UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/094,866	04/08/2016	ANANDHA RUBAN TT	TI-75976	4499

23494 7590 09/18/2020

TEXAS INSTRUMENTS INCORPORATED
P O BOX 655474, MS 3999
DALLAS, TX 75265

EXAMINER
SPRENGER, KEVIN H

ART UNIT	PAPER NUMBER
2838	

NOTIFICATION DATE	DELIVERY MODE
09/18/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@ti.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ANANDHA RUBAN TT,
PREETAM CHARAN ANAND TADEPARTHY,
VIKRAM GAKHAR, and MUTHUSUBRAMANIAN NV

Appeal 2019-006383
Application 15/094,866
Technology Center 2800

Before JEFFREY T. SMITH, KAREN M. HASTINGS, and MICHAEL G. McMANUS, *Administrative Patent Judges*.

McMANUS, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), Appellant[1] seeks review of the Examiner's decision to reject claims 1–11, 13, 14, and 16–20. We have jurisdiction under 35 U.S.C. § 6(b).

We reverse.

---

[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as Texas Instruments, Incorporated. Appeal Brief dated March 4, 2019 ("Appeal Br.") 2.

CLAIMED SUBJECT MATTER

The present application generally relates to DC-DC converters used to regulate a voltage source to a fixed output voltage. Specification filed April 8, 2016 ("Spec.") ¶ 3. The Specification teaches that, where a converter has multiple DC-DC converter units, it is known as a multi-phase DC-DC converter. *Id.* A multi-phase DC-DC converter consists of several single-phase DC-DC converter units connected in parallel. *Id.* Multi-phase DC-DC converters are used to supply current for higher loads. *Id.*

The Specification further teaches that, with multiphase DC-DC converters, it is efficient to use a greater number of phases at high load currents. *Id.* ¶ 5. Conversely, it is efficient to use fewer phases in low load conditions. *Id.* "The threshold currents to change the phases, is chosen such that the DC-DC converter operates with maximum efficiency." *Id.* The Specification teaches that the processing unit "stores a threshold current limit corresponding to each phase of the N phases based on the input voltage and a switching frequency." *Id.* ¶ 6. Figure 6, reproduced below, is exemplary.

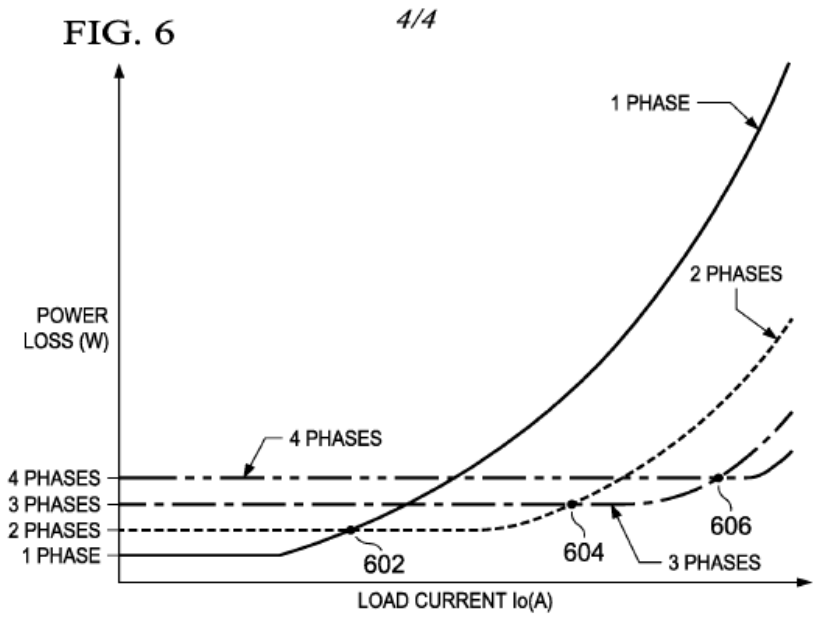

Figure 6 is a graph that illustrates power loss for various load currents in a multi-phase converter. *Id.* ¶ 57. As the load current increases, power loss is mitigated by increasing the number of phases. "The threshold current limit corresponding to a first phase is represented as 602, and the threshold current limit corresponding to a second phase is represented as 604, and the threshold current limit corresponding to a third phase is represented as 606." *Id.*

Claim 1 is illustrative of the subject matter on appeal and is reproduced below with certain limitations italicized for emphasis:

1. A multi-phase converter comprising:

N switches coupled to an input voltage terminal and an output terminal, wherein N is a positive integer greater than 1;

a processing unit configured to store *a threshold current limit corresponding to an input voltage and a switching frequency* of one or more of the N switches; and

a controller coupled to the processing unit and the N switches, the controller configured *to activate a number of the*

> *N switches based on a comparison of a measured load current against the threshold current limit*.

