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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MARIO SANTILLO, MRDJAN J. JANKOVIC, STEVE WILLIAM MAGNER, and MICHAEL JAMES UHRICH[1]

Appeal 2017-009292
Application 13/967,911
Technology Center 3700

Before JENNIFER D. BAHR, JEREMY M. PLENZLER, and SEAN P. O'HANLON, *Administrative Patent Judges*.

BAHR, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1–20. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

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[1] Appellant (Ford Global Technologies, LLC) is the Applicant as provided in 37 C.F.R. § 1.46 and is identified as the real party in interest. Appeal Br. 3.

THE CLAIMED SUBJECT MATTER

Claim 1, reproduced below, is illustrative of the claimed subject matter.

> 1. A method for controlling an engine, comprising:
> cutting off fuel to the engine during a deceleration event;
> open loop operating an engine air/fuel ratio rich of stoichiometry for a predetermined time after said deceleration event ends;
> feedback controlling said air/fuel ratio on average around a value rich of stoichiometry for a preselected time after said predetermined time; and
> feedback controlling said air/fuel ratio to gradually return to stoichiometry after said preselected time.

REJECTIONS

I. Claims 1–3 and 5 stand rejected under 35 U.S.C. § 102(b) as anticipated by Nakagawa (US 2007/0169465 A1, pub. July 26, 2007).

II. Claims 4, 7, 12, and 15 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Nakagawa.

III. Claims 6 and 16–20 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Nakagawa and Surnilla (US 2005/0119822 A1, pub. June 2, 2005).

IV. Claims 8–11, 13, and 14 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Nakagawa and Makki (US 2004/0249556 A1, pub. Dec. 9, 2004).

DISCUSSION

Rejection I

The Examiner finds that Nakagawa discloses a method comprising, in pertinent part, "open loop operating an engine air/fuel ratio rich of stoichiometry for a predetermined time after [a] deceleration event ends" (Final Act. 3, citing Nakagawa ¶¶ 8, 9), "feedback controlling said air/fuel ratio on average around a value rich of stoichiometry for a preselected time after said predetermined time" (*id.*, citing Nakagawa ¶ 27), and "feedback controlling said air/fuel ratio to gradually . . . return to stoichiometry after said preselected time" (*id.*, citing Nakagawa ¶ 10), as called for in claim 1. The Examiner finds that Nakagawa "describes that after a period of non-feedback (the reference says it in terms of correcting integral terms) the fueling will be corrected during the enrichment and the stoichiometric controls." *Id.* at 8 (citing Nakagawa ¶ 27).

Appellant argues that the rejection is in error because "Nakagawa only teaches open loop controlling the [air/fuel ratio (AFR)] to a value rich of stoichiometry after a [deceleration fuel shutoff (DFSO)] event." Appeal Br. 10. Specifically, Appellant argues that "the system [of Nakagawa] is unable to correct the AFR using the proportional or integral terms of the feedback controller." *Id.* at 11 (citing Nakagawa ¶¶ 26, 27). Appellant adds that "Nakagawa's system is not applying feedback to the AFR control, but is rather using a stored integral value to approximate an AFR correction during enriching control." *Id.* at 14. Appellant submits that

> Nakagawa only teaches one type of enriching control. If Nakagawa's enriching control is open loop (as Appellant believes, and as explained above), then Nakagawa does not teach the feedback control. Conversely, if Nakagawa teaches

> rich feedback control (as the Office alleges, and which Appellant disputes), then Nakagawa does not teach the rich open loop control. Either Nakagawa's enriching control is open loop or feedback controlled.

Id. at 14–15.

Appellant submits Declarations under 37 C.F.R. § 1.132 by Steve William Magner and Michael James Uhrich (hereinafter "Magner Declaration" ("Magner Decl.") and "Uhrich Declaration" ("Uhrich Decl."), respectively, or "Declarations" ("Decl.") collectively)[2] in support of the interpretation of Nakagawa asserted in the Appeal Brief. *See* Appeal Br. 10, 12–19; Appendix A. Declarants Magner and Uhrich state that there is no disclosure in paragraphs 8 and 9, or anywhere in Nakagawa, of feedback controlling the air/fuel ratio around a value rich of stoichiometry for a preselected time after open loop operating the air/fuel ratio rich of stoichiometry after a deceleration event. Decl. ¶ 15. Declarants Magner and Uhrich state that Nakagawa discloses only open loop operating the air/fuel ratio to richer than stoichiometric after a deceleration event because updating the integral term is prohibited during fuel cutoff, during enrichment control immediately following the fuel cutoff, and immediately after completion of the enriching control, because the air/fuel ratio is far from

