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(54) **METHOD AND APPARATUS FOR ENCODING/FRAMING FOR MODULATED SIGNALS OVER IMPULSIVE CHANNELS**

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(58) Field of Search 375/260, 240.24, 375/240.27, 267; 714/755, 758; 370/468, 479, 480

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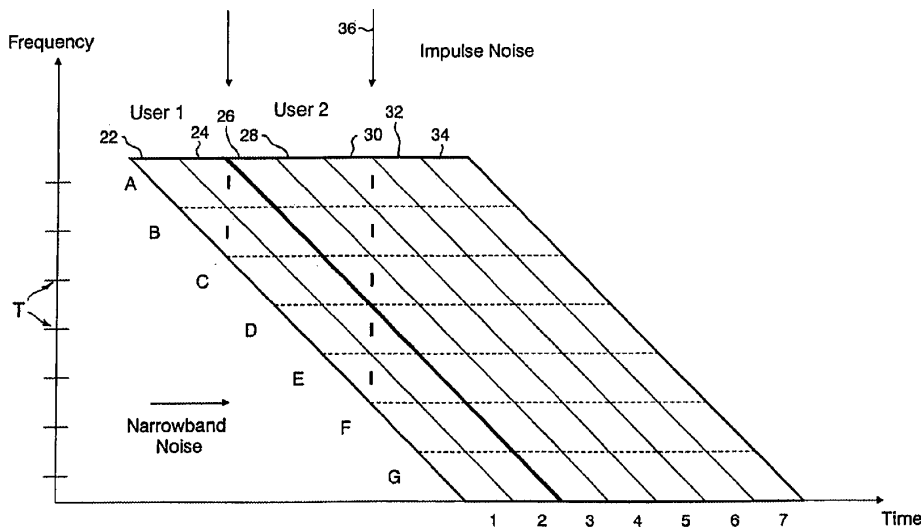* cited by examiner

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(57) **ABSTRACT**

An encoding/framing scheme for multitone modulation over impulsive channels which allows efficient operation in multipoint to point channels which are affected by ingress (narrowband noise) and impulsive (burst) interference. The coding is achieved using a concatenated approach, with the inner code being Trellis Coded Modulation (TCM), using, for example, convolutional coding, and the outer code being a Reed Solomon (RS) code. Two dimensional interleaving is performed, with one dimension being time, and the other dimension being frequency (tones or sub-channels). The TCM coding provided by the present invention is quite effective in dealing with impulse noise effects. The interleaving may be applied in two levels. According to one embodiment, user data is RS encoded, and a portion of the RS encoded data is interleaved and filled along columns for transmission using a multitone transmission system. The remaining portion of the RS encoded user data is then TCM encoded, interleaved and effectively filled along rows for subsequent transmission. In another embodiment, a portion of the user data is RS encoded, interleaved and filled along columns for transmission, while the remaining portion of the user data is instead TCM encoded, interleaved and effectively filled along rows for subsequent transmission. A diagonalization scheme is also used to provide immunity against impulse noise, while at the same time allowing for a simple method of utilizing tones of different loading. According to the diagonalization principle, data packets are spread over time in a diagonal fashion, such that an impulse noise affects more than one user's packets, with the effect on each being reduced. In this way, a code having lower redundancy can be used since the amount of corruption expected in one user's data packet will be reduced.
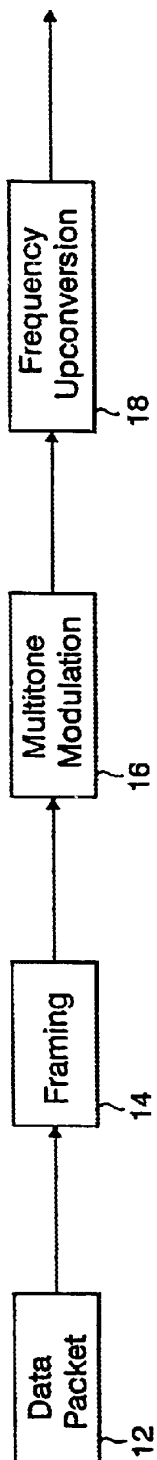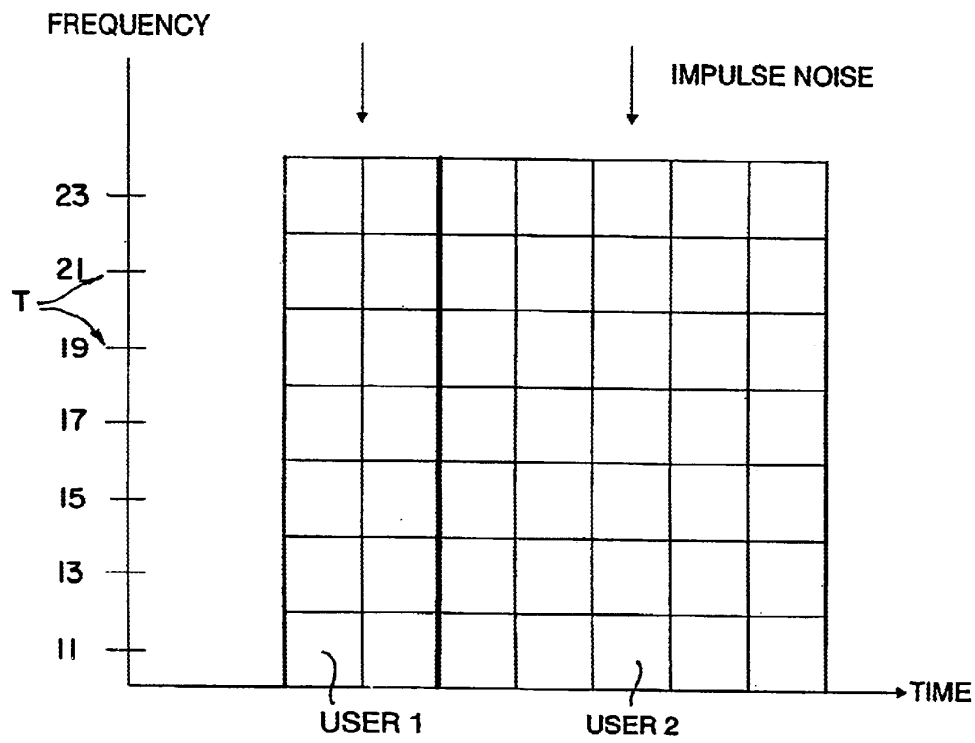
42 Claims, 6 Drawing Sheets
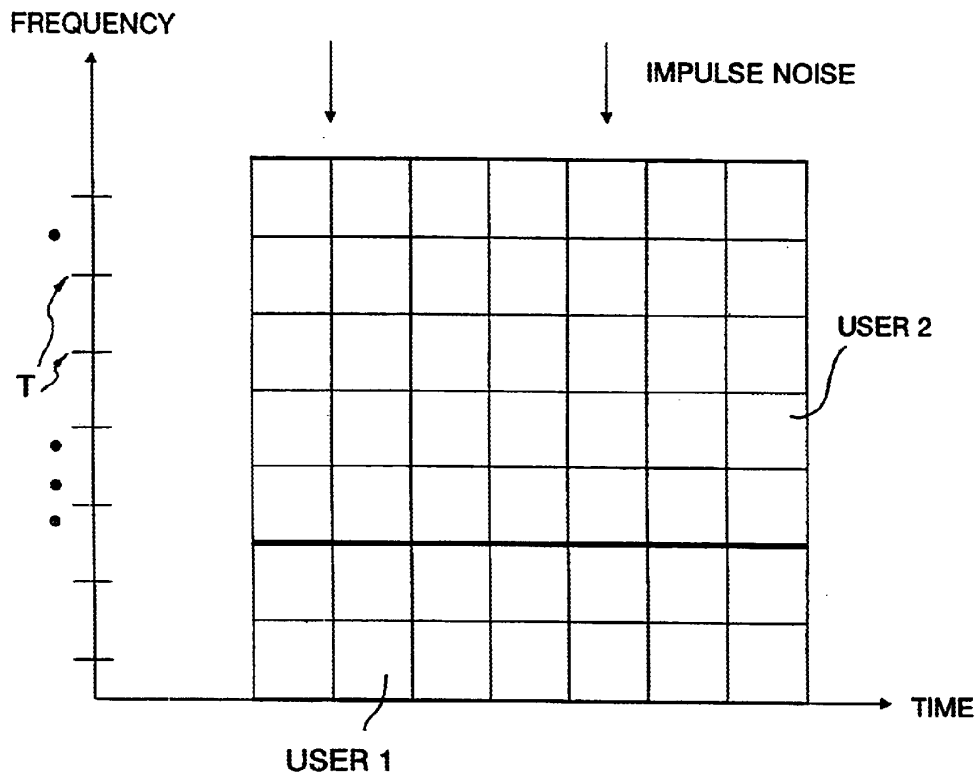
FIG. 1
PRIOR ART

