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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JEFFREY W. WALDRIP, YONGPING FAN, and JING LI

Appeal 2018-005455
Application 15/152,462
Technology Center 2800

Before MICHAEL P. COLAIANNI, DONNA M. PRAISS, and
N. WHITNEY WILSON, *Administrative Patent Judges*.

WILSON, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant¹ appeals under 35 U.S.C. § 134(a) from the Examiner’s
September 25, 2017 decision finally rejecting claims 13, 15–20, and 22–26
 (“Final Act.”). We have jurisdiction over the appeal under 35 U.S.C. § 6(b).

We affirm.

¹ We use the word “Appellant” to refer to “applicant” as defined in
37 C.F.R. § 1.42. Appellant identifies Intel Corporation as the real party in
interest (Appeal Br. 1).

CLAIMED SUBJECT MATTER

Appellant's disclosure generally relates to phase locked loop (PLL) circuits, and in particular, to a circuit for calibrating an inductor capacitor PLL (LCPLL) (Spec. ¶¶ 2, 3). Such LCPLL's are said to be useful for generating accurate clocks for transmitting and receiving data (Spec. ¶ 3). LCPLL's are said to use automatic frequency control (AFC) techniques to calibrate oscillator settings to conform about an operable control voltage range (*id.*). The disclosure describes what is said to be an improved system for setting these frequencies which handles variations incurred by differing temperatures (Spec. ¶¶6, 7). Details of the claimed apparatus are set forth in representative claim 13, which is reproduced below from the Claims Appendix to the Appeal Brief:

13. An apparatus comprising:

a digitally controlled oscillator (DCO) including capacitors that can be enabled or disabled to change a capacitance loading to change an oscillating frequency of the DCO;

a first control having a first code to adjust the capacitance loading of the DCO by a coarse amount such that a phase locked loop (PLL) is locked for a target clock frequency;

a second control having a second code to adjust the capacitance loading of the DCO by a fine amount, wherein the fine amount is to change the capacitance loading by a smaller amount than a change in the capacitance loading by the coarse amount, and wherein the first control is applied prior to the application of the second control; and

an automatic frequency control (AFC) circuitry to provide the first and second controls such that the second code has a value which is near a middle of a range of values of the second code when a temperature is to be at a mid-range value[;]

wherein the AFC circuitry comprises:

a calibration logic, coupled to the DCO, to generate the first control to lock the PLL prior to adjusting of the capacitance loading of the DCO by the fine amount by the second control, wherein the PLL includes the DCO;

a multiplexer coupled to the DCO; and

a circuitry coupled to a first input of the multiplexer, wherein the circuitry is to generate the second control during a calibration mode, wherein the multiplexer has a second input to receive an output of a digital low pass filter (DLPF).

REJECTIONS

1. Claims 13, 15–20, and 22–26 are rejected under 35 U.S.C. § 103(a) as unpatentable over Costa² in view of Sakurai.³
2. Claims 13, 15–20, and 22–26 are rejected under 35 U.S.C. § 103(a)⁴ as unpatentable over Liu⁵ in view of Sakurai.

DISCUSSION

Appellant argues independent claims 13 and 18 together (*see, e.g.*, Appeal Br. 8–11), but makes separate arguments for the two rejections, and makes a separate argument regarding claims 19 and 20 (as a pair) and claim

² Costa et al, US 7,463,097 B2, issued December 9, 2008.

³ Sakurai et al., US 2009/0302958 A1, published December 10, 2009.

⁴ The Final Action indicates in the statement of the rejection that the rejection was under §102(e) (Final Act. 10). However, Appellant and the Examiner acknowledge understanding that this was an error and that the rejection was intended to be made under §103(a) (Appeal Br. 6; Ans. 2).

⁵ Liu et al, US 8,253,506 B2, issued August 28, 2012.

17 (*see*, Appeal Br. 11–13). The remaining dependent claims (claims 24–26) are not argued separately from claims 13 and 18.

Claims 13 and 18 over Costa in view of Sakurai. The Examiner’s findings regarding the rejection of claim 13 over Costa in view of Sakurai are found at pages 3 and 4 of the Final Action. The Examiner finds that Costa discloses each of the elements of claim 13, except that Costa does not disclose a second control comprising a second code (Final Act. 4). The Examiner further finds that Sakurai teaches controlling fine tuning capacitors in an LC oscillator with digital control codes (Final Act. 4, citing Sakurai ¶ 39). The Examiner also finds that Sakurai teaches a capacitor bank structure used for finely, digitally tuned capacitors (*id.*). The Examiner determines that it would have been obvious to replace the analog fine control signals of Costa with digital fine control codes as taught by Sakurai “because such a modification would have been merely a replacement of well known, art recognized functionally equivalent fine tuning capacitor control signals that would yield predictable results in the oscillator of Costa” (*id.*)

Appellant makes several arguments urging reversal of this rejection. First, Appellant contends that the Examiner improperly relied on hindsight in making the combination, because nothing in Costa suggests using a digital code for the second control to adjust capacitance by a fine amount, and because there is no benefit to Costa in using a digital code (Appeal Br. 8–9). This argument is not persuasive because, as explained by the Examiner, the proposed combination is simply the “substitution of one known element for another” *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 417 (2007). In this instance, it is the substitution of a digital code, which was known – as shown by Sakurai – for an analog controller as used by Costa. The Examiner finds

that making this substitution would yield predictable results in Costa's oscillator (Final Act. 4). Therefore, a person of skill in the art would have found making this substitution to have been obvious. *KSR*, 550 U.S. at 417.

