



United States Patent [19]

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Nakamura et al.

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[54] **QUADRATURE AMPLITUDE MODULATION COMMUNICATION SYSTEM WITH TRANSPARENT ERROR CORRECTION**

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[30] **Foreign Application Priority Data**

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[51] Int. Cl.⁵ **H04L 05/12**
[52] U.S. Cl. **375/39; 371/37.5**
[58] Field of Search **375/39, 27, 42, 27, 375/39, 42; 371/37.1, 37.5, 43**

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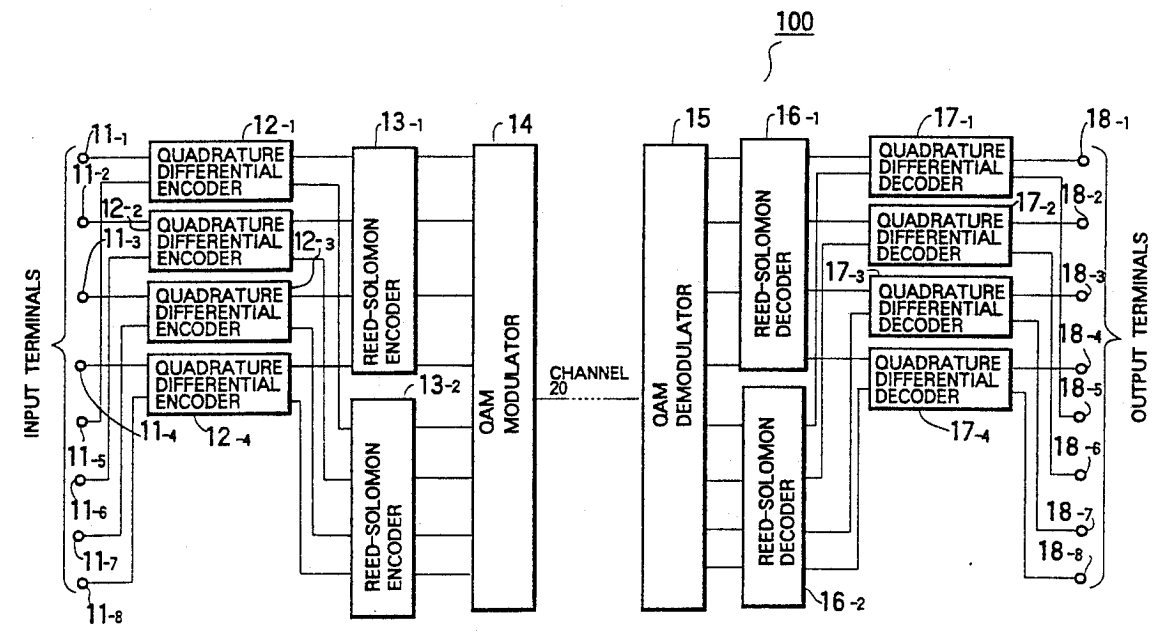
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Primary Examiner—Curtis Kuntz
Assistant Examiner—T. Ghebretinsae
Attorney, Agent, or Firm—Foley & Lardner

