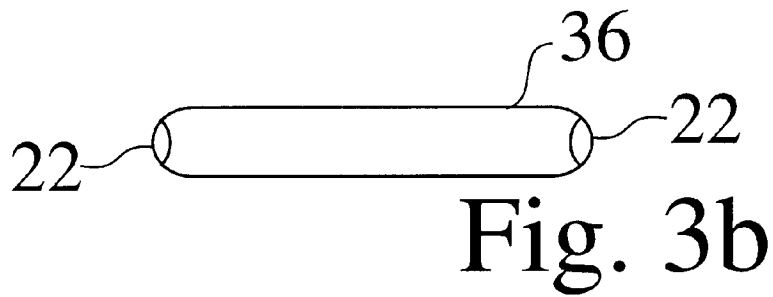
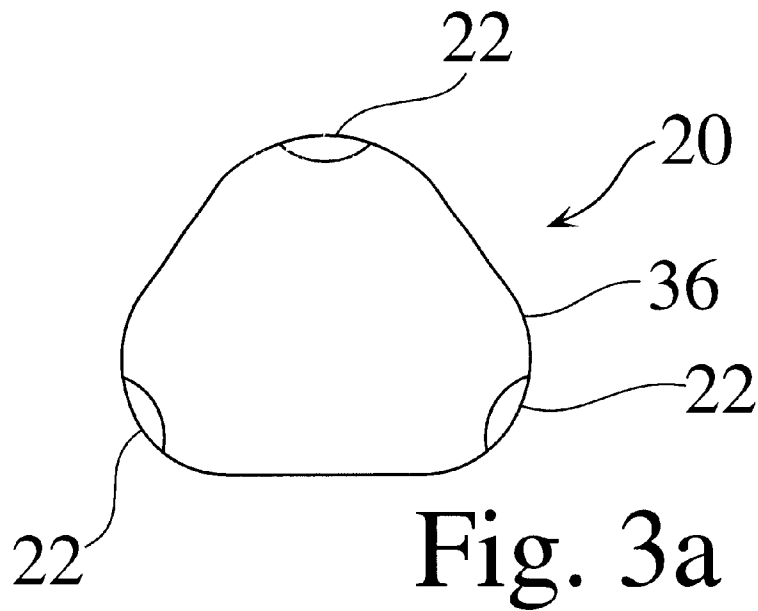


Fig. 2c



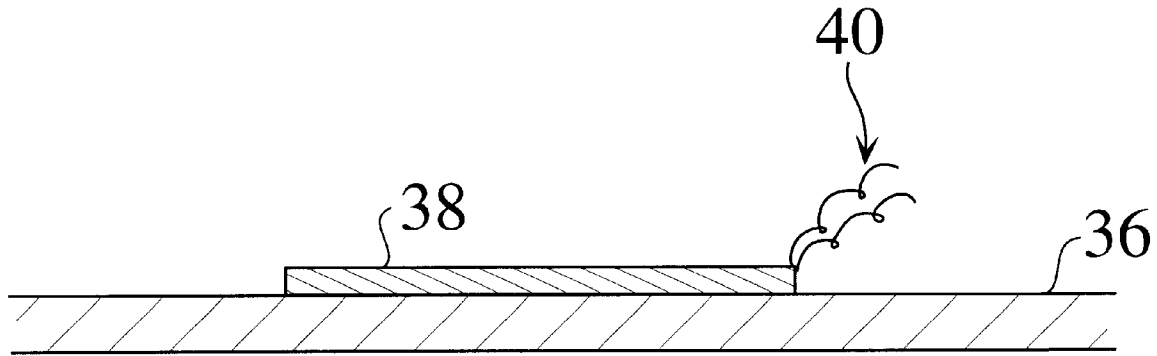


Fig. 4a

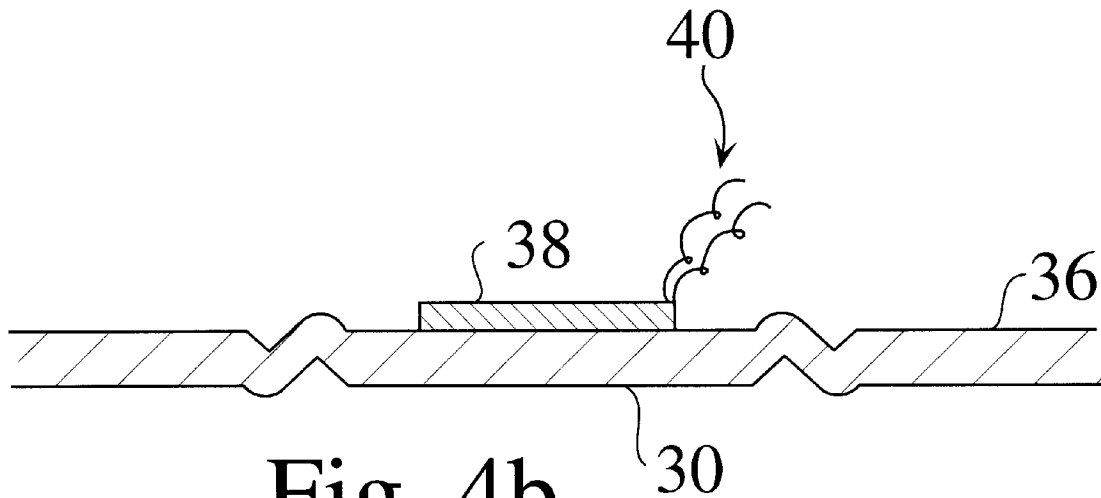


Fig. 4b

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