Appellant contends that the proposed combination would not have been a simple substitution because it would have required "changing the entire architecture of Costa which is designed around analog circuitry" (Appeal Br. 9). However, as explained by the Examiner (Ans. 3), the use of digital oscillator tuning codes instead of analog tuning codes is a basic modification that was well-known and well-established, and well within the ability of one of ordinary skill in the art. Appellant does not challenge this finding, arguing only that one of skill in the art would not have made the substitution because Costa calls for the use of an analog system.

Second, Appellant argues that Costa does not disclose a second control having a second code. The Examiner finds that Costa's Vtune corresponds to the second control (Final Act. 3). Appellant argues that Costa's Vtune node receives "an analog voltage and not a code" (Appeal Br. 10). This argument is not persuasive, because the Examiner acknowledges that Costa does not teach the use of a second digital code, and there is no dispute that there is a difference between an analog signal and a digital signal. However, the use of a second digital code, as taught by Sakurai (and other references noted by the Examiner) remedies this deficiency in Costa.

Third, Appellant argues that Costa does not teach or suggest the limitation "an automatic frequency control (AFC) circuitry to provide the first and second controls such that the second code has a value which is near

a middle of a range of values of the second code when a temperature is to be at a mid-range value” (Appeal Br. 14). Appellant contends that:

The alleged Fig. 6 of Costa only shows “an example of simulated V_{tune_cal} vs temperature curves (A-C) that can be generated by the embodiment of the temperature variable voltage source 30.” That alone provides no disclosure that the second control is to have an associated code which is near a middle of a range of the associated code when a temperature is to be at a mid-range value. Again, Examiner is respectfully requested to consider all words of the claim.

(Appeal Br. 14). This argument is not persuasive. In the rejection, the voltage V_{tune_cal} corresponds to the claimed code, with the Examiner demonstrating that a middle range voltage corresponds to the mid-range temperature value. As detailed by the Examiner, Costa admittedly does not disclose a digital second code, but this is suggested by the combined teachings of Costa and Sakurai.

Claims 13 and 18 over Liu and Sakurai. The Examiner’s findings with respect to the rejection over Liu and Sakurai parallel the findings with respect to Costa and Sakurai, in that the Examiner finds that Liu teaches each of the claimed limitations except the second control comprising a second code (Final Act. 10–11).

Appellant contends that Liu teaches that $V_1(T)$ is a voltage that varies with temperature, but is not shown to adjust the capacitance by a fine amount (Appeal Br. 13–14). Appellant alleges that $V_1(T)$ is a bias voltage that changes the reference to one of the capacitor nodes, but does not adjust its capacitance (Appeal Br. 14). The Examiner cites col. 7, lines 49–51 of Liu – which discloses that “Multiplexing circuit 90 couples a selected one of fine tuning analog signal VTUNE and temperature compensation analog

signal V1(T) onto control node N5” – as teaching the limitation that the second code adjusts the capacitance loading of the DCO by a fine amount. Appellant’s argument is persuasive, as we agree that the Examiner has not adequately explained how the cited passage from Liu shows an adjustment of the capacitance loading.

The Examiner has the initial burden of establishing a *prima facie* case of obviousness based on an inherent or explicit disclosure of the claimed subject matter under 35 U.S.C. § 103. *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992) (“[T]he examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability.”). To establish a *prima facie* case of obviousness, the Examiner must show that each and every limitation of the claim is described or suggested by the prior art or would have been obvious based on the knowledge of those of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988). In this instance, we determine that Appellant has demonstrated that the preponderance of the evidence of record does not support the Examiner’s finding that Liu teaches a second control to adjust a capacitance loading of a DCO by a fine amount. Accordingly, we reverse the rejection over Liu in view of Sakurai.

Claims 17, 19, and 20. Appellant contends that the Examiner failed to provide sufficient evidence to support the factual findings supporting the rejections of these claims (Appeal Br. 11–12). In particular, Appellant challenges the Examiner’s finding in connection with claims 19 and 20 that “it is well-known to those of ordinary skill in the art to use a transmitter with serial IO PCIe technology” (Final Act. 8), and in connection with claim 17 that it was well known “to generate a control voltage for a DCO from a

reference clock and an output of the DCO” (Final Act. 6). Appellant contended that the Examiner was required to provide adequate evidence to support these findings (Appeal Br. 11–12). The Examiner supplied the requested evidence in the Answer (*see* Ans. 4–5), and Appellant does not argue that this evidence is insufficient. Accordingly, we determine that this argument does not show reversible error in the rejections.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Basis	Affirmed	Reversed
13, 15–20, 22–26	103(a)	Costa, Sakurai	13, 15–20, 22–26	
13, 15–20, 22–26	103(a)	Liu, Sakurai		13, 15–20, 22–26
Overall Outcome			13, 15–20, 22–26	

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