EXHIBIT 2

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Burnett et al.

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(45) **Date of Patent:**   *Sep. 13, 2011

(54) **VOICE ACTIVITY DETECTOR (VAD) -BASED MULTIPLE-MICROPHONE ACOUSTIC NOISE SUPPRESSION**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 713 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/667,207**

(22) Filed: **Sep. 18, 2003**

(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 09/905,361, filed on Jul. 12, 2001, now abandoned.

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(51) **Int. Cl.**
H03B 29/00   (2006.01)
(52) **U.S. Cl.** **381/71.8**; 704/215
(58) **Field of Classification Search** 381/70, 381/94.1–94.7, 71.8, 91–92, 122, 71.1; 704/200, 704/231, 233, 246, 214–215
See application file for complete search history.

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(57)   **ABSTRACT**

Acoustic noise suppression is provided in multiple-microphone systems using Voice Activity Detectors (VAD). A host system receives acoustic signals via multiple microphones. The system also receives information on the vibration of human tissue associated with human voicing activity via the VAD. In response, the system generates a transfer function representative of the received acoustic signals upon determining that voicing information is absent from the received acoustic signals during at least one specified period of time. The system removes noise from the received acoustic signals using the transfer function, thereby producing a denoised acoustic data stream.

20 Claims, 10 Drawing Sheets
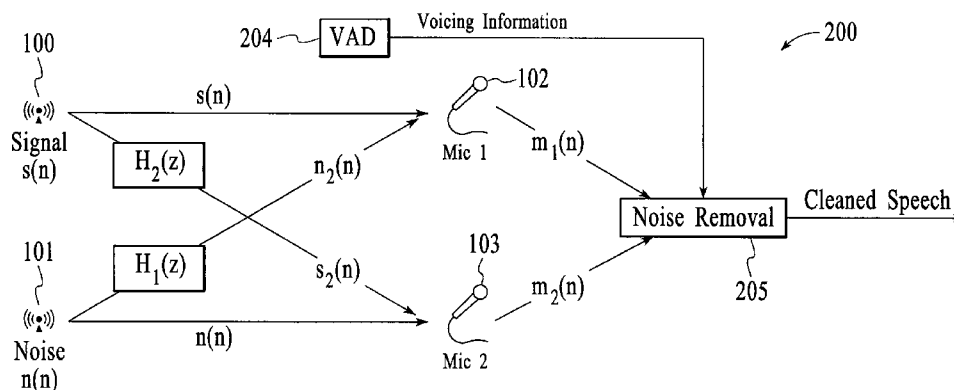
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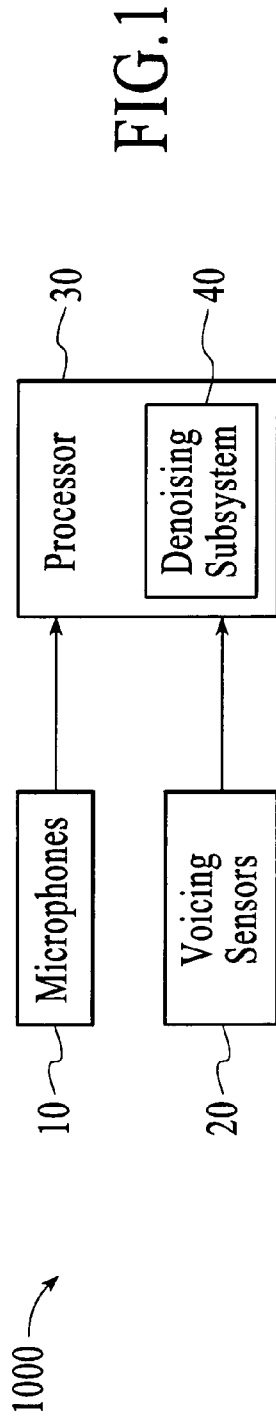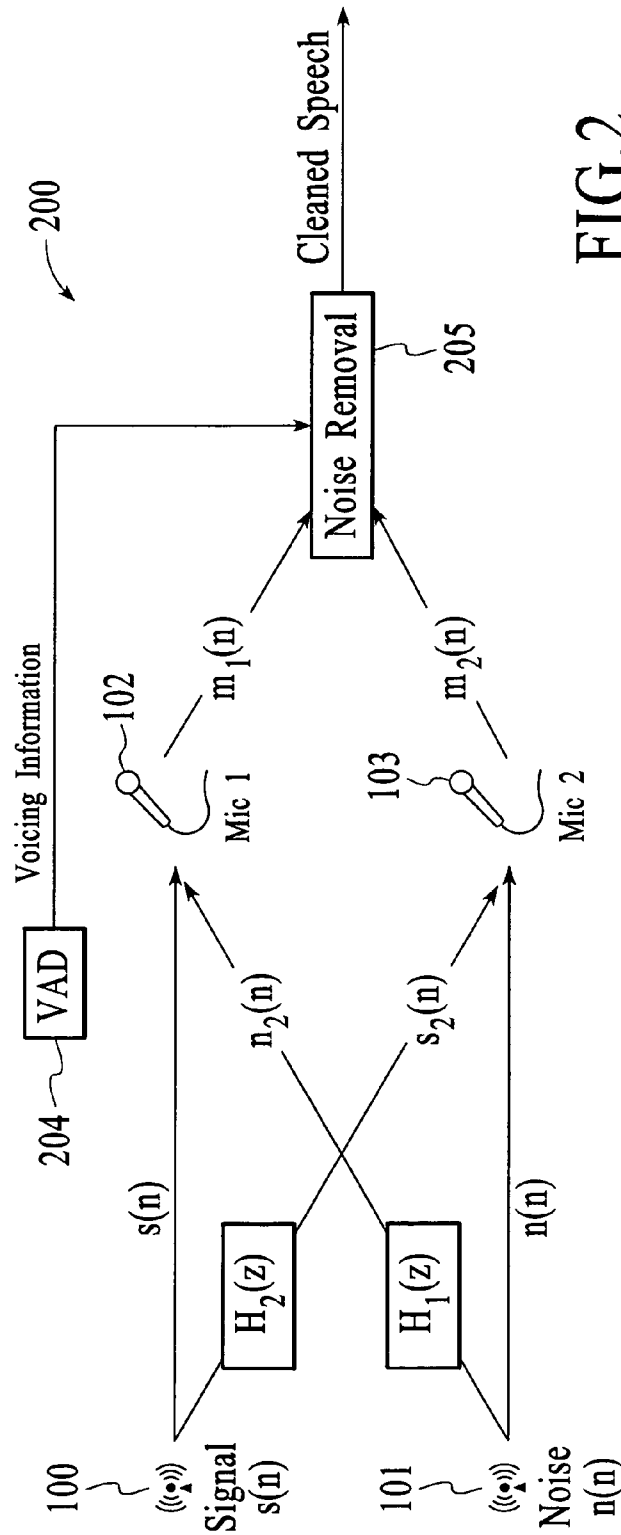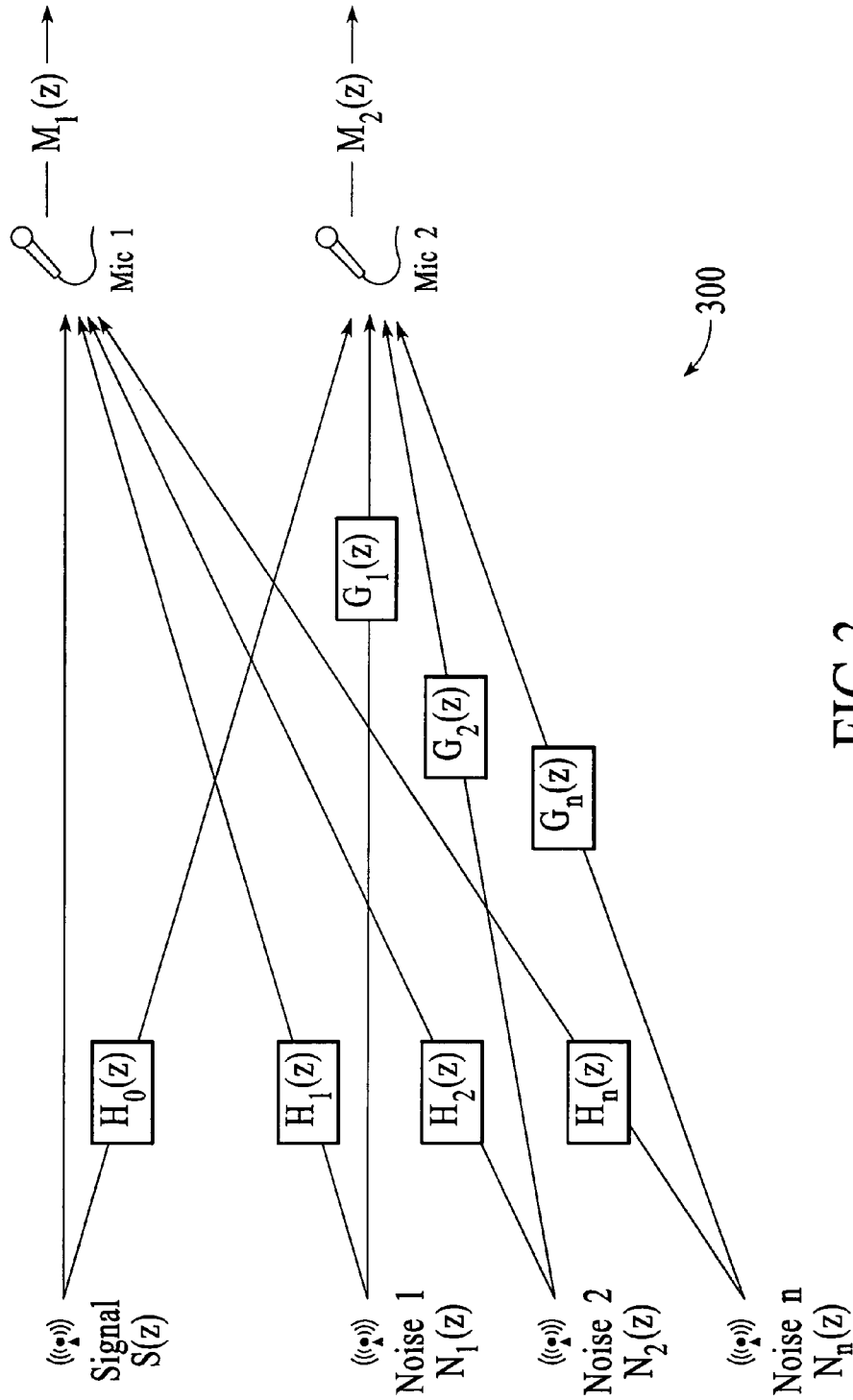
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FIG.1

FIG.2

FIG.3

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