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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* JOSEPH YOUQUING XIANG, YUAN ZHANG,  
SHAILESH SHRIKANT KOZAREKAR, and MICHAEL W. DEGNER

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Appeal 2015-003175  
Application 13/293,437  
Technology Center 2800

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Before TERRY J. OWENS, BEVERLY A. FRANKLIN, and  
JEFFREY R. SNAY, *Administrative Patent Judges*.

SNAY, *Administrative Patent Judge*.

DECISION ON APPEAL<sup>1</sup>

STATEMENT OF THE CASE

Appellants<sup>2</sup> appeal under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1, 3–5, 7–13, and 15–20. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

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<sup>1</sup> We cite to the Specification (“Spec.”) filed Nov. 10, 2011; Final Office Action (“Final Act.”) dated Mar. 7, 2014; Examiner’s Answer (“Ans.”); and Appellants’ Appeal Brief (“App. Br.”) and Reply Brief (“Reply Br.”).

<sup>2</sup> Appellants identify Ford Global Technologies, LLC as the real party in interest. App. Br. 2.

*Background*

The subject matter on appeal relates to electric drive torque ripple compensation. Spec. ¶ 1. In their Specification, Appellants state that “the dominating torque ripple of an interior permanent magnet motor is the electrical sixth order component which can be canceled out by injecting fifth and seventh order current harmonics into the stator winding.” *Id.* at 5. Generally, Appellants disclose that, based on finite analysis calculation for a given motor, “an optimal current waveform can be obtained to reduce electromagnetic torque ripple.” *Id.* at 9. Claim 1 is illustrative and is reproduced below from the Claims Appendix to the Appeal Brief as follows:

1. A system for controlling a vehicle including an electric machine, the system comprising a controller configured to:  
control the electric machine with an electric machine current including a plurality of current harmonic components, wherein a torque ripple of the electric machine is an electrical k-th order harmonic and wherein the current harmonic components include an electrical k-1 order harmonic component having a first magnitude and an electrical k+1 order harmonic component having a second magnitude different than the first magnitude to reduce the torque ripple.

*Rejection*

The Examiner maintained the following ground of rejection:<sup>3</sup>

Claims 1, 3–5, 7–13, and 15–20 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Schulz<sup>4</sup> and Ho.<sup>5</sup>

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<sup>3</sup> Final Act. 2–8; Ans. 2.

<sup>4</sup> US 2009/0251096 A1, published Oct. 8, 2009 (“Schulz”).

<sup>5</sup> US 6,777,907 B2, issued Aug. 17, 2004 (“Ho”).

OPINION

Appellants argue the claims as a group, relying on limitations that are common to independent claims 1, 5, and 13. *See* App. Br. 3–4; Reply Br. 2. We, therefore, limit our discussion to representative claim 1, and decide the propriety of the Rejection based on the representative claim alone.

After having considered the evidence presented in this Appeal and each of Appellants’ contentions, we are not persuaded that Appellants identify reversible error, and we sustain the Examiner’s § 103(a) rejection for the reasons expressed in the Final Action, the Answer, and below.

As is relevant to Appellants’ arguments on appeal, the Examiner found that Schulz discloses a current regulated torque control module and a harmonic cancellation synchronous regulator that, together, are configured to control an electric machine by providing a current having a plurality of current harmonic components, at least two of which components have different magnitudes. Final Act. 2. Particularly, Schulz provides a controller “for generating reduced torque ripple pulse width modulated operational control signals in a permanent magnet motor system.” Schulz ¶ 5. To that end, Schulz’s regulator is configured to generate a torque ripple reduction signal based on measured torque ripple characteristics of the motor. *Id.* at ¶ 33. The generated reduction signal includes “one or more predetermined harmonics of the current signal.” *Id.* The torque control module modifies the current in response to the torque ripple reduction signal “to generate reduced ripple operational control signals” *Id.* at ¶ 34. Significant harmonics in operating Shulz’s control scheme “appear at five, seven, eleven, thirteen, twenty-three and twenty-five times the fundamental frequency.” *Id.* at ¶ 35.

The Examiner also found that Ho teaches that torque ripple in an electric motor includes an  $n$ th harmonic torque component which is generated by the  $(n+1)^{\text{th}}$  and  $(n-1)^{\text{th}}$  harmonic currents. Ans. 4 (citing Ho col. 1, ll. 28–30). The Examiner further found that Ho specifies that the 6<sup>th</sup> harmonic component is particularly troublesome with regard to torque ripple, and can be reduced by regulating the 5<sup>th</sup> and 7<sup>th</sup> harmonics currents. Final Act. 3; Ans. 2–3. *See* Ho col. 3, l. 67 to col. 4, l. 3 (“As discussed, the 6<sup>th</sup> harmonic torque component is particularly troublesome. To reduce it, the 5<sup>th</sup> and 7<sup>th</sup> harmonics currents are regulated, as shown in FIG. 2.”).

Appellants argue that “Ho discloses regulators that drive  $n+1$  and  $n-1$  harmonics to zero to reduce the  $n^{\text{th}}$  harmonic torque,” rather than providing these current harmonic components at different magnitudes to reduce torque ripple. App. Br. 3–4. However, Appellants do not dispute the Examiner’s finding that Schulz teaches regulating current harmonic components at different magnitudes to reduce torque ripple. *See id.*; Reply Br. 2. Neither do Appellants dispute the Examiner’s finding that Ho recognizes  $n^{\text{th}}$  harmonic torque as mainly resulting from  $(n-1)^{\text{th}}$  and  $(n+1)^{\text{th}}$  current harmonic components. *See id.* Appellants’ sole argument on appeal, that Ho purportedly teaches a different scheme for modifying the  $(n-1)^{\text{th}}$  and  $(n+1)^{\text{th}}$  current harmonic components, fails to persuasively refute the Examiner’s articulated obviousness rationale which is based upon the combined teachings of Schulz and Ho. *See In re Keller*, 642 F.2d 413, 426 (CCPA 1981) (“[O]ne cannot show non-obviousness by attacking references individually where, as here, the rejections are based on combinations of references.”).

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Because Appellants do not persuade us of reversible error in the Examiner's obviousness determination based on the combined teachings of Schulz and Ho, we sustain the Rejection of claims 1, 3-5, 7-13, and 15-20.

DECISION/ORDER

The Examiner's rejection of claims 1, 3-5, 7-13, and 15-20 under 35 U.S.C. § 103(a) is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED