

**United States Patent** [19]

[11] **Patent Number:** 5,691,992

Molnar et al.

[45] **Date of Patent:** Nov. 25, 1997

[54] **PUNCTURED CODING SYSTEM FOR PROVIDING UNEQUAL ERROR PROTECTION IN A DIGITAL COMMUNICATION SYSTEM**

Kjell J. Hole, "An Algorithm for Determining If a Rate  $(n-1)/n$  Punctured Convolutional Encoder is Catastrophic," *IEEE Transactions on Communications*, vol. 39, No. 3, Mar. 1991.

[75] **Inventors:** Barbara Davis Molnar; Stanley Lynn Reinhold; Amer Aref Hassan, all of Cary, N.C.

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[57] **ABSTRACT**

[21] Appl. No.: 542,276

A coding system for error protecting both insignificant and significant symbols of a digital message to be transmitted from a transmitter to a receiver of a digital system. Error protection for both insignificant and significant symbols is provided by coding at the transmitter both significant and insignificant symbols of message blocks forming the digital message. The symbol rate of the coded signal to be transmitted is reduced and unequal error protection is provided to the significant symbols by puncturing a selected number of insignificant symbols of each codeword of the coded signal. At the receiver, a correction determination is made for each received codeword as to whether the erasures and errors of the received codeword are correctable. The correction determination is a function of the number of errors, number of erasures, and the minimum distance of the code. Based on this correction determination, the received codeword is depunctured and decoded.

[22] Filed: Oct. 12, 1995

[51] Int. Cl.<sup>6</sup> ..... H03M 13/00

[52] U.S. Cl. .... 371/37.1

[58] Field of Search ..... 371/43, 37.1, 30

[56] **References Cited**

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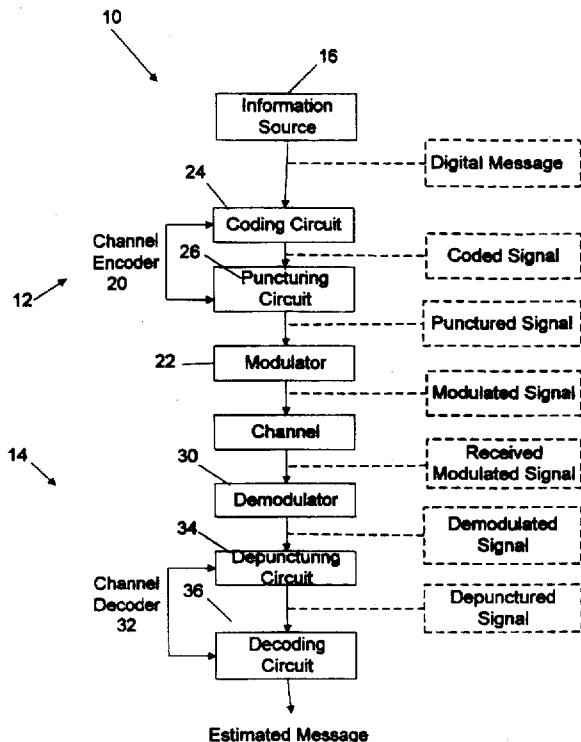
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**21 Claims, 6 Drawing Sheets**



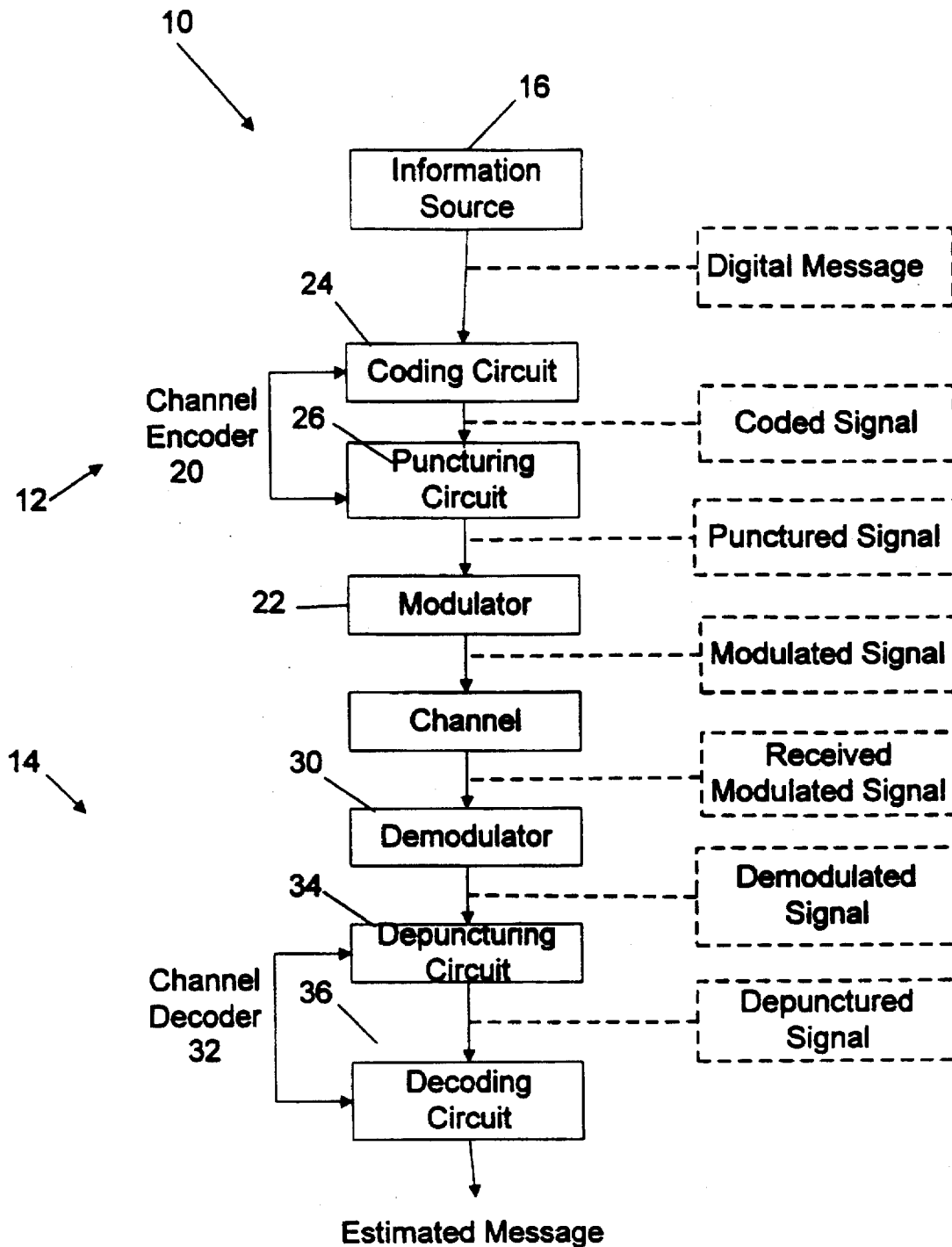


FIG. 1

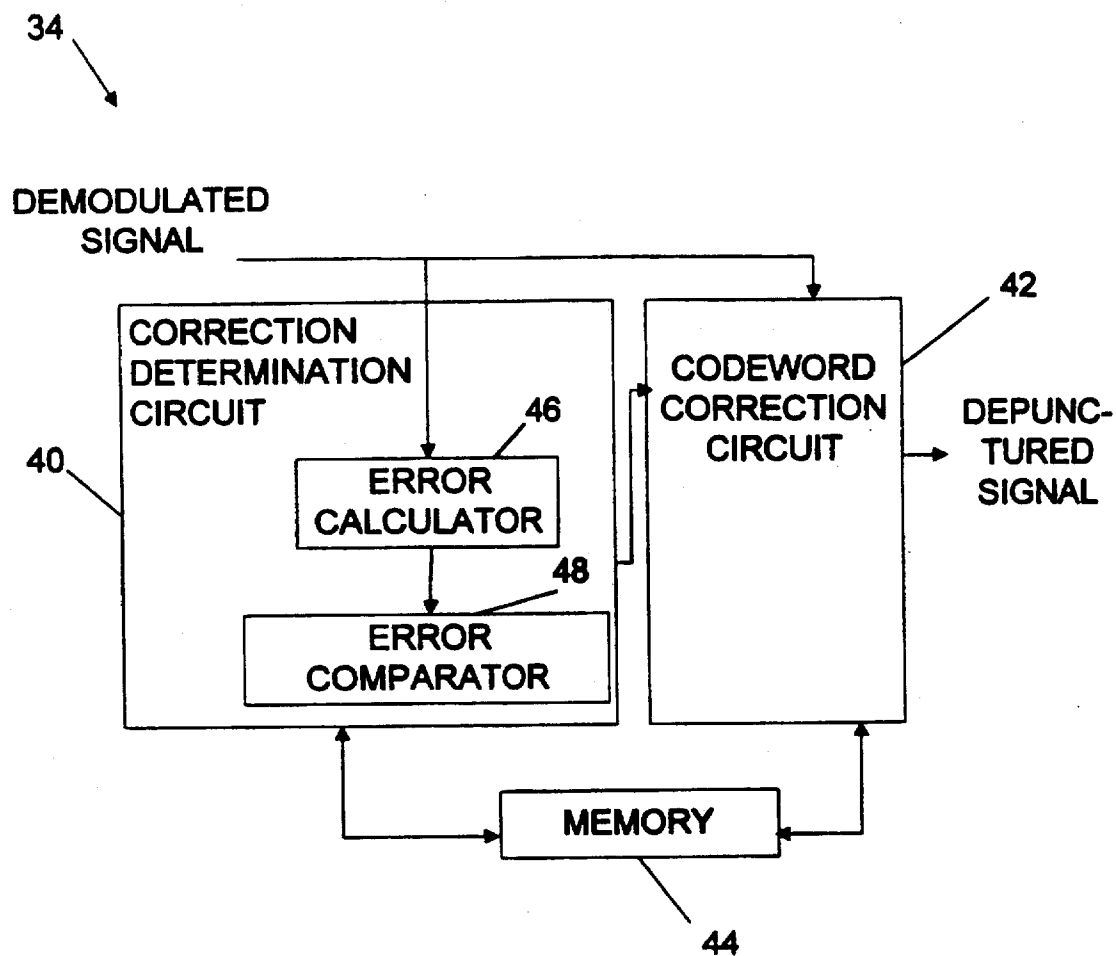


