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Ma et al.

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(54) **SCATTERED PILOT PATTERN AND CHANNEL ESTIMATION METHOD FOR MIMO-OFDM SYSTEMS**

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Related U.S. Application Data

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(51) **Int. Cl.**

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H04Q 7/00	(2006.01)
H04B 7/216	(2006.01)
H04B 7/02	(2006.01)
H04L 27/00	(2006.01)

(52) **U.S. Cl.** **370/208**; 370/328; 370/335; 370/342; 370/441; 375/299; 375/316; 455/101

(58) **Field of Classification Search** 370/208, 370/203, 334, 435, 437, 465, 491, 500
See application file for complete search history.

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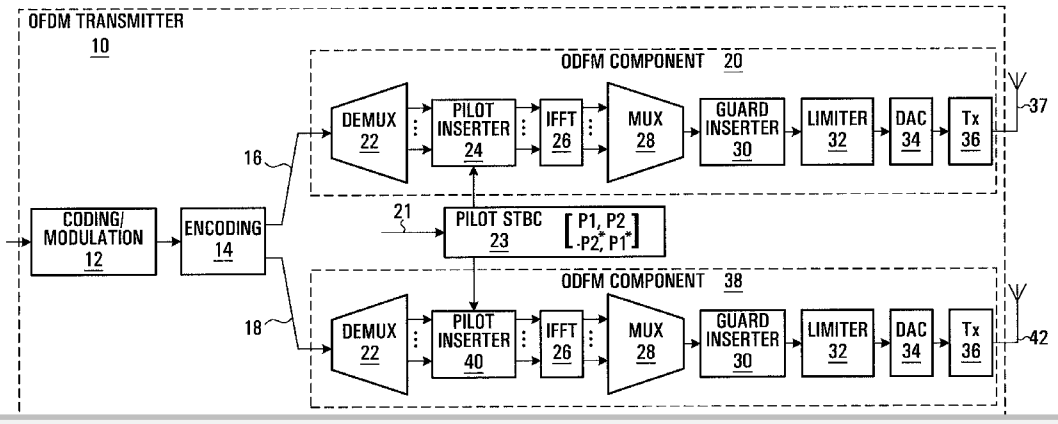
Assistant Examiner—Melanie Jagannathan

(57) **ABSTRACT**

A method and apparatus are provided for reducing the number of pilot symbols within a MIMO-OFDM communication system, and for improving channel estimation within such a system. For each transmitting antenna in an OFDM transmitter, pilot symbols are encoded so as to be unique to the transmitting antenna. The encoded pilot symbols are then inserted into an OFDM frame to form a diamond lattice, the diamond lattices for the different transmitting antennae using the same frequencies but being offset from each other by a single symbol in the time domain. At the OFDM receiver, a channel response is estimated for a symbol central to each diamond of the diamond lattice using a two-dimensional interpolation. The estimated channel responses are smoothed in the frequency domain. The channel responses of remaining symbols are then estimated by interpolation in the frequency domain.

44 Claims, 7 Drawing Sheets



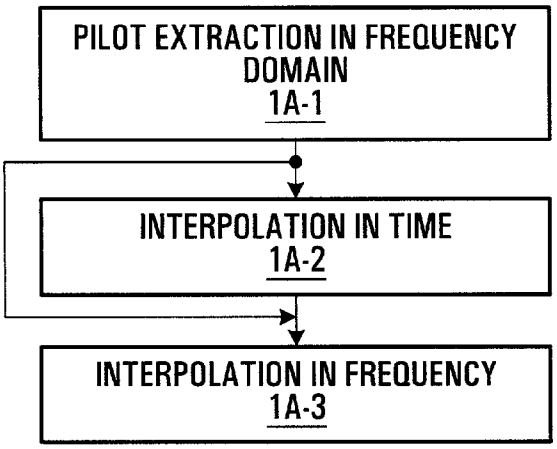


FIG. 1A
(PRIOR ART)

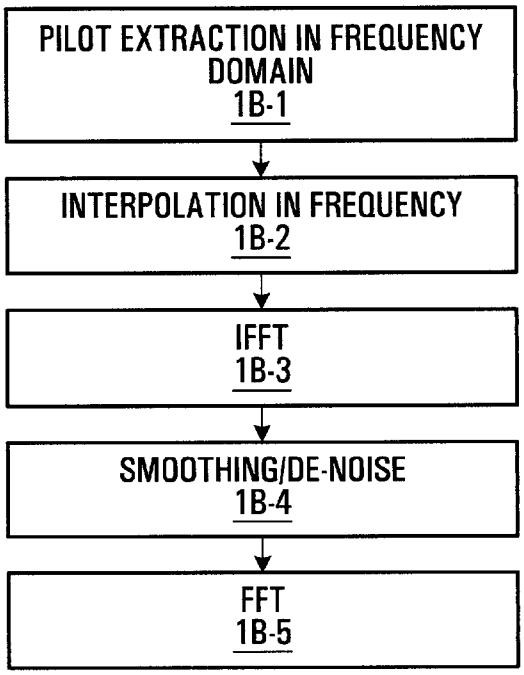


FIG. 1B
(PRIOR ART)

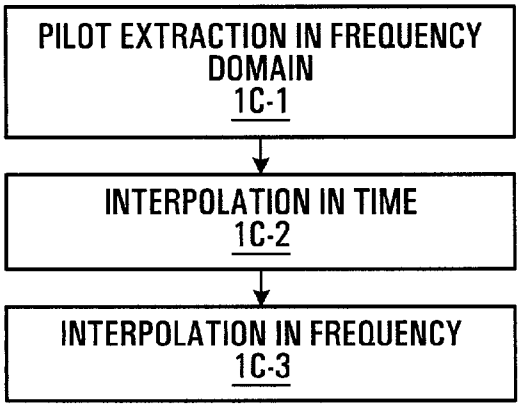


FIG. 1C
(PRIOR ART)

