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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JAMES WRIGHT, PASPULETI ASHISH KUMAR NAIDU,
PETER GEORGE BRITTLE, and MATTHEW MITCHELL

Appeal 2019-003721
Application 15/241,144
Technology Center 3700

Before JENNIFER D. BAHR, EDWARD A. BROWN, and
MICHAEL J. FITZPATRICK, *Administrative Patent Judges.*

BAHR, *Administrative Patent Judge.*

DECISION ON APPEAL

STATEMENT OF THE CASE

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

We AFFIRM.

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[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 Ford Global Technologies, LLC. Appeal Br. 1.

CLAIMED SUBJECT MATTER

Appellant's invention is directed to "internal combustion engines and to a method of reducing the NOx emissions from an engine of a motor vehicle during acceleration of the vehicle." Spec. ¶ 2. Claims 1, 8, and 13 are independent. Claims App. 2–3. Claims 8 and 13, reproduced below, are illustrative of the claimed subject matter.

> 8. A vehicle comprising:
>
> an engine having exhaust gas recirculation (EGR);
>
> an integrated starter-generator (ISG) coupled to the engine; and
>
> a controller programmed to, in response to predicted NOx feedgas emissions exceeding a threshold, operate the ISG as a motor to reduce an engine torque rate of increase needed to provide a desired wheel torque, wherein the controller predicts NOx feedgas emissions using a model based on engine speed, engine torque, and intake EGR ratio.
>
> 13. A method for controlling a vehicle having an electric machine coupled to an engine with exhaust gas recirculation, comprising:
>
> controlling, by a controller, the electric machine to provide torque in response to predicted NOx feedgas emissions associated with a rate of increase of engine torque to provide a driver demand torque during acceleration, and
>
> reducing an engine torque set point by an amount corresponding to the electric machine torque to reduce actual NOx feedgas emissions.

EVIDENCE

The prior art relied upon by the Examiner is:

Name	Reference	Date
Hata	US 4,168,683	Sept. 25, 1979
Burckhardt	US 4,480,309	Oct. 30, 1984
Takeshima	US 5,437,153	Aug. 1, 1995
Ortmann	US 7,517,298 B2	Apr. 14, 2009
Ewert	US 8,290,682 B2	Oct. 16, 2012
Nakagawa	US 2005/0056002 A1	Mar. 17, 2005
Kamada	US 2006/0270519 A1	Nov. 30, 2006
Soliman	US 2008/0305925 A1	Dec. 11, 2008
Wildgen	DE 10 2012 200 062 A1	July 4, 2013

REJECTIONS

I. Claim 13 stands rejected under 35 U.S.C. § 102(a)(1) as anticipated by Kamada.

II. Claims 1, 2, 7–9, 16, 18, and 19 stand rejected under 35 U.S.C. § 103 as unpatentable over Kamada, Wildgen, and Nakagawa.

