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(54) **CAPACITY ACHIEVING MULTICARRIER
MODULATION AND CODING SYSTEMS
AND METHODS**

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ABSTRACT

Related U.S. Application Data

(63) Continuation of application No. 16/400,273, filed on
May 1, 2019, now Pat. No. 11,381,257.

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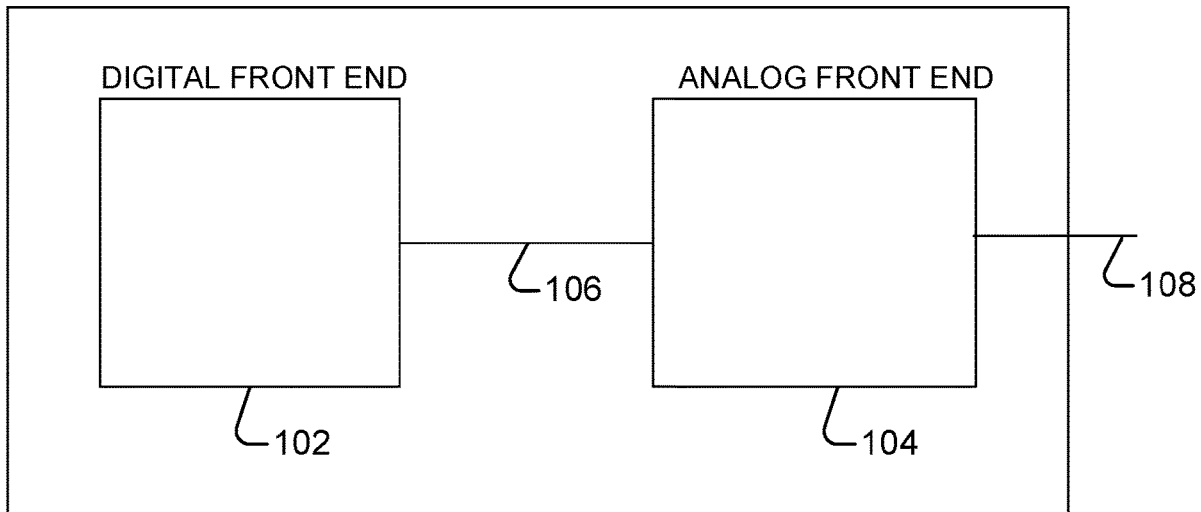
A multi-carrier transmitter apparatus is disclosed. The apparatus includes an outer encoder, a shell mapper and an inner encoder. The outer encoder is configured to receive a signal, perform error correction using an outer code on the received signal and generate an outer encoder signal. The shell mapper is configured to perform constellation shaping on a subset of bits from the outer encoder signal and generate one or more constellation shaping bits. The inner encoder is configured to perform inner error correction/encoding using an inner code on a second subset of bits from the outer encoder signal and generate an inner correction signal.

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**WIRED
COMMUNICATION
SYSTEM e.g., xDSL**