

[54] **NOISE REDUCTION SYSTEM FOR BINAURAL HEARING AID**

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[51] **Int. Cl.**<sup>6</sup> ..... **H04R 25/00**

[52] **U.S. Cl.** ..... **381/68.2; 381/68.4; 395/2.35**

[58] **Field of Search** ..... 381/68.2, 68, 68.4, 381/60, 26, 74, 94, 46, 47; 395/2.35, 2.12, 2.37, 2.42

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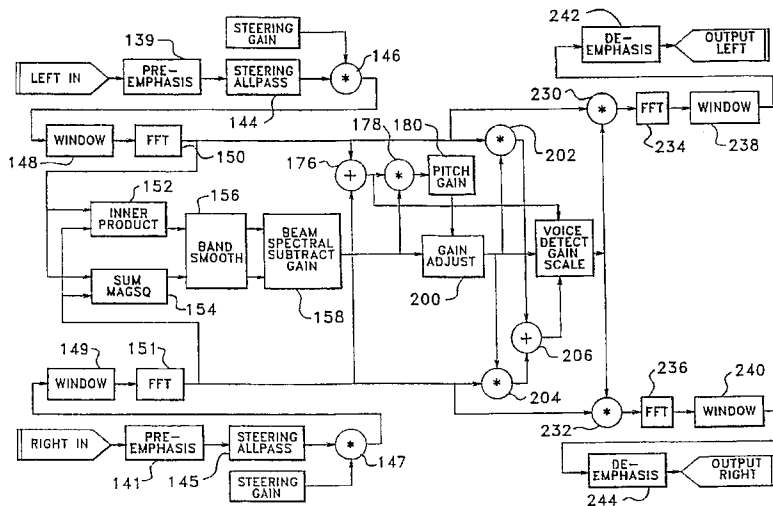
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*Assistant Examiner*—Huyen D. Le  
*Attorney, Agent, or Firm*—Homer L. Knearl; Holland & Hart

[57] **ABSTRACT**

In this invention noise in a binaural hearing aid is reduced by analyzing the left and right digital audio signals to produce left and right signal frequency domain vectors and thereafter using digital signal encoding techniques to produce a noise reduction gain vector. The gain vector can then be multiplied against the left and right signal vectors to produce a noise reduced left and right signal vector. The cues used in the digital encoding techniques include directionality, short term amplitude deviation from long term average, and pitch. In addition, a multidimensional gain function based on directionality estimate and amplitude deviation estimate is used that is more effective in noise reduction than simply summing the noise reduction results of directionality alone and amplitude deviations alone. As further features of the invention, the noise reduction is scaled based on pitch-estimates and based on voice detection.