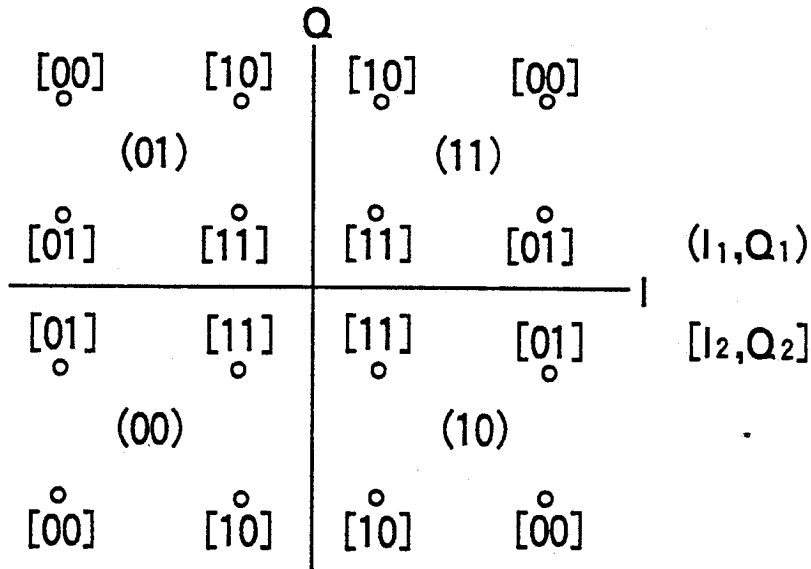
[57] **ABSTRACT**

In a multi-level QAM communication system, Reed-Solomon encoders and Reed-Solomon decoders are employed for error correction purposes. The phase ambiguity of the received signal is eliminated with differential coding. The multi-level QAM communication system utilizing n bits ("n" being an integer) QAM signal having 2ⁿ signal points, comprises: a quadrature differential encoder/decoder unit for differentially encoding/decoding n pieces of input digital signal series to produce n pieces of differentially coded signal series; an error correction unit including a Reed-Solomon encoder and a Reed-Solomon decoder, provided inside the quadrature differential encoder/decoder unit along a signal processing path of the input digital signal series, for error-correcting the n pieces of differentially-coded signal series by utilizing at least one of the digital signal series with employment of a Reed-Solomon code; and, a QAM modulator/demodulator unit for QAM-modulating/demodulating n pieces of error-corrected signal series so as to produce 2ⁿ QAM signals.

16 Claims, 14 Drawing Sheets



PRIOR ART
FIG. 1
 (GRAY MAPPING)



PRIOR ART
FIG. 2
 (QUADRANT SYMMETRY MAPPING)

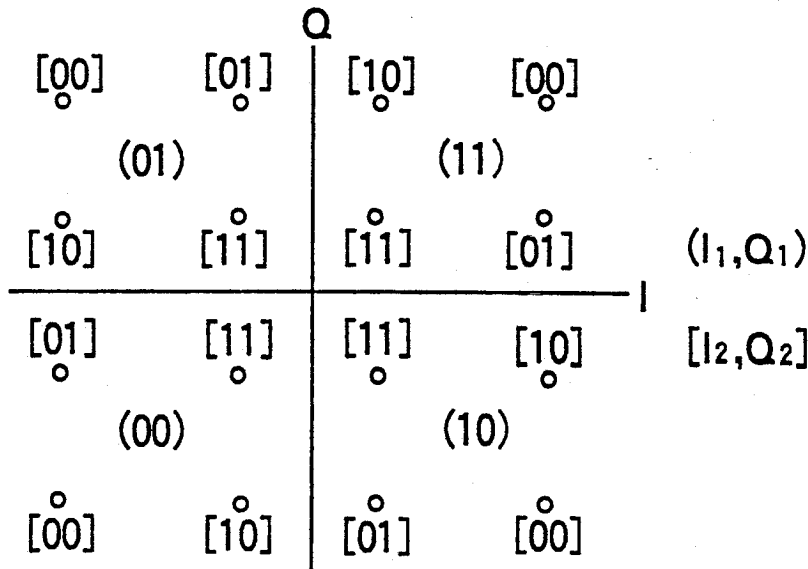
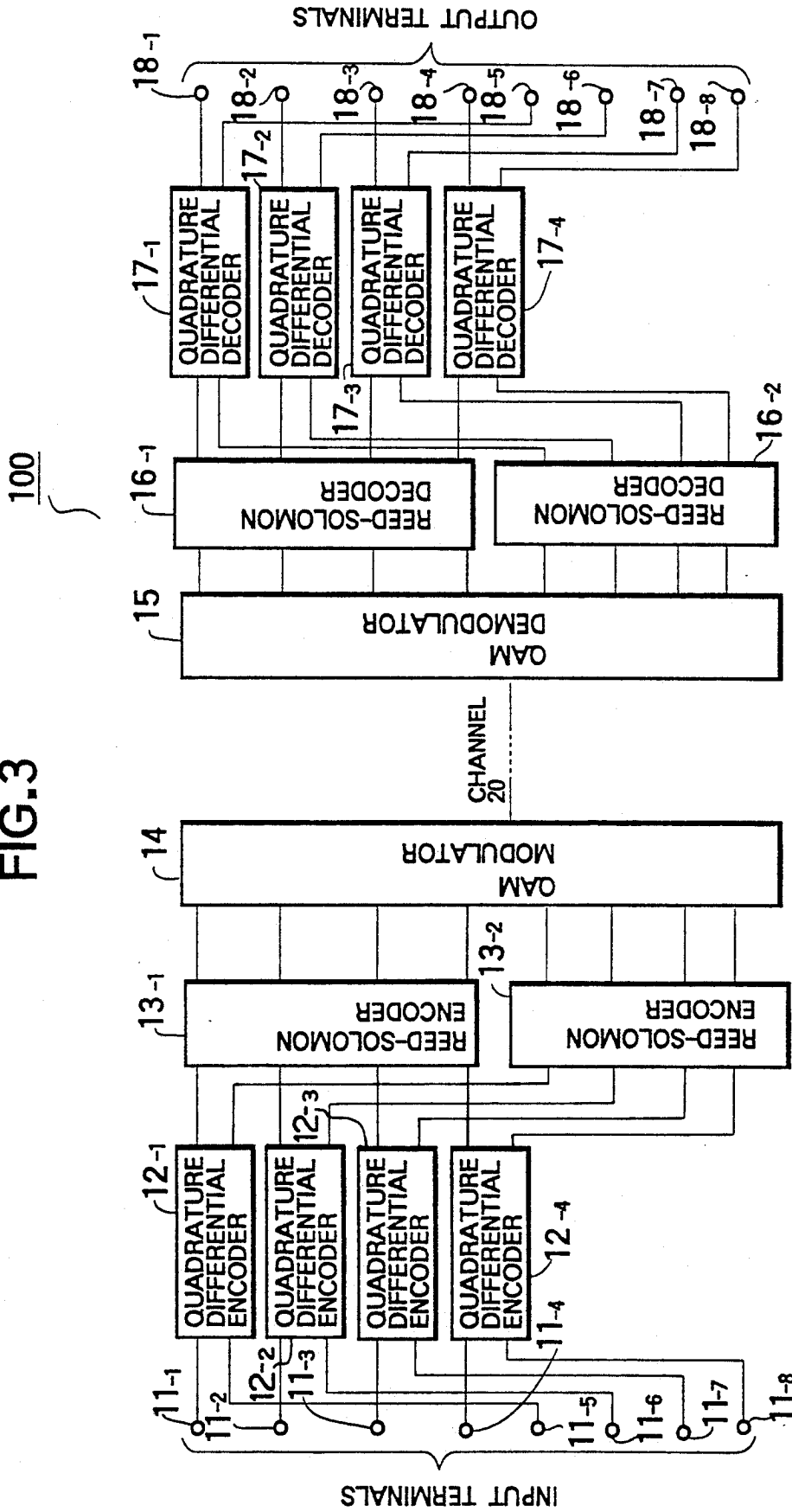