III. Claim 3 stands rejected under 35 U.S.C. § 103 as unpatentable over Kamada, Wildgen, Nakagawa, and Takeshima.

IV. Claims 4 and 11 stand rejected under 35 U.S.C. § 103 as unpatentable over Kamada, Wildgen, Nakagawa, and Ortmann.

V. Claims 5 and 12 stand rejected under 35 U.S.C. § 103 as unpatentable over Kamada, Wildgen, Nakagawa, and Ewert.

VI. Claim 6 stands rejected under 35 U.S.C. § 103 as unpatentable over Kamada, Wildgen, Nakagawa, Ewert, and Burckhardt.

VII. Claim 10 stands rejected under 35 U.S.C. § 103 as unpatentable over Kamada, Wildgen, Nakagawa, and Hata.

VIII. Claim 14 stands rejected under 35 U.S.C. § 103 as unpatentable over Kamada and Hata.

IX. Claim 15 stands rejected under 35 U.S.C. § 103 as unpatentable over Kamada and Nakagawa.

X. Claim 17 stands rejected under 35 U.S.C. § 103 as unpatentable over Kamada and Ortmann.

XI. Claim 20 stands rejected under 35 U.S.C. § 103 as unpatentable over Kamada and Soliman.

OPINION

Claim 13—Anticipation

The dispositive issue raised in the appeal of the rejection of claim 13 is whether the Examiner erred in finding that the output of Kamada's NOx emission amount map shown in Figure 10 is a "predicted NOx feedgas emissions associated with a rate of increase of engine torque to provide a driver demand torque during acceleration" as called for in claim 13. *See* Final Act. 4; Ans. 12 (stating that "[t]he controller stores an emission gas map which holds predictions for each combination of engine speed and engine torque [Kamada, 0032, 0058] and example of the map is shown in Figure 10"); Appeal Br. 4 (arguing that "[t]here is no disclosure that the NOx map of Figure 10 is used to predict NOx feedgas emissions associated with a rate of increase of engine torque, only that the map of Figure 10 is used to determine NOx associated with the engine torque and speed at the higher load condition" (emphasis omitted)).

The Examiner finds that Kamada's "Figure 17 illustrates the predicted NOx feedgas emissions . . . for each instantaneous combination of engine speed and engine torque when the electric machine does not provide torque during acceleration" and that Kamada's "Figure 18 illustrates the predicted NOx feedgas emissions, based on changes in engine speed and engine torque, when the electric machine provides torque during acceleration." Ans. 12 (citing Kamada ¶¶ 39, 40). The Examiner also finds that, as shown in Figures 17 and 18 of Kamada, "the engine torque increases over the period between times t_1 and t_2 and this relationship corresponds to a rate of increase of engine torque." *Id.* According to the Examiner, "Appellant appears to ascribe undue meaning to the words 'predicted' and 'associated with' as they appear in claim 13." *Id.* (noting that "claim 13 does not specify steps that further define how the prediction is performed; the claim merely requires that the predicted NOx feedgas emissions are associated with, i.e. related to, the rate of increase of engine torque").

Appellant asserts that "[t]he plain meaning of 'predict' is 'to say or estimate (a specified thin[g]) will happen in the future or *will be a consequence of something*." Reply Br. 1–2 (emphasis added). Given Appellant's asserted definition of "predict," Appellant does not apprise us of error in the Examiner's finding that the NOx emission gas amount read in from the map of Kamada's Figure 10 is a *predicted* NOx feedgas emissions amount.

Appellant points to paragraph 36 of the Specification in an apparent attempt to show that the Examiner's reliance on the map of Kamada's Figure 10 and the diagrams of Kamada's Figure 17 "as showing a 'predicted' NOx is misplaced." *See* Reply Br. 2. However, Appellant does not specifically identify, nor do we discern, any disclosure in paragraph 36 of the Specification that distinguishes the "NOx out prediction model" described therein from Kamada's NOx emission amount map.

Kamada discloses that Figure 10 "is an example of a map of the NOx emission amount that is empirically determined on the basis of the load state of the engine expressed by the engine rotation speed and the engine torque and is stored beforehand." Kamada ¶ 32. Kamada provides emission gas amount read-in means 128, which "reads in . . . a NOx emission amount map as shown in FIG. 10 . . . as the actual NOx emission amount from the NOx emission amount map on the basis of the engine rotation speed NE and the engine torque TE." *Id.* ¶ 100. Kamada further describes Figure 10 as

> an example of a map (relationship) of the emission amount [g/sec] of NOx . . . for the engine 8 of this embodiment, which is empirically determined on the basis of the load state of the engine 8 expressed by the engine rotation speed NE and the engine torque TE [that] is stored beforehand.

Id. ¶ 88. With reference to the flowchart of Figure 16, Kamada discloses that, at step S2, emission gas amount read-in means 128 reads in an emission gas amount from the "empirically determined and pre-stored emission gas amount map" of, for example, Figure 10 "on the basis of the actual engine rotation speed NE and the actual engine torque TE" and treats this value as "as an actual emission gas amount." *Id.* ¶ 115. Thus, Kamada reads in the NOx emission amount that will be a consequence of the actual engine rotation speed and the actual engine torque of the engine. In other words, the NOx emission amount read in at step S2 of the flowchart in Kamada's Figure 16 is a "predicted NOx feedgas emissions" as construed in accordance with the definition of "predict" asserted by Appellant.

