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United States Patent [19]

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Jensen et al.

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- [54] **APPARATUS AND METHODS FOR INCLUDING CODES IN AUDIO SIGNALS AND DECODING**
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- [73] Assignee: **The Arbitron Company, Laurel, Md.**
- [21] Appl. No.: **221,019**
- [22] Filed: **Mar. 31, 1994**
- [51] Int. Cl.⁶ **H04L 9/00; H04H 9/00**
- [52] U.S. Cl. **380/6; 455/2; 348/1**
- [58] Field of Search **380/6; 455/2; 348/1**
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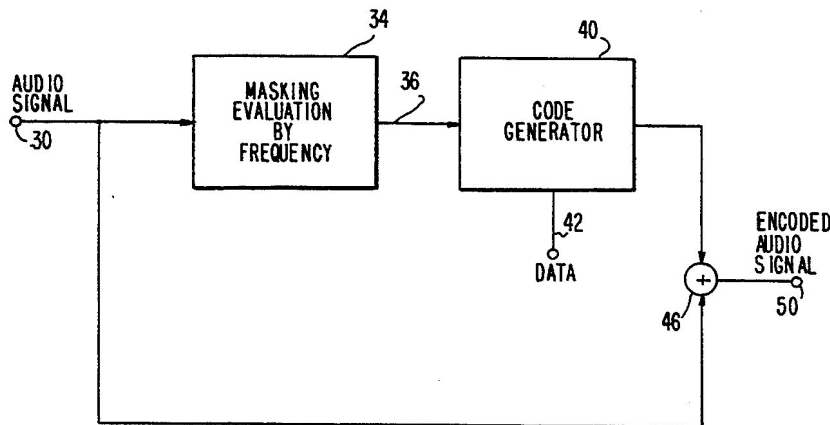
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[57]

ABSTRACT

Apparatus and methods for including a code having at least one code frequency component in an audio signal are provided. The abilities of various frequency components in the audio signal to mask the code frequency component to human hearing are evaluated and based on these evaluations an amplitude is assigned to the code frequency component. Methods and apparatus for detecting a code in an encoded audio signal are also provided. A code frequency component in the encoded audio signal is detected based on an expected code amplitude or on a noise amplitude within a range of audio frequencies including the frequency of the code component.