FIG. 3



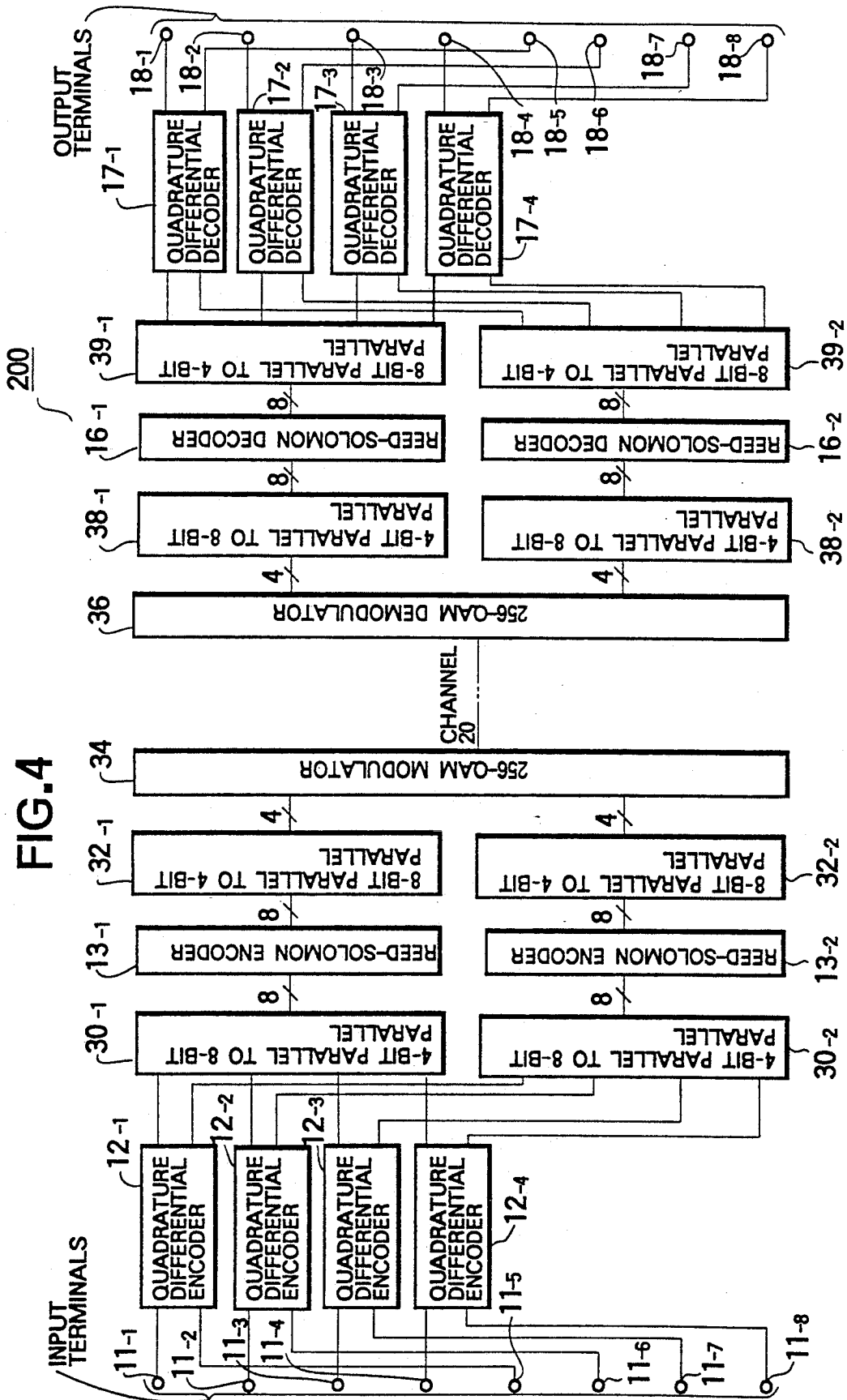
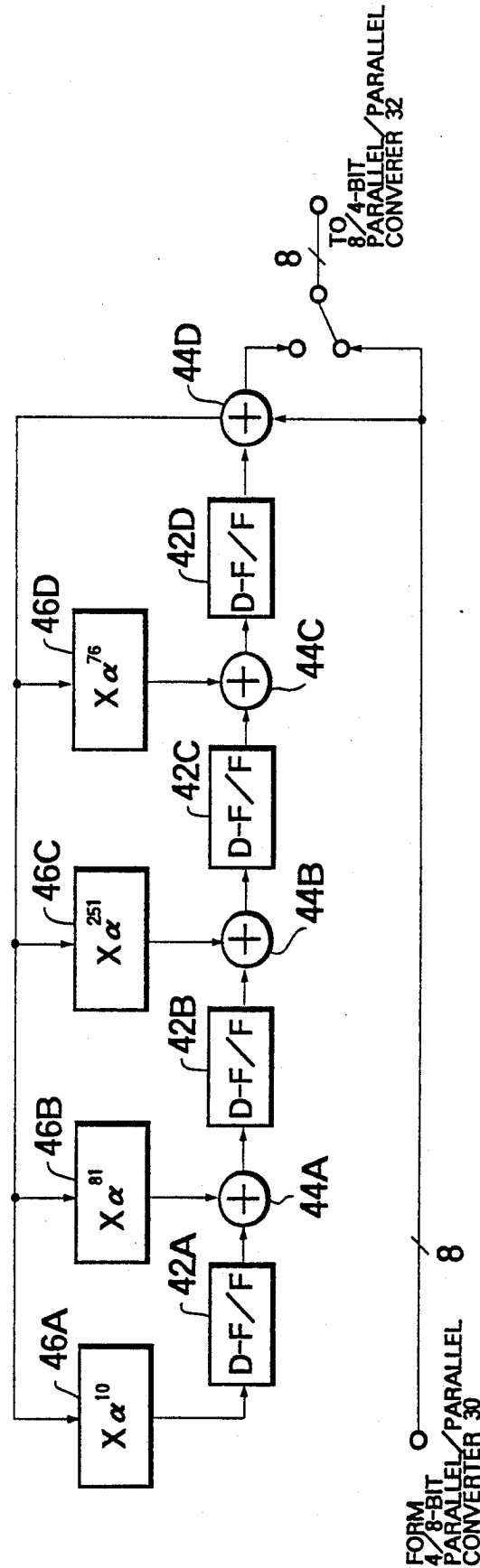


FIG. 4

FIG. 5

REED-SOLOMON ENCODER 13



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