Paper No. ___
Filed: November 21, 2017

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

CALIFORNIA INSTITUTE OF TECHNOLOGY,
Patent Owner.

Case IPR2017-00728
Patent No. 7,421,032

PATENT OWNER'S RESPONSE
PURSUANT TO 37 C.F.R. § 42.120

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I. STATEMENT OF PRECISE RELIEF REQUESTED

Apple, Inc. ("Petitioner") filed a petition for *inter partes* review of various claims of U.S. Patent No. 7,421,032 (the "'032 patent", EX1201). The patent owner ("Caltech") hereby requests that the Board now issue a final written decision confirming that claims 18-23 are not unpatentable.

II. INTRODUCTION AND OVERVIEW OF ARGUMENT

The '032 patent is one of four Caltech patents that resulted from research performed by the inventors, Dr. Jin, Dr. Khandekar, and Dr. McEliece, in 1999-2000. The patents claim inventions directed to a revolutionary class of error-correction codes, dubbed "irregular repeat and accumulate codes," or "IRA codes," which surpassed the performance of the best known codes at that time. One of the features that made IRA codes superior to other known codes, however, was their capability of being encoded *and* decoded with linear complexity, a critical requirement for most practical applications. No other code known at the time could boast linear encoding, linear decoding, and performance near the theoretical Shannon limit.

In arguing that the instituted claims are unpatentable, Petitioner relies chiefly on three prior art references: the MacKay reference, which discloses randomly generated parity-check matrices (which are "irregular" in the sense that 11 of 12 columns are weight 3 and 1 of 12 columns are weight 9), the Ping reference, which

describes a method of improving random parity-check matrices of the type described by MacKay by imposing certain structural constraints to the matrix, and the Divsalar reference, which describes an altogether different kind of code: a simple "turbo-like" code created for the purpose of proving a mathematical conjecture.

Petitioner's obviousness challenges are lacking in many respects. In ascribing motivation to combine the asserted references, Petitioner attempts to take MacKay's teachings about nonuniform column weights in a *full* parity-check matrix and apply it to only a *part* of Ping's parity-check matrix. Yet nothing in MacKay teaches the propriety of applying a general aspect of a full matrix to merely a part of a matrix in a different code. Indeed, Ping's parity-check matrix as a whole is already "irregular" (in fact, more "irregular") according to MacKay's teachings, and neither reference provides any motivation to add *more* irregularity to *part* of the matrix, as Petition proposes. To the contrary, Petitioner's proposed combination ignores and destroys fundamental constraints of Ping's codes imposed explicitly for performance reasons. Ping's code is presented as an improvement over random parity-check matrices like those in MacKay, and modifying it in light of MacKay would have been viewed as a step backwards. There would simply be no motivation to modify Ping in light of the fact it already achieves what MacKay

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