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ASML CIP (San Diego) / DMIPG
c/o ASML Netherlands B.V.
PO Box 324
Veldhoven, 5500 AH
NETHERLANDS

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HAGAN, SEAN P	

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte RAHUL AHLAWAT

Appeal 2019-003536
Application 14/681,675
Technology Center 2800

Before JEFFREY T. SMITH, KAREN M. HASTINGS, and DONNA M. PRAISS, *Administrative Patent Judges.*

PRAISS, *Administrative Patent Judge*.

DECISION ON APPEAL[1]

Appellant[2] appeals under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1–5, 7–13, 15–30, 32, and 33. We have jurisdiction over the appeal under 35 U.S.C. § 6(b).

We REVERSE.

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[1] Our Decision refers to the Specification ("Spec.") filed Apr. 8, 2015, the Final Office Action dated May 18, 2018 ("Final Act."), Appellant's Appeal Brief ("Appeal Br.") filed Dec. 17, 2018, the Examiner's Answer ("Ans.") dated Feb. 8, 2019, and Appellant's Reply Brief ("Reply Br.") filed Apr. 2, 2019.

[2] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies Cymer, LLC as the real party in interest. Appeal Br. 1.

STATEMENT OF THE CASE

The invention relates to wavelength stabilization of an optical source. Spec. 1:4. Claim 1, reproduced below from the Claims Appendix to the Appeal Brief, is illustrative (disputed limitations italicized).

> 1. A method comprising:
>
> receiving a pulsed light beam emitted from an optical source, the pulsed light beam comprising at least a first burst of pulses of light and a second burst of pulses of light, the first burst of pulses comprising a first subset of pulses and the second burst of pulses comprising a second subset of pulses;
>
> determining a wavelength error for each pulse in the first subset of pulses;
>
> determining a correction signal based on the determined wavelength error, the correction signal comprising a correction signal associated with each pulse in the first subset of pulses;
>
> applying a correction based on the determined correction signal to each pulse in the second subset of pulses, wherein
>
> > the correction signal is determined during operation of the optical source and without prior knowledge of an operating condition of the optical source, and
> >
> > applying the correction to a pulse in the second subset of pulses reduces the wavelength error of the pulse in the second subset of pulses;
>
> after the correction is applied, determining whether the wavelength error of each pulse in the second subset of pulses is outside of a wavelength error range defined by an upper wavelength error bound and a lower wavelength error bound; and
>
> *if the wavelength error for more than a threshold number of pulses in the second subset of pulses is outside of the wavelength error range, determining a second correction signal based on the wavelength error of the second subset of pulses to apply to a subset of pulses in a subsequent burst of*

pulses, wherein

the wavelength error for any particular pulse is a difference between a wavelength of that particular pulse and a target wavelength.

Claims 18, 23, and 24 are also independent. Claim 18 is directed to a method that also requires "applying a correction based on the correction signal to a second subset of pulses." Claim 23, directed to a controller, and claim 24, directed to a light system, both require determining a correction signal if more than a threshold number of pulses is outside a wavelength error range.

ANALYSIS

We review the appealed rejections for error based upon the issues Appellant identifies. *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) (*cited with approval in In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) ("[I]t has long been the Board's practice to require an applicant to identify the alleged error in the examiner's rejections.")). After considering the positions of both the Examiner and Appellant, we are persuaded the Examiner reversibly erred for the reasons set forth in Appellant's briefs and discussed below.

The Examiner rejects the claims as follows:

Claim(s)	**35 U.S.C. §**	**References**
1–5, 9, 10, 12, 13, 15–23, 28–30, 32, 33	103	Spangler,[3] Everage[4]
7, 11	103	Spangler, Everage, Riggs[5]

[3] US 2002/0006149 A1, published Jan. 17, 2002. We adopt the Examiner's reference to "Spangler 2" for citations to a second process described in paragraph 78 of Spangler. *See, e.g.*, Final Act. 9.
[4] US 6,078,599, issued June 20, 2000.
[5] US 2011/0116522 A1, published May 19, 2011.

Claim(s)	35 U.S.C. §	References
8	103	Spangler, Everage, Takeda[6]
24–27	103	Spangler, Heintze[7]

Final Act. 7–24. We address each of the rejections below.

Rejection over Spangler and Everage

The Examiner rejects claims 1–5, 9, 10, 12, 13, 15–23, 28–30, 32, and 33 over Spangler's method for correcting wavelength error as modified by Everage's disclosure that the correction signal is determined without prior knowledge of an operating condition of optical source, thereby allowing minor adjustments to be eliminated, and further modified by, *inter alia*, Spangler's second disclosed process (Spangler 2) comparing the average deviation in determining if a correction is to be made. Final Act. 7–19.

Appellant argues that the Examiner erred in modifying Spangler's first process (Spangler, Fig. 11), which uses a feed forward algorithm, with Spangler's separate embodiment (Spangler ¶ 78), which relates to a feedback control algorithm. Appeal Br. 7–9. Appellant contends that even if Spangler 2 teaches "a wavelength error of each pulse in the second subset of pulses is outside of a wavelength error range defined by an upper wavelength error bound and a lower wavelength error bound," which Appellant disputes (Appeal Br. 14–16), paragraph 78 does not disclose that the adjustment is applied to a subset of pulses in a subsequent burst of pulses. *Id.* at 9. Regarding Everage, Appellant contends that neither of those claim limitations is disclosed by Everage either. *Id.* at 10. According to Appellant, Everage's "learning step 54" dynamically determines a number

[6] US 5,473,409, issued Dec. 5, 1995.
[7] US 2004/0021840 A1, published Feb. 5, 2004.

of pulses that constitute the wavelength chirp, then determines the wavelength shift of each sampled pulse to determine a pattern or shape of the wavelength chirp. *Id.* (citing Everage 4:39–44).

Regarding the difference between Spangler and Spangler 2, Appellant contends Spangler's adaptive feed-forward algorithm separates a burst of pulses into two regions: an L region and a K region. Appeal Br. 11. The K region is said to have a wavelength with relatively high variation pulse-to-pulse, and the L region of the burst has a relatively low wavelength variation pulse-to-pulse. *Id.* at 12 (citing Spangler ¶ 26). According to Appellant, because the L region has different characteristics than the K region, the technique applied to the K region is intentionally different from the technique applied to the L region, thus a skilled artisan would have had no reason to modify the K region processing of Spangler's feed-forward algorithm with the alternative L region processing technique of Spangler 2. *Id.* (citing Spangler, Fig. 11 in which "proportional constant P_k" and "integral constant I_k" is not applied to each pulse in the L region).

The Examiner responds that Spangler 2's technique may be implemented prior to execution of the correction signal calculation step for the K region of pulses in Spangler, thus requiring only a change in input to the process of Spangler rather than a process redesign. Ans. 8. The Examiner finds that Spangler 2 teaches the determined error signal may first be filtered according to a deviation from a desired value such that the correction signal is only computed in the case of a large deviation and this can be employed in computing the feed forward correction signal for correcting the K region pulses. *Id.* at 7.

Regarding an average of some sort with Spangler's single pulse, the Examiner responds that application of Spangler 2's technique to the process of creating a correction signal for the K region, consideration of the line center error of the kth pulse would necessarily be performed for calculating the wavelength correction to be applied to the kth pulse of the subsequent burst. *Id.* at 10–11. The Examiner also finds an average can be determined from a list of numbers, including a list having a singular number. *Id.* at 14–15.

Regarding modification of Spangler's process shown in Figure 11, the Examiner finds the creation of a correction signal created for the L region determines deviation based on average deviations of previous pulses, thus fewer pulses results in greater sensitivity to deviations whereas the use of more pulses results in lesser sensitivity. *Id.* at 11–12. Modifying the teachings of Spangler with the technique of Spangler 2, the Examiner finds a different correction signal for the K region of pulses will be produced for each burst until no pulse in the K region exceeds the upper or lower threshold deviation. *Id.* at 12. The Examiner also explains that modification of Spangler 2's technique is a consequence of fitting the technique to the available resources in Spangler and, thus, obvious. *Id.* at 13.

In the Reply Brief, Appellant contends incorporating Spangler 2 into the process of Spangler's Figure 11 is not simply a "change in the input" to Equation 1 as the Examiner finds. Reply Br. 5. Appellant argues it would be a substantial redesign because the K region processing of Spangler's Figure 11 uses line center error (LCE) values, deviations from a target wavelength, and the sum of LCEs for pulses up to and including current pulse k in burst t which requires determining LCE for each distinct pulse, which Spangler 2 does not produce. *Id.* at 6. According to Appellant, Spangler 2 is therefore not applicable to determining the LCE value for each pulse k in Spangler's correction signal calculation because Spangler 2 is a feedback algorithm that relies on data related past pulses, thus it would be contrary to Spangler 2's purpose to average only the wavelength of the current pulse k then find the deviation of the wavelength of the current pulse k absent impermissible hindsight. *Id.* at 6–7.

Appellant's arguments are persuasive of harmful error. The Examiner's rejection does not adequately explain why a person having ordinary skill in the art would modify Spangler with Spangler 2's feedback system absent hindsight from Appellant's disclosure. Appellant's position that there is no reason, based on the Spangler 2 embodiment, for a skilled artisan to average only the wavelength of the current pulse k absent impermissible hindsight because Spangler 2 is a feedback system is supported by the record. Spangler ¶ 78. Even if Spangler 2 performs a calculation pulse to pulse (Ans. 8), the Examiner does not adequately explain why a skilled artisan would understand Spangler 2 to broadly suggest modifying Spangler's process to insert error deviation appropriate to the K region prior to the step of calculating the correction for the K region. We also find the Examiner's reasoning to lack rational underpinnings because the Examiner acknowledges a mathematical average does not require more than two numbers or values (Ans. 14), but nevertheless determines Spangler 2's averaging technique can be applied to a single pulse on the basis that an average is of a list of numbers and a list may consist of only one number (*id.* at 14–15).

In view of the above, we reverse the Examiner's rejection of independent claim 1 over Spangler and Everage.

Remaining Rejections

Appellant relies on the same arguments presented with respect to claim 1 in asserting that claims 7, 8, 11, and 24–27 are patentable over the modification of Spangler with Spangler 2. Appeal Br. 17–21. The Examiner's additional findings regarding dependent claims 7, 8, and 11 do not cure the deficiencies discussed above with regard to independent claim 1. Therefore, we do not sustain the Examiner's rejection of dependent claims 7, 8, and 11 under § 103 over the combination of Spangler and Everage with secondary references. Because claim 24, and claims 25–27 which depend from claim 24, require determining a correction signal if more than a threshold number of pulses is outside a wavelength error range as discussed above in connection with claim 1, we reverse the Examiner's rejection of claims 24–27 for the same reason.

CONCLUSION

For these reasons, we reverse the Examiner's rejection of claims 1–5, 7–13, 15–30, 32, and 33 under 35 U.S.C. § 103.

DECISION SUMMARY

In summary:

Claim(s) Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1–5, 9, 10, 12, 13, 15–23, 28–30, 32, 33	103	Spangler, Everage		1–5, 9, 10, 12, 13, 15–23, 28–30, 32, 33
7, 11	103	Spangler, Everage, Riggs		7, 11
8	103	Spangler, Everage, Takeda		8
24–27	103	Spangler, Heintze		24–27
Overall Outcome				1–5, 7–13, 15–30, 32, 33

REVERSED