FIG. 2

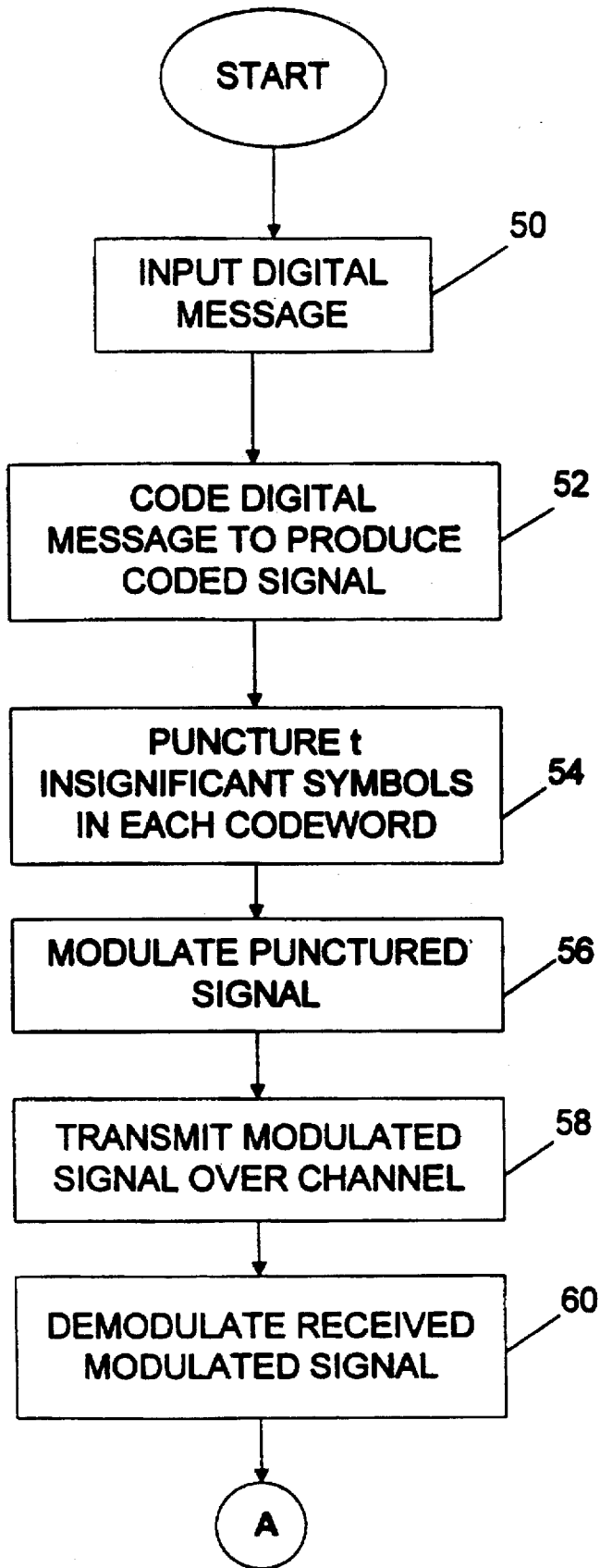


FIG. 3a