47 Claims, 20 Drawing Sheets



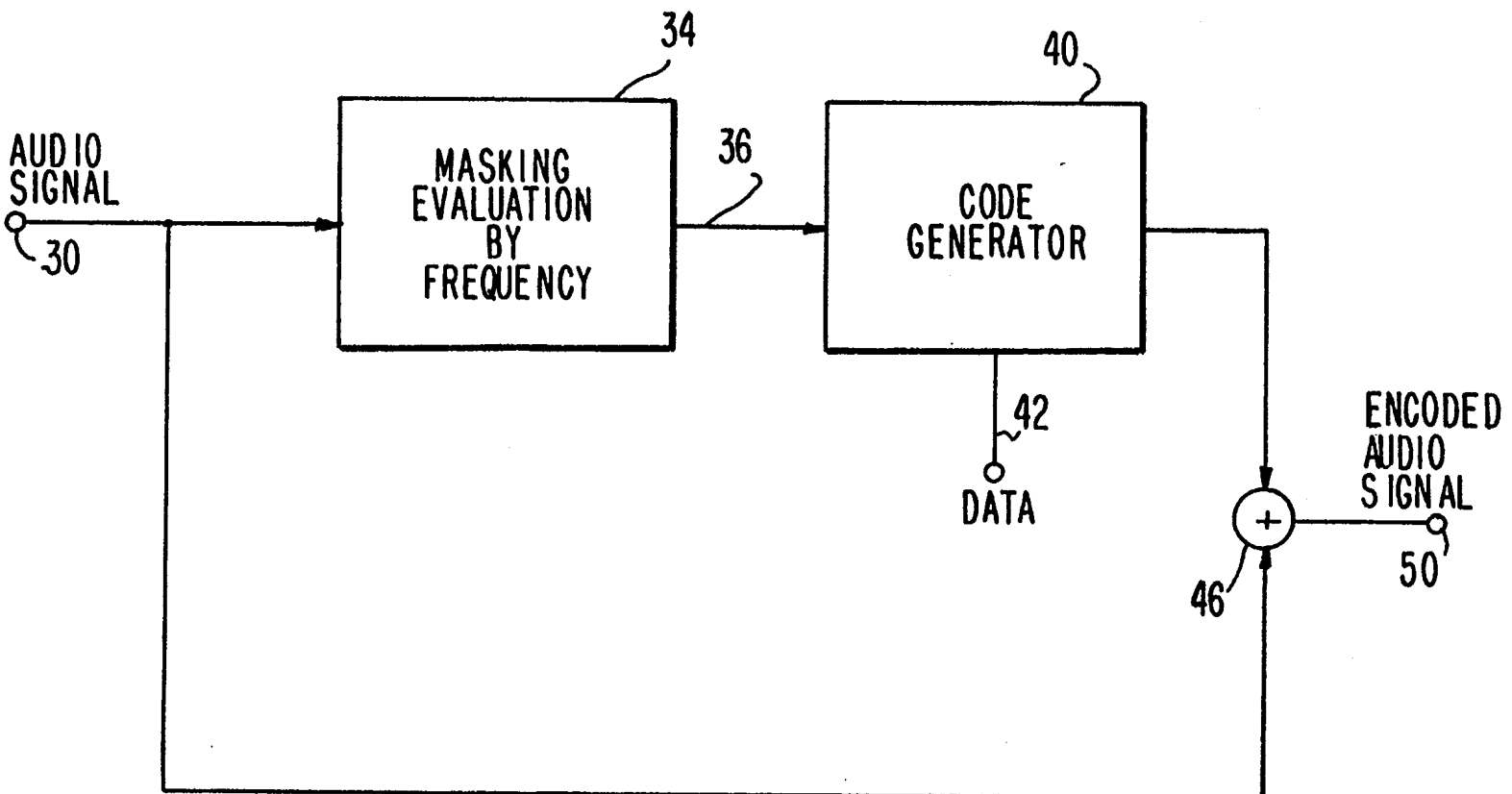


FIG. 1