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[2] Magner is one of the named inventors of the present application and avers that he has "27 years of experience in the field of automotive powertrain controls." Magner Decl. ¶¶ 1, 2. Uhrich is one of the named inventors of the present application and avers that he has "21 years of experience in the field of Powertrain Controls & Diagnostics." Uhrich Decl. ¶¶ 1, 2. All subsequent numbered paragraphs of the Declarations, following these first two paragraphs identifying Declarants and indicating their credentials, appear to be identical. *Compare* Magner Decl. ¶¶ 3–28, *and* Uhrich Decl. ¶¶ 3–28.

stoichiometry. *Id.* ¶ 16 (citing Nakagawa ¶¶ 8, 9, 31). According to Declarants Magner and Uhrich, Nakagawa teaches using outputs from the exhaust gas sensor to control the air/fuel ratio closer to stoichiometry, and, "[t]hus, Nakagawa only discloses closed loop operating the air/fuel ratio at stoichiometry." *Id.* Declarants Magner and Uhrich aver that, even if the enriching control disclosed by Nakagawa were considered to be feedback controlled, which they dispute, the enriching control disclosed in Nakagawa is either open loop control, which Declarants submit is the accurate characterization, or feedback control (i.e., closed loop control), but not both. Decl. ¶ 19.

The Examiner responds that

> paragraph[s] 9 and 27 disclose how the oxygen sensor data is unreliable and further cannot be corrected due to a lack of updating of correction factors during a fuel cut off period and so there is a period of time once fuel is resumed where the oxygen sensor is not a part of controlling the air/fuel ratio.

Ans. 3. The Examiner adds, "[p]aragraph 27 [of Nakagawa] ends by discussing how the data from the sensor is ultimately corrected to provide control during a portion of the enriching control and stoichiometric control." *Id.*

In Nakagawa, the air/fuel ratio control apparatus employs air/fuel ratio sensor 2, three-way catalyst device 1, and oxygen sensor 3 downstream of catalyst device 1 to regulate the air/fuel ratio of exhaust gasses passing through catalyst device 1. Nakagawa, Fig. 1; ¶¶ 20–21. To maintain a stoichiometric air/fuel ratio, output "V" of the upstream sensor (used to correct the amount of fuel to be injected with respect to the amount of intake air detected by the airflow meter) is corrected in view of a proportional term

"P," which is calculated by multiplying deviation "d" (deviation of actual output of the oxygen sensor relative to a reference output that would be obtained when the air/fuel ratio is stoichiometric) by a predetermined gain, and an integral term "I" integrating the values of such deviations over an extended duration. *Id.* ¶¶ 7, 22–23.

To address the problem of the catalyst device becoming saturated with oxygen during a deceleration event in which fuel supply to the engine is cut off, an enriching control may be implemented to reduce the amount of oxygen stored in the catalyst device before stoichiometric control is resumed. *Id.* at Fig. 2; ¶¶ 24, 25. This approach is hindered when, during the enriching control, the value of the proportional term (and, therefore, the value of the integral term) cannot be calculated. *Id.* at ¶¶ 7, 26. Nakagawa explains that the value of deviation "d" cannot be calculated during enriching control because "d" is the value of the deviation of the actual output from oxygen sensor 3 with respect to a reference output *at stoichiometry*, not a reference output for a rich air/fuel ratio. *Id.* ¶ 26. Consequently, integral term "I" cannot be updated during enriching control. *Id.*

To address this problem, upon restarting an engine, Nakagawa implements a fuel supply cutoff prohibition procedure in which fuel supply cutoff is prohibited until sufficient data has been gathered to obtain an appropriate integral term. *Id.* at Fig. 3, ¶¶ 27–30 (flag F is reset to 0 when the engine stops). During this time period, there will not be any deceleration fuel cutoff events. Until Nakagawa's system determines that "d" has been calculated enough times and sufficient time has passed for the integral term to be updated, Nakagawa uses the proportional term calculated based on the current value of "d" and the integral term used when the engine was previously stopped. *Id.* ¶ 28. Once the integral term has been updated, the output from air/fuel ratio sensor 2 is corrected using the newly calculated proportional term and the updated integral term, and, thus, stoichiometric control is executed while fuel supply cutoff is prohibited. *Id.* ¶ 29. Once it is determined, after updating the integral term a number of times, that the integral term has sufficiently converged to an appropriate value, the fuel supply cutoff prohibition is cancelled (flag F is set to 1) and fuel supply cutoff during deceleration is permitted. *Id.* ¶ 30–31.