FIG. 2
PRIOR ART

FIG. 3A
PRIOR ART

FIG. 3B
<u>PRIOR ART</u>

DOCKET ALARM
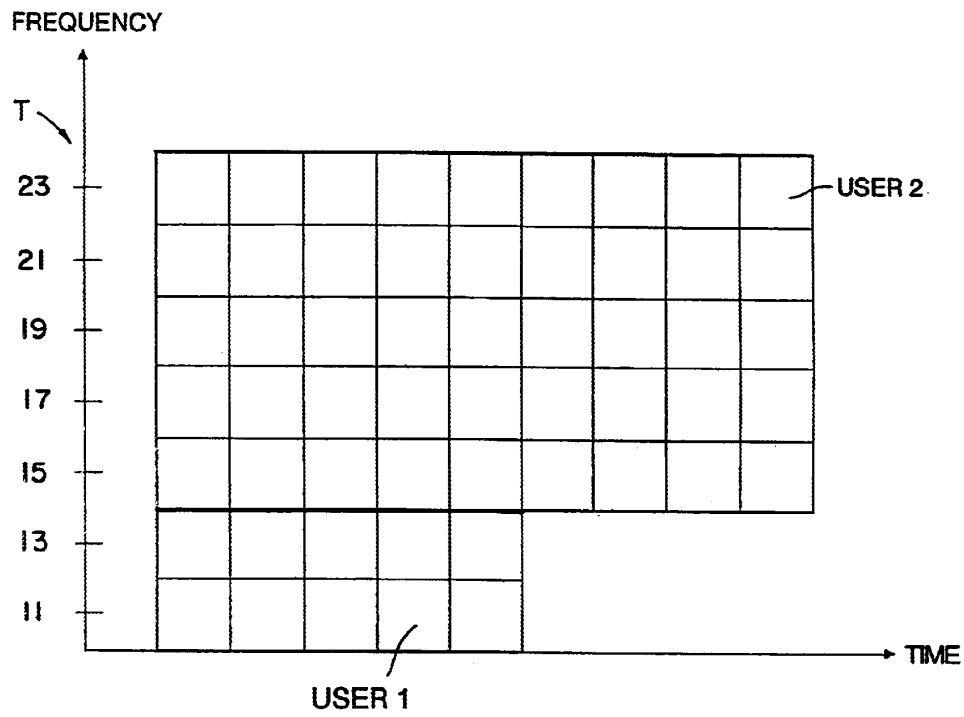
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