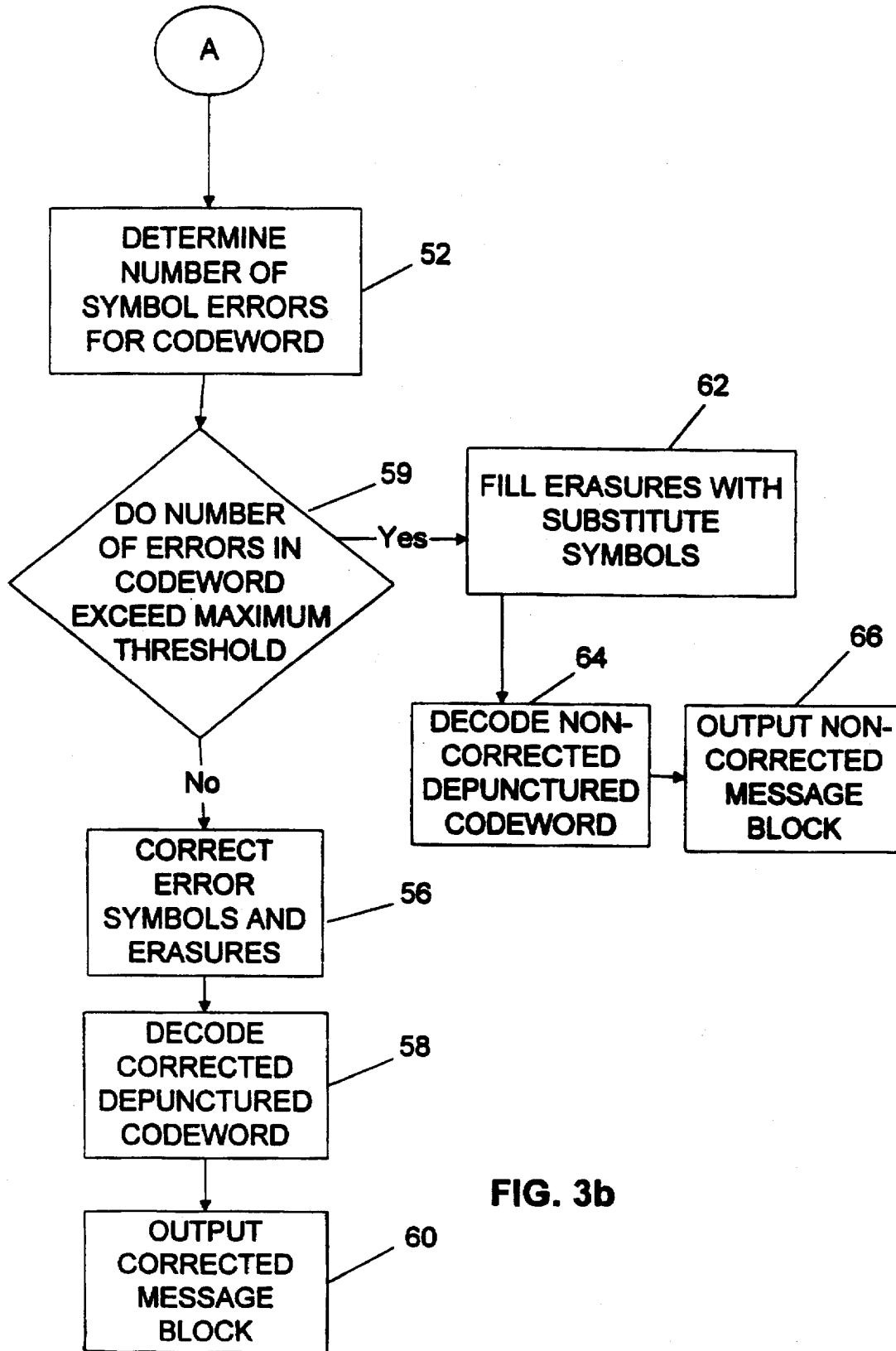


FIG. 3b

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