After fuel cutoff prohibition has been cancelled, "when the engine decelerates, the fuel supply is cut off." *Id.* ¶ 31. Immediately after the fuel supply resumes, enriching control is executed, and, with fuel supply cutoff not being prohibited (i.e., flag F is set to 1), the condition for calculating "d" is not satisfied when the fuel supply is cut off, during the enriching control, or immediately after completion of the enriching control, because the air/fuel ratio of exhaust gas flowing out of catalyst device 1 is not close to the stoichiometric air/fuel ratio. *Id.* Thus, the proportional term and the integral term cannot be updated, and the output from air/fuel ratio sensor 2 is corrected using the integral term from before the fuel supply cutoff. *Id.*, Fig. 3 (a NO determination at step 104 resulting in no update to the integral term). Once the air/fuel ratio of exhaust gas flowing out of catalyst device 1 becomes close to the stoichiometric air/fuel ratio, thereby satisfying the condition for calculating "d," at some time *after completion of the enriching control*, the integral term can be updated, and control to a stoichiometric air/fuel ratio begins. *Id.* ¶¶ 32–34. Nakagawa discloses that "after the integral term I is updated at least once, the updated integral term I can be used during the stoichiometric control and the enriching control." *Id.* ¶ 38; *see also id.* ¶ 27 (stating that the air/fuel ratio control apparatus appropriately corrects the output from air/fuel ratio sensor 2 so that the combustion air/fuel ratio can be controlled during enriching control and during stoichiometric control). This does not mean that the integral term can be updated during enriching control; rather, this means that, once updated, this updated integral term can be used subsequently during stoichiometric control and enriching control in instances when the integral term cannot be further updated using current oxygen sensor data. This control is, according to Nakagawa, an improvement over prior art systems in which there is no data with which to correct the air/fuel ratio sensor output governing enriching control. *See id.* ¶¶ 22–23, 26–27.

Based on our findings with respect to the disclosure of Nakagawa, we agree with Appellant's argument that Nakagawa only teaches one type of enriching control. During Nakagawa's enriching control, the output of air/fuel ratio sensor 2 is corrected using an integral term that is derived from stored oxygen sensor data describing conditions during stoichiometric control prior to the deceleration fuel cutoff, not from data from the oxygen sensor describing exhaust conditions during the enriching control. *See id.* ¶¶ 27, 28, 31–34. Whether one characterizes this type of enriching control as open loop, as Appellant asserts, or as feedback/closed loop, it is one or the other, and not both. The Magner Declaration and the Uhrich Declaration, as discussed above, support our findings in this regard. Thus, Nakagawa does not disclose both "open loop operating an engine air/fuel ratio rich of stoichiometry for a predetermined time after a deceleration event ends" and "feedback controlling said air/fuel ratio on average around a value rich of stoichiometry for a preselected time after said predetermined time," as required in Appellant's independent claim 1.

Similarly, the Examiner's position that "there is an inherent open loop control of the engine until the exhaust gasses that have been combusted reach the oxygen sensor to provide feedback" (Ans. 5) is untenable. This observation by the Examiner relates only to the efficacy of the output of a sensor at any particular time, or what that output might reflect, based on transient conditions, and does not address whether such output from the sensor is used to provide feedback in the control process. Whether characterized as open loop or feedback (closed loop), as discussed above, during Nakagawa's enriching control, the output of air/fuel ratio sensor 2 is corrected using an integral term that is derived from stored oxygen sensor data describing conditions during stoichiometric control prior to the deceleration fuel cutoff, and not from current oxygen sensor output.

For the above reasons, the Examiner does not establish a sustainable case that Nakagawa discloses both open loop operating an engine air/fuel ratio rich of stoichiometry for a predetermined time after a deceleration event ends and feedback controlling said air/fuel ratio on average around a value rich of stoichiometry for a preselected time after said predetermined time, as required in Appellant's independent claim 1. Accordingly, we do not sustain the rejection of claim 1, or claims 2, 3, and 5, which depend from claim 1, as anticipated by Nakagawa.

Rejections II, III, and IV

The aforementioned deficiency in the rejection of claim 1 also pervades the rejections of independent claims 7 and 17, which similarly require both "operating an engine air/fuel ratio open loop at a constant air/fuel ratio rich of stoichiometry for a predetermined time" and "feedback controlling said air/fuel ratio . . . to average around a value rich of stoichiometry for a preselected time after said predetermined time" (Appeal Br. 31, 33 (Claims App.)), as well as dependent claims 4, 6, 8–16, and 18–20. *See* Final Act. 3–7. The Examiner does not rely on Surnilla or Makki for any teaching, or articulate any additional findings or reasoning, that would make up for this deficiency. *See id.* Accordingly, we do not sustain the rejections of claims 4 and 6–20.

DECISION

The Examiner's decision rejecting claims 1–20 is reversed.

<u>REVERSED</u>