**14 Claims, 5 Drawing Sheets**

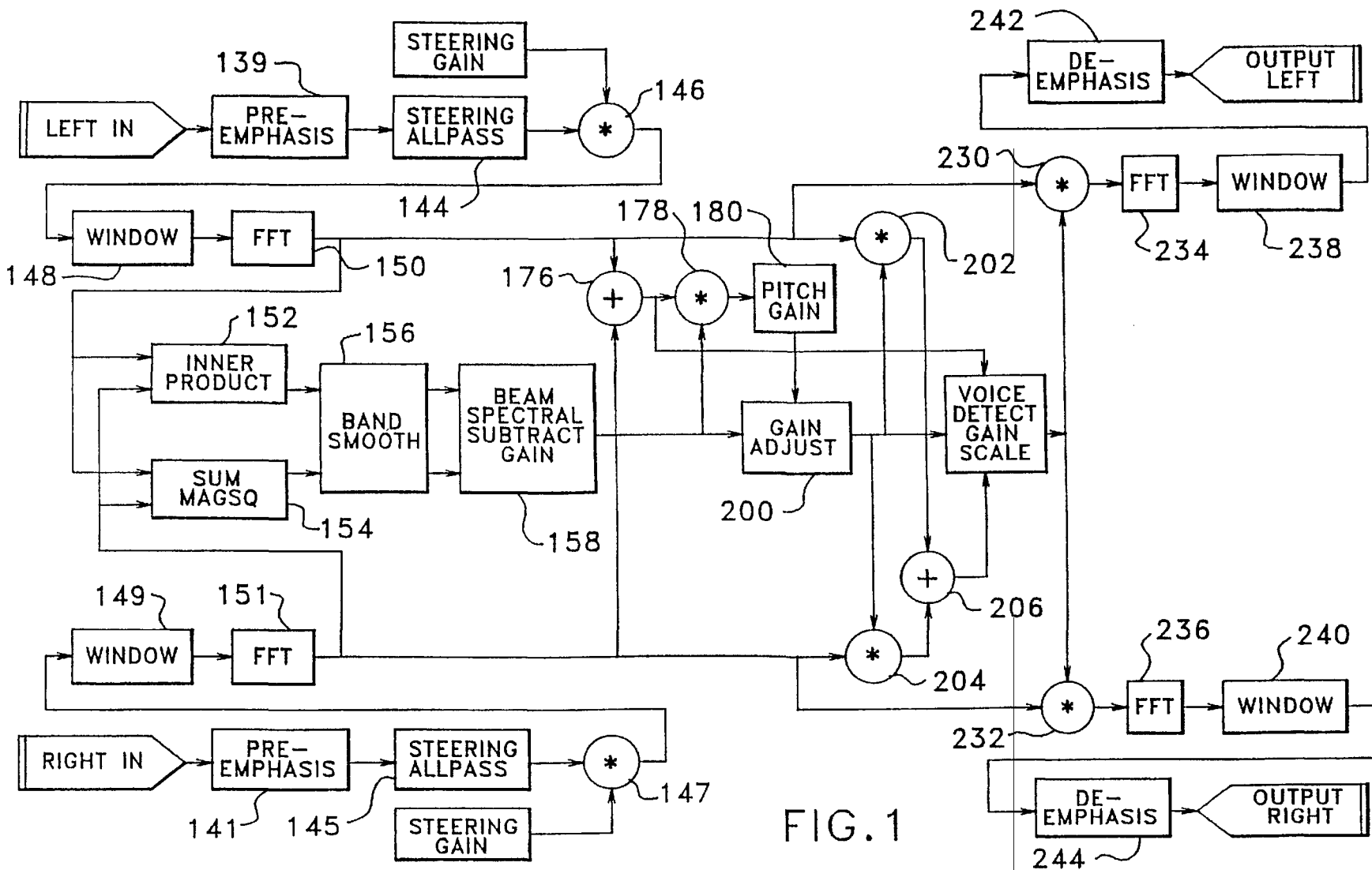


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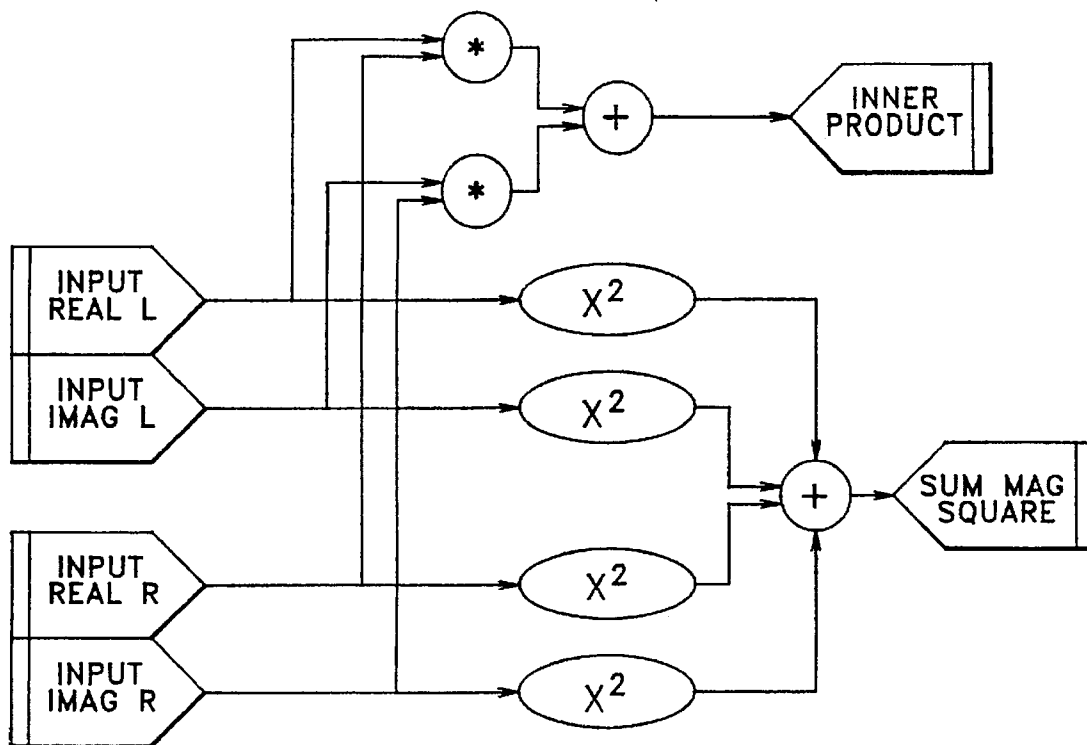