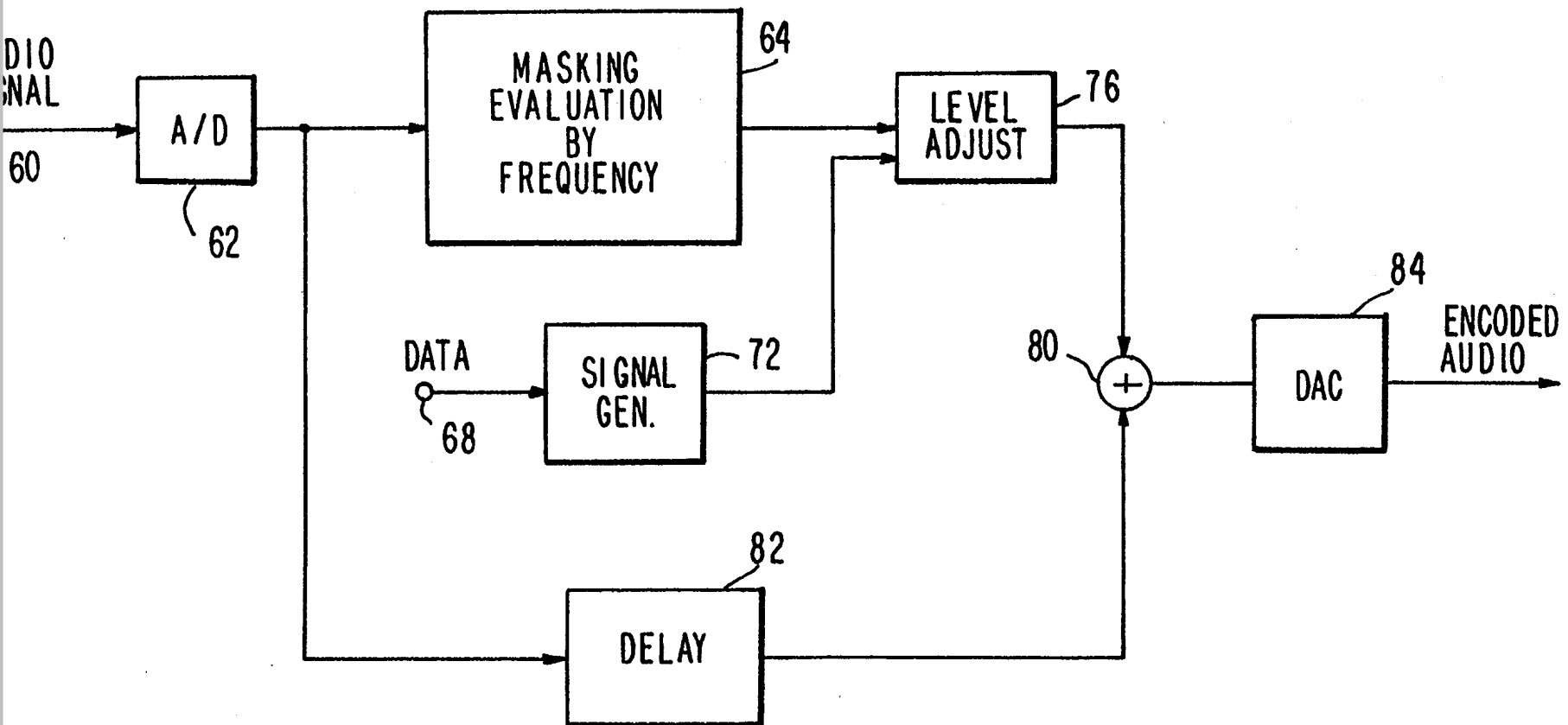


FIG. 2

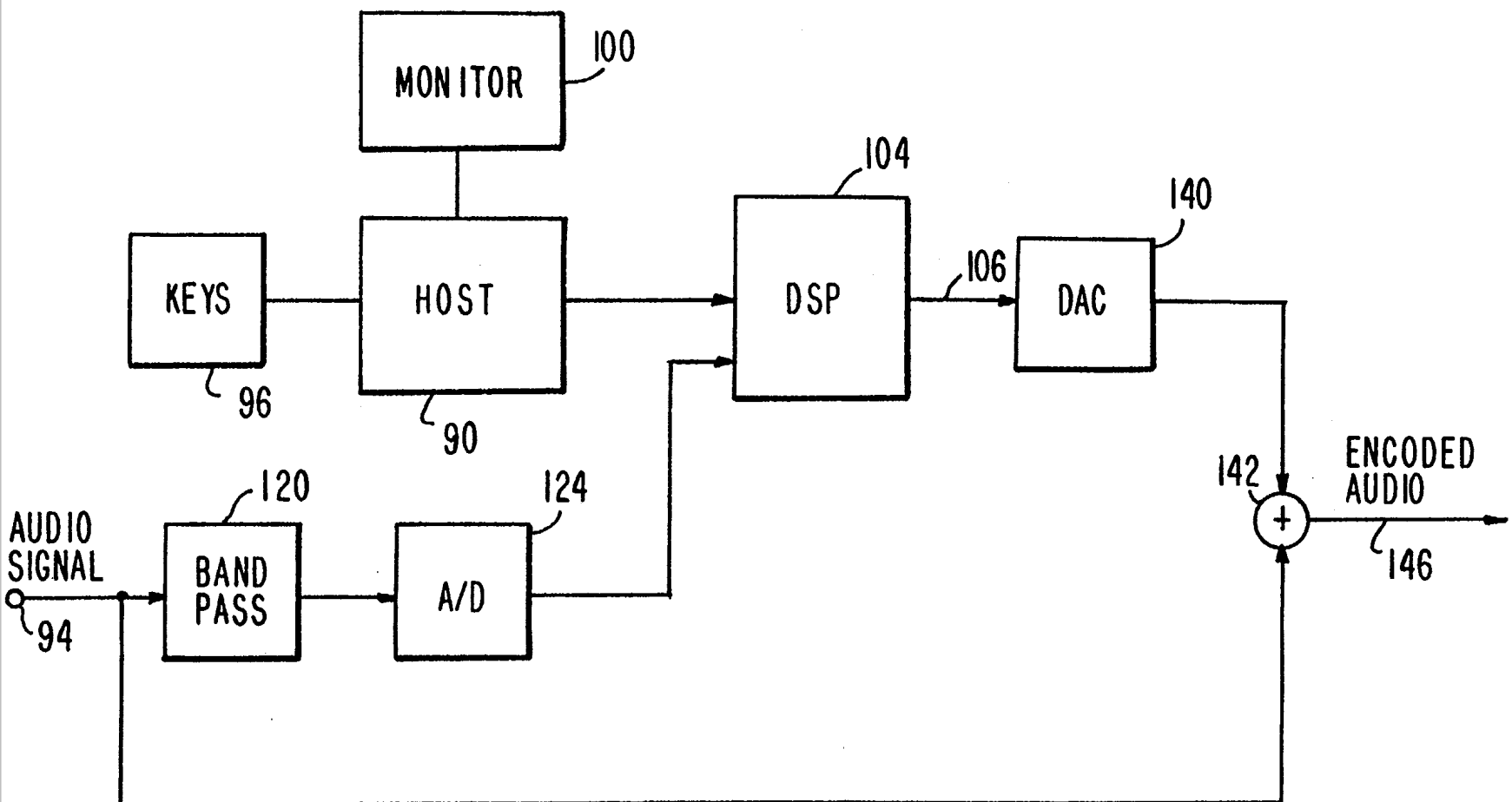


FIG. 3