Appeal Br. 9 (Claims App.) (emphasis added).

DISCUSSION

The Examiner rejects claims 1–11, 13, 14, and 16–20 under 35 U.S.C § 102(a)(1) as anticipated by Mathew et al. (US 2016/0116549 A1, filed Oct. 24, 2014; hereinafter "Mathew"). Final Office Action dated Feb. 8, 2018 ("Final Act.").

In support of the rejection, the Examiner finds that Mathew teaches "a processing unit (Figure 1: 118) configured to store a threshold current limit (Paragraph [0043]) corresponding to an input voltage and a switching frequency of one or more of the N switches; and a controller" where the controller is "configured to activate a number of the N switches based on a comparison of a measured load current against the threshold current limit." Final Act. 4.

The Examiner additionally quotes the following portion of Mathew:

> [A] voltage regulator may operate in an autonomous phase shedding mode in which the number of phases in operation may vary as a load current of the voltage regulator varies. In light loading conditions, a voltage regulator may operate in a discontinuous conduction mode (DCM) with only one phase at lower currents and a continuous conduction mode (CCM) with one or more multiple phases 114 at higher currents, and the efficiency or power loss of each mode versus current may be approximated by a different polynomial.

Id. at 2–3 (citing Mathew ¶ 43) (Examiner's emphases omitted). The Examiner determines that the foregoing "is analogous to storing a threshold current limit corresponding to an input voltage and a switching frequency . .

. and controlling a number of the N switches based on a comparison of a measured load current against the threshold current limit" as required by claim 1. *Id.* at 3. The Examiner further states that the "profile" and "curve fit" of Mathew teach the threshold current limit because the output is compared to these metrics. *Id.*

Appellant argues that the rejection should be reversed. Appeal Br. 4–8. Appellant directs us to Mathew's teaching "to calculate an input current to the voltage regulator based on a fitted curve indicative of power efficiency of the voltage regulator." *Id.* at 5 (quoting Mathew ¶ 41). Mathew further teaches that "curve-fit information 118 may store information indicative of the power loss (e.g., input power minus output power) of a voltage regulator versus measured output current." *Id.* Appellant argues that Mathew does not teach that curve-fit information 118 includes any "threshold current limit corresponding to an input voltage and a switching frequency." *Id.* Appellant asserts that the Examiner did not explain how a "threshold current limit corresponding to an input voltage and a switching frequency" is expressly or inherently taught by Mathew. *Id.* at 6.

Appellant further directs us to the Examiner's determination that the teachings of Mathew's Paragraph 43 are "analogous" to storing a threshold current limit corresponding to an input voltage and a switching frequency. *Id.* (citing Final Act. 3). Appellant argues that a finding that a feature of a prior art reference is analogous to a claim element is insufficient to support a prima facie case of anticipation. *Id.*

In the Answer, the Examiner summarizes the steps of Mathew. Answer 4. Such summary, however, does not address switching frequency. *Id.*

In another portion of the Answer, the Examiner contends that Mathew teaches a processing unit configured to store a threshold current limit corresponding to an input voltage and a switching frequency of one or more of the N switches. *Id.* at 5. In support of the finding regarding "switching frequency," the Examiner directs us to switches 108 and 109 of Figure 1 and Paragraphs 39–41, 43 of Mathew. *Id.* None of the cited portions of Mathew, however, teach a switching frequency or a threshold current limit *corresponding to a switching frequency*.

In view of the foregoing, we are persuaded that the rejection fails to show an express teaching of a threshold current limit corresponding to a switching frequency.[2] Nor does the rejection include an explanation as to whether and how such limitation may be inherently disclosed. In view of the foregoing, we determine that Appellant has shown error in the rejection of claim 1 and claims depending therefrom. As independent claims 16 and 19 (the only other independent claims pending) include similar limitations, we likewise determine that Appellant has shown error in the rejection of these claims and their dependent claims.

[2] Our decision is limited to the determination under review. The Board relies on the involved parties to focus the issues and decides those issues based on facts and arguments presented by the involved parties. *Ex Parte Frye*, 94 USPQ2d 1072 (BPAI 2010 (precedential)). The Examiner has not based any pending rejection on a theory that a threshold current limit corresponding to an input voltage and a switching frequency as claimed would have been obvious to a person having ordinary skill in the art at the time of Appellant's invention. Accordingly, we take no position on this issue.

CONCLUSION

The Examiner's rejection is reversed.

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1–11, 13, 14, 16–20	102(a)(1)	Mathew		1–11, 13, 14, 16–20

REVERSED