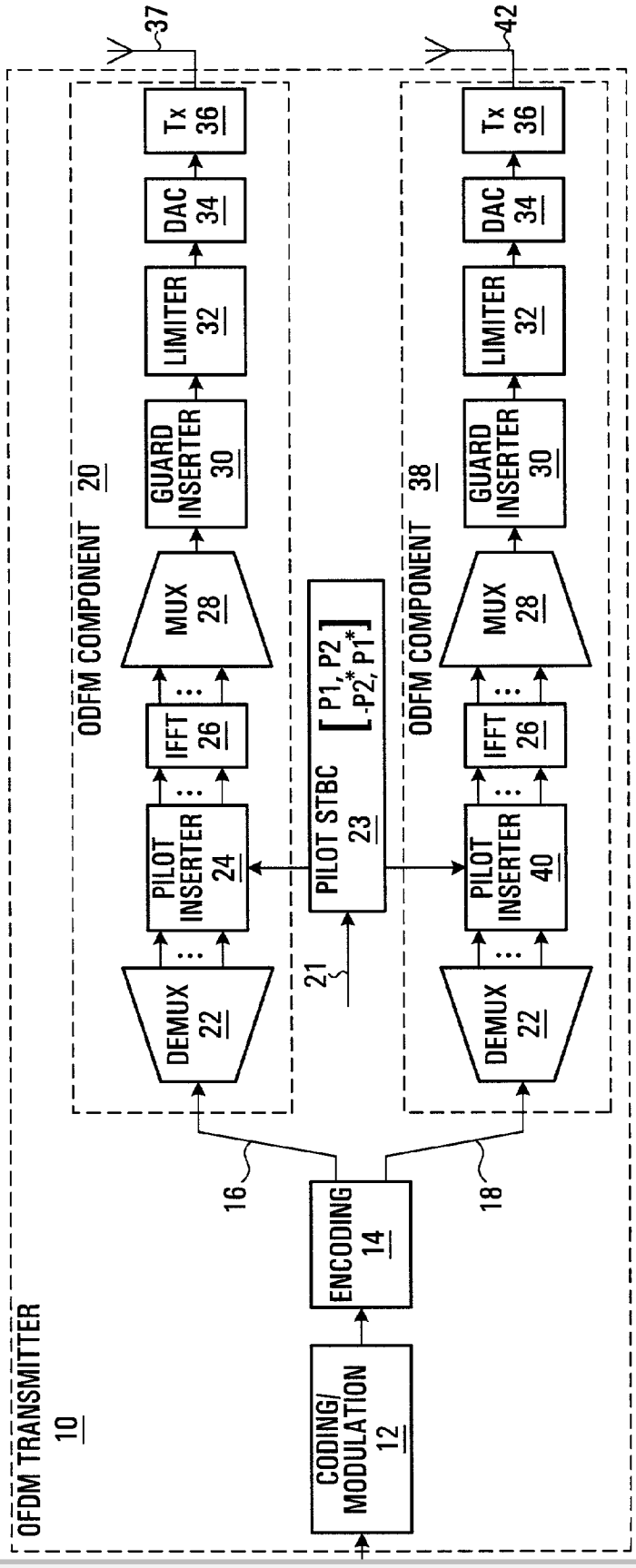


FIG. 2

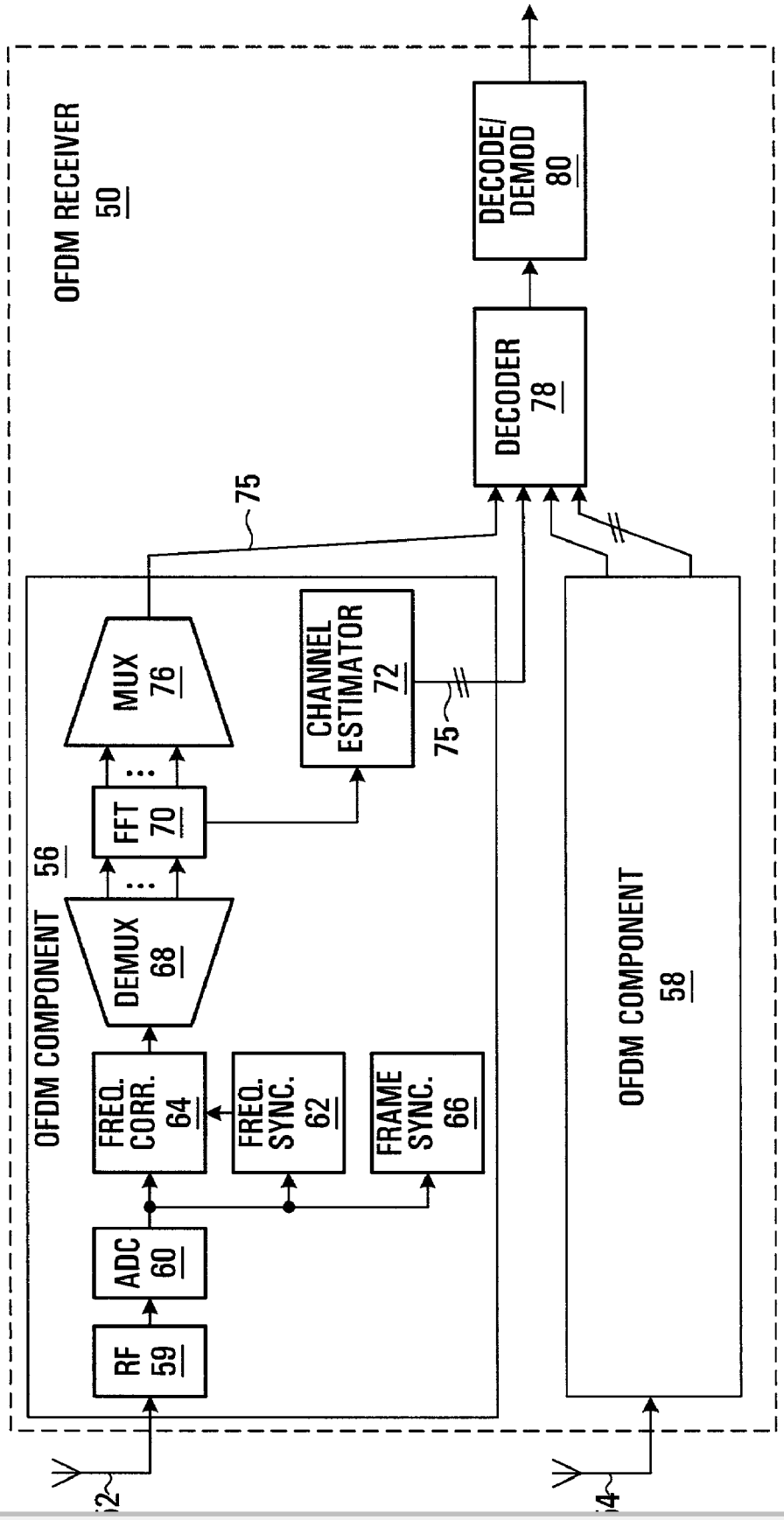


FIG. 3

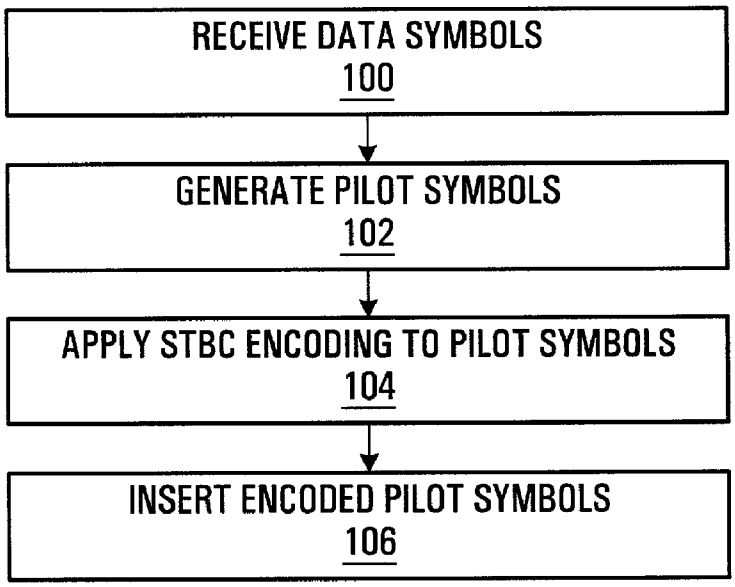


FIG. 4

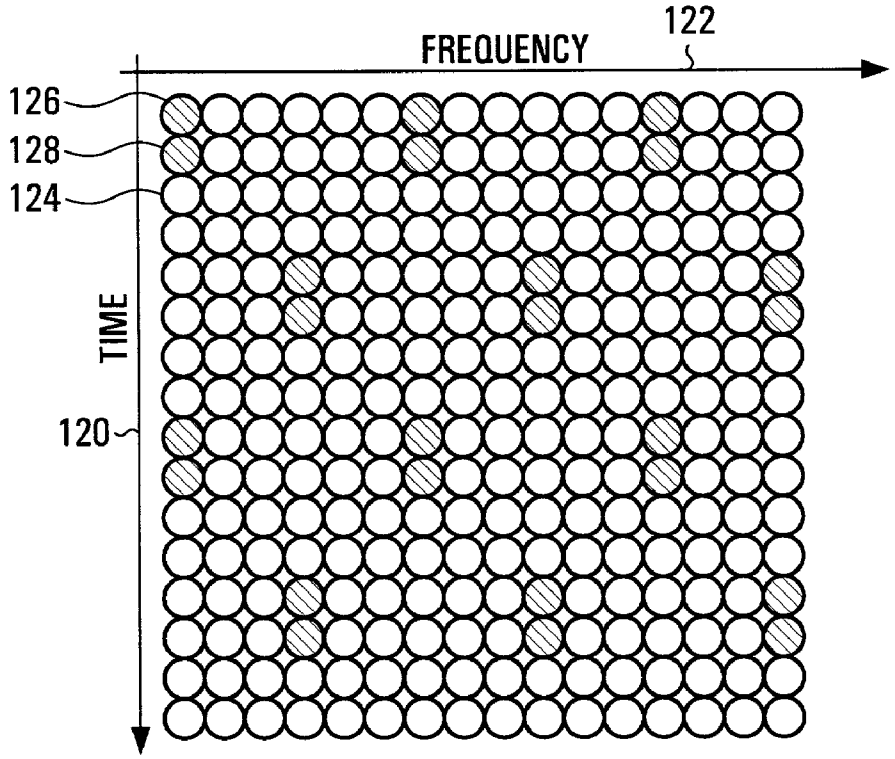


FIG. 5

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