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Paper 58
Entered: April 14, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LSI CORPORATION and AVAGO TECHNOLOGIES U.S., INC.,
Petitioner,

v.

REGENTS OF THE UNIVERSITY OF MINNESOTA,
Patent Owner.

IPR2017-01068
Patent 5,859,601 B2

Before JENNIFER S. BISK, ROBERT J. WEINSCHENK, and CHARLES J. BOUDREAU, *Administrative Patent Judges*.

BISK, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

LSI Corporation and Avago Technologies U.S., Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1, 2, 8, 10, 12–17, and 21 of U.S. Patent No. 5,859,601 B2 (Ex. 1001, "the '601 patent"). Paper 1 ("Pet."). Regents of the University of Minnesota ("Patent Owner"), identified as the owner of and real party in interest to the '601 patent (Paper 3, 2), did not file a Preliminary Response. Paper 34 (Patent Owner's Waiver of Preliminary Response). On February 14, 2020, Patent Owner filed a statutory disclaimer of claims 1–12, 15, 16, and 21. Ex. 2004. We instituted this review of Petitioner's challenges to claims 13, 14, and 17, the only remaining challenged claims of the '601 patent. Paper 35 ("Inst. Dec.").

Subsequent to institution, Patent Owner filed a Patent Owner Response. Paper 41 ("PO Resp."). Petitioner filed a Reply. Paper 48 ("Reply").[1] Patent Owner also filed a Sur-Reply. Paper 51 ("Sur-Reply"). A transcript of the oral hearing held on January 19, 2021, has been entered into the record as Paper 57 ("Tr.").

This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a). For the reasons that follow, Petitioner has demonstrated by a preponderance of the evidence that claim 13 of the '601 patent is unpatentable, but has not demonstrated by a preponderance of the evidence that claims 14 and 17 are unpatentable.

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[1] Petitioner filed two versions of the Reply Brief, a confidential version (Paper 48), and a redacted version available to the public (Paper 46). For purposes of this Decision, we refer to the public version of the brief.

II. BACKGROUND

A. Related Matters

The parties indicate that the ’601 patent is involved in litigation, *Regents of the University of Minnesota v. LSI Corp.*, No. 0:16-cv-02891-WMW-SER (D. Minn).[2] Pet. 69; Paper 3, 2.

B. The ’601 Patent

The ’601 patent, titled “Method and Apparatus for Implementing Maximum Transition Run Codes,” issued January 12, 1999. Ex. 1001, codes (45), (54). The ’601 patent relates generally to “a channel coding technique to improve data storage devices such as magnetic computer disk drives and professional and consumer tape recorders.” *Id.* at 2:40–43. In particular, the ’601 patent describes using maximum transition-run (“MTR”) coding to eliminate the storage of certain binary data patterns determined to be error-prone. *Id.* at 2:43–47. According to the ’601 patent, using MTR coding significantly improves the final bit error rate. *Id.* at 2:47–49.

The ’601 patent describes MTR coding as “impos[ing] a limit on the maximum number of consecutive transitions that can occur in the written magnetization pattern in magnetic recording.” *Id.* at 2:59–61. In particular, performance is improved most significantly “when the maximum number of consecutive transitions [referred to as ‘constraint length j’] is limited to two.” *Id.* at 2:62–65.

In addition to MTR coding, the ’601 patent describes prior art coding methods, such as Runlength limited (“RLL”) codes, which “impose a (d,k)

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[2] On February 7, 2018, the identified case was transferred to the Northern District of California as No. 5:18-cv-00821-EJD (N.D. Cal.).

constraint on the recorded data sequence." *Id.* at 1:21–24. In describing RLL codes, the '601 patent describes two commonly used formats for recording binary data: (1) Non-Return-to-Zero ("NRZ"), in which "the binary '1' represents a positive level in the magnetization waveform and the binary '0' [represents a] negative level in the same waveform"; and (2) Non-Return-to-Zero-Inversion ("NRZI"), in which a 1 represents a magnetic transition and a 0 represents no transition. *Id.* at 1:24–36. For NRZ formatting, d+1 defines the minimum number of consecutive like symbols and k+1 defines the maximum number of consecutive like symbols in the sequence. *Id.* at 1:24–29. For NRZI formatting, "d and k are the minimum and maximum number of consecutive 0's between any two 1's, respectively." *Id.* at 1:29–36.

According to the '601 patent, RLL (1,k) codes, which do not allow any consecutive transitions in an NRZ format, eliminate some patterns which cause the most errors. *Id.* at 3:53–4:17. However, this coding allows for fewer patterns overall, resulting in a lower code rate and increasing inefficiency. *Id.* at 4:18–24. MTR coding, on the other hand, "eliminate[s] all sequences with three or more consecutive transitions, but allow[s] the dibit pattern to survive," which eliminates error-prone patterns with less inefficiency than a RLL (1,k) code. *Id.* at 4:24–30. MTR parameters are written as (j;k), where j is the MTR constraint described above and "k is the usual RLL constraint." *Id.* at 4:46–48.

C. Illustrative Claim

Independent claim 13 is illustrative of the subject matter at issue and reads as follows:

> 13. A method for encoding m-bit binary datawords into n-bit binary codewords in a recorded waveform, where m and n are preselected positive integers such that n is greater than m, comprising the steps of:
>
> receiving binary datawords; and
>
> producing sequences of n-bit codewords;
>
> imposing a pair of constraints (j;k) on the encoded waveform;
>
> generating no more than j consecutive transitions of said sequence in the recorded waveform such that $j \geq 2$; and
>
> generating no more than k consecutive sample periods of said sequences without a transition in the recorded waveform.

Ex. 1001, 10:46–61.

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