NOTE: This disposition is nonprecedential.

United States Court of Appeals for the Federal Circuit

ANDREA ELECTRONICS CORPORATION,
Appellant

v.

APPLE INC.,
Appellee

2021-1248

Appeal from the United States Patent and Trademark Office, Patent Trial and Appeal Board in No. IPR2017-00626.

Decided: April 22, 2022

WILLIAM D. BELANGER, Troutman Pepper Hamilton Sanders LLP, Boston, MA, argued for appellant. Also represented by FRANK D. LIU; ANDREW PETER ZAPPIA, Rochester, NY.

JOSHUA JOHN FOUGERE, Sidley Austin LLP, Washington, DC, argued for appellee. Also represented by THOMAS ANTHONY BROUGHAN, III, JEFFREY PAUL KUSHAN; TIMOTHY Q. LI, New York, NY.

Before MOORE, *Chief Judge*, REYNA and CHEN, *Circuit Judges*.

CHEN, *Circuit Judge*.

Patent owner Andrea Electronics Corp. (Andrea) appeals the *inter partes* review decision of the Patent Trial and Appeal Board (Board) finding claims 6–9 of U.S. Patent No. 6,363,345 ('345 patent) unpatentable as obvious over Hirsch[1] in view of Martin.[2] *Apple Inc. v. Andrea Elecs. Corp.*, No. IPR2017-00626, 2020 WL 6324693 (P.T.A.B. Oct. 28, 2020) (*Board Decision*).

This case is before us for a second time after we remanded part of the case back to the Board. *Apple Inc v. Andrea Elecs. Corp.*, 949 F.3d 697 (Fed. Cir. 2020), *vacating* No. IPR2017-00626, 2018 WL 3414463 (P.T.A.B. July 12, 2018) (*Prior Board Decision*). In the first appeal, we held the Board erred by not considering an argument made by petitioner Apple Inc. (Apple) on reply that we held did not present a new legal ground and properly responded to arguments raised by the patent owner's response. *Id.* at 706. The reply argument was that Martin discloses a "current minimum" and "future minimum" in an embodiment involving multiple subwindows. *Id.* at 699, 703–04. On remand, the Board considered the argument and found the claim limitations met but failed to properly analyze the motivation to combine Hirsch with Martin. We, therefore,

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[1] H.G. Hirsch & C. Ehrlicher, *Noise Estimation Techniques for Robust Speech Recognition*, 1 International Conference on Acoustics, Speech, and Signal Processing 153 (1995). J.A. 453–456.

[2] R. Martin, *An Efficient Algorithm to Estimate the Instantaneous SNR of Speech Signals,* 92 Eurospeech 1093 (1993). J.A. 457–460.

vacate and remand. We affirm the Board's finding that Martin discloses the limitations of claim 9.

BACKGROUND

A

Our previous decision discusses the relevant technology, purported invention, and the prior art references. We therefore only provide details with particular relevance to this appeal.

Claims 6 through 9 are directed to an apparatus for canceling noise in an audio signal by detecting, for each frequency bin of the audio signal, a noise threshold using "current magnitude," "future minimum," and "current minimum" values. '345 patent, claims 6–9. The current magnitude is the value of the audio signal at a given time. *See id.* at col. 5 ll. 35–38, col. 6 ll. 23–28. The future minimum is reset periodically to the current magnitude, and then updated to the current magnitude whenever the current magnitude is smaller than the future minimum. *Id.* at col. 6 ll. 24–32, col. 10 ll. 1–4, col. 10 ll. 9–12. The current minimum is initiated periodically with the value of the future minimum, and also follows the minimum value of the current magnitude. *Id.* at col. 6 ll. 33–41, col. 9 ll. 65–67, col. 10 ll. 5–8. The current minimum is used to determine the noise threshold, and the future minimum is used for initiation and refreshing of the current minimum. *Id.* at col. 6 ll. 38–57, col. 9 ll. 54–60. Based on the threshold, a portion of the signal that is estimated to be noise is removed in a technique called spectral subtraction. *See id.* at col. 1 ll.19–21, col. 1 l. 58–col. 2 l. 10, col. 3 ll. 11–15, col. 3 ll. 24–45, col. 6 ll. 38–41, 58–61. The '345 patent purports to differ from the prior art because its method can be used on audio signals that contain continuous speech rather than requiring a signal that contains explicit non-speech segments. *See id.* at col. 2 l. 45–col. 3 l. 15, col. 3 ll. 24–45.

Independent claim 1 and dependent claims 4 and 5 together recite an "apparatus for canceling noise" comprising a "threshold detector for setting a threshold for each frequency bin" of an audio signal "in accordance with a current minimum value," which in turn is derived "in accordance with a future minimum value," which itself is "determined as the minimum value of the magnitude . . . within a predetermined period of time." *Id.* at col. 9 ll. 35–64. The dependent claims at issue in this appeal recite how the current minimum and the future minimum values are determined:

> 6. The apparatus according to claim 5, wherein said current minimum value is set to said future minimum value periodically.
>
> 7. The apparatus according to claim 6, wherein said future minimum value is replaced with the current magnitude value when said future minimum value is greater than said current magnitude value.
>
> 8. The apparatus according to claim 6, wherein said current minimum value is replaced with the current magnitude value when said current minimum value is greater than said current magnitude value.
>
> 9. The apparatus according to claim 5, wherein said future minimum value is set to a current magnitude value periodically; said current-magnitude value being the value of the magnitude of the corresponding frequency bin.

B

The prior art reference Hirsch discloses a noise estimation technique for use with spectral subtraction. J.A. 453, Abstract. Like the '345 patent, Hirsch explains that noise reduction is "usually done by detection of speech pauses to evaluate segments of pure noise" and that detecting speech pauses "is a difficult task" in practical situations, specifically "if the background noise is not stationary." J.A. 453. Hirsch acknowledges that "[s]ome approaches are known to avoid the problem of speech pause detection and to estimate the noise characteristics just from a past segment of noisy speech" and cites, among other references, Martin. J.A. 453 (citing reference [6]). Hirsch notes the "disadvantage of most approaches is the need of relatively long past segments of noisy speech." J.A. 453. Hirsch then presents its spectral subtraction method for "estimat[ing] the spectral parameters of noise without an explicit speech pause detection" based on "calculat[ing] the noise level in each subband." J.A. 453. Hirsch describes testing the accuracy of its method on "[d]ifferent stationary noise signals." J.A. 454.

Hirsch's estimation method involves a noise estimate that "is calculated with a first order recursive system," in which an adaptive threshold is calculated as a weighted sum of past spectral magnitude values in a frequency subband according to a specific recursive algorithm. J.A. 453.

Martin, referenced in Hirsch, is directed to noise power estimation with a focus on using the noise power estimation to compute signal-to-noise ratios. J.A. 457–58. Martin also briefly discusses the use of the power estimation in spectral subtraction applications to reduce noise in a signal. J.A. 460. Like the '345 patent and Hirsch, Martin describes the conventional approach of acquiring noise statistics based on "noise only segments." J.A. 457. Like the '345 patent and Hirsch, Martin then explains that its proposed algorithm "does not need an explicit speech/no-speech decision to gather noise statistics." J.A. 457. Martin asserts that its algorithm is "capable [of] track[ing] non stationary noise signals and has a low computational complexity." J.A. 457. The Board found Martin discloses a specific noise-level estimation algorithm that includes the steps recited in claims 6 through 9. *Board* Decision, at *6–7. In fact, Andrea does not dispute that Martin discloses

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