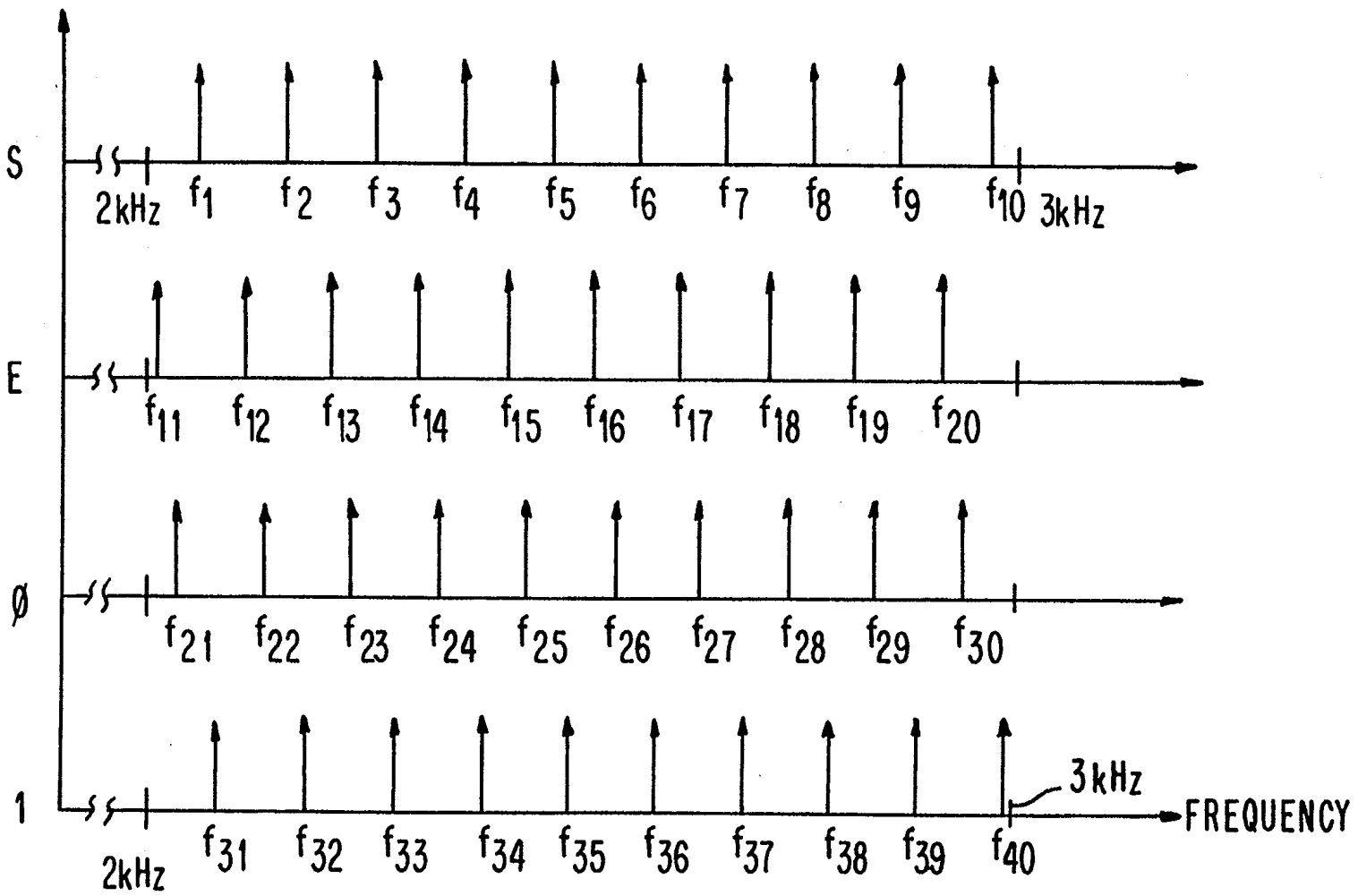


FIG. 4

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