Moreover, as the Examiner explains, Kamada's emission gas read-in means 128 reads in the NOx emission amount "for each instantaneous combination of engine speed and engine torque." Ans. 12. Kamada's emission gas read-in means 128 reads in the NOx emission amount during operation of the engine, including, in particular, during the time between times t_1 and t_2 in Figure 18, which is associated with a rate of increase in the engine torque during acceleration. Thus, Kamada reads in a NOx emission amount associated with a rate of increase in the engine torque. Kamada does not calculate, or predict, a future NOx emission amount based on, or as a function of, a rate of increase in the engine torque, but claim 13 does not require that the NOx feedgas emissions be predicted based on, or as a function of, a rate of increase in the engine torque.

In light of the above, Appellant fails to apprise us of error in the Examiner's finding that the output of Kamada's NOx emission amount map shown in Figure 10 is a "predicted NOx feedgas emissions associated with a rate of increase of engine torque to provide a driver demand torque during acceleration" as called for in claim 13.

Kamada discloses, at step S4, determining whether the NOx emission amount read in at step S2 is greater than or equal to an emission gas amount threshold value and, if the determination at step S4 is affirmative, determining at, step S6, the torque assist amount and executing, at step S7, torque assist via the electric motor. *See* Kamada, Fig. 16; ¶¶ 117–120. As illustrated in Figure 18, the motor torque reduces the engine torque, "such that the actual emission gas amount becomes less than or equal to the emission gas amount threshold value." *Id.* ¶ 119. In other words, Kamada discloses controlling the electric motor to provide torque in response to predicted NOx feedgas emissions (the NOx emission amount read in at step S2) associated with a rate of increase of engine torque to provide a driver demand torque during acceleration and reducing engine torque to reduce actual NOx feedgas emissions, as required in claim 13.

For the above reasons, Appellant does not identify error in the rejection of claim 13. Accordingly, we sustain the rejection of claim 13 as anticipated by Kamada.

Claims 1–12 and 14–20—Obviousness

Independent Claims 1 and 8

In contesting the rejection of independent claims 1 and 8, Appellant argues that "Kamada does not disclose or suggest NOx feedgas emissions determined by a NOx model based on engine speed, engine torque, and the EGR ratio as disclosed and claimed by [Appellant]." Appeal Br. 7. More particularly, Appellant first contends that "Kamada does not disclose whether the 'emission amount' illustrated in the NOx emissions map of Figure 10 applies to feedgas emissions as disclosed and claimed by [Appellant], i.e. emissions upstream of emissions treatment devices such as an LNT [(Lean NOx Trap)] or SCR [(Selective Catalytic Reduction)]." *Id.* Appellant next contends,

> To the extent that the map disclosed in Figure 10 constitutes a 'NOx model', it is only based on engine torque and engine rotation speed. There is no disclosure or suggestion that the NOx map of Figure 10 is based on EGR ratio as disclosed and claimed in rejected Claims 1 and 8.

Id. With respect to this second contention, Appellant adds that "[n]one of the secondary references are relied upon as curing this deficiency and none appear to do so." *Id.*

Appellant's first contention is not convincing because Kamada does not disclose an LNT or SCR device and, as the Examiner points out, claims 1 and 8 do not recite such devices. *See* Kamada, Fig. 4 (illustrating only EGR device 64 in the exhaust passageway for reducing NOx emissions); *id.* ¶ 6 (disclosing that NOx emissions cannot be reduced if the EGR rate decreases due to a decrease in intake negative pressure as the engine shifts to a higher-load operation state); Claims App. 1–2 (claims 1 and 8). Further, as discussed above, Kamada describes Figure