FIG.2

NOTE: THIS CIRCUIT IS REPEATED FOR EVERY FREQUENCY F OF THE FFT

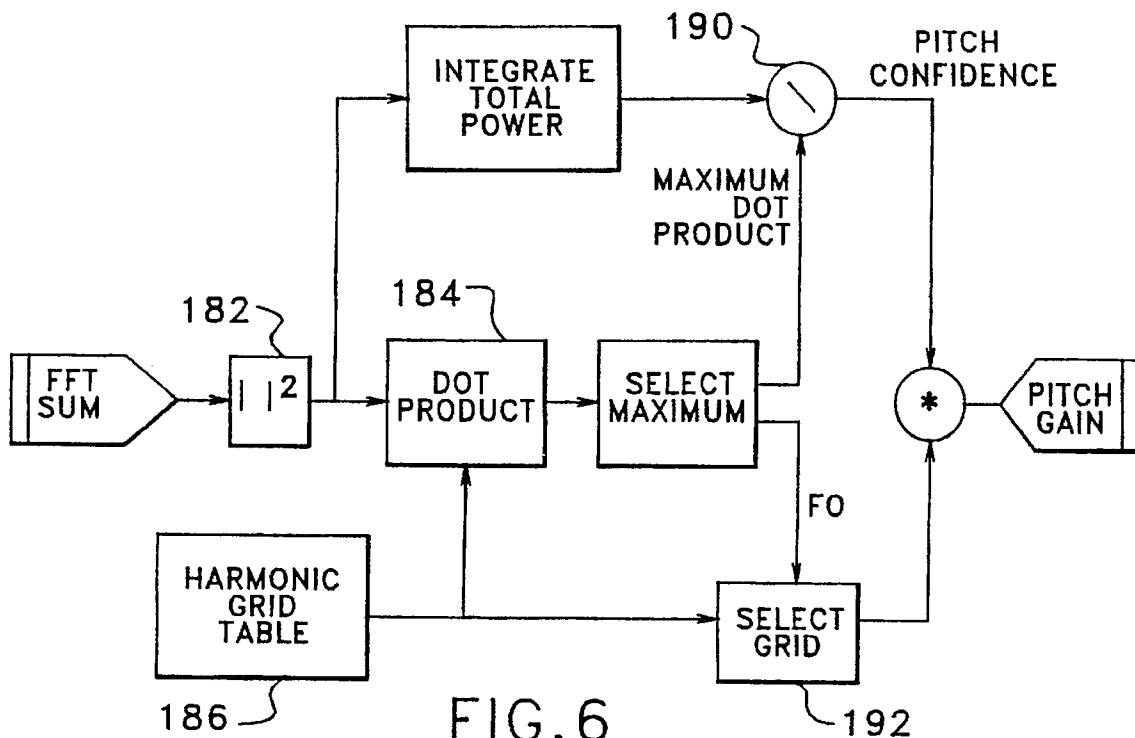


FIG.6

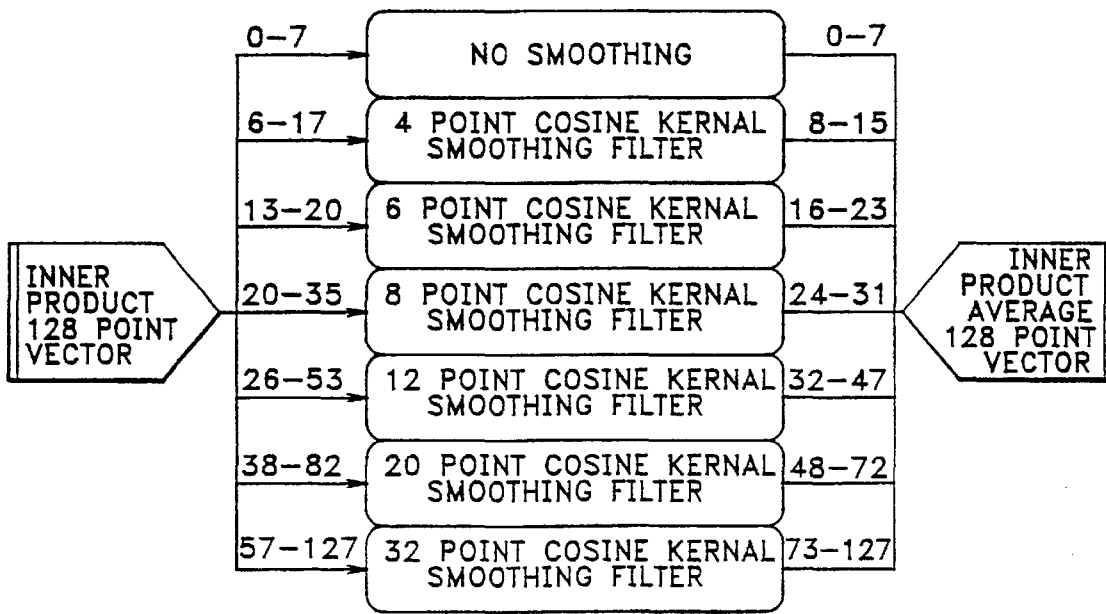


FIG. 3A

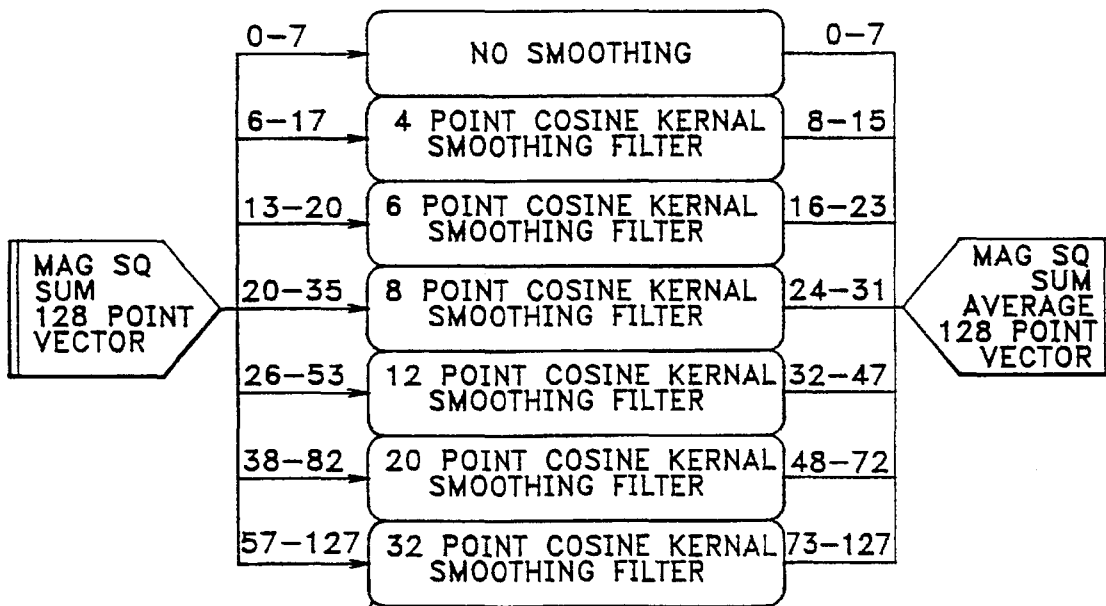


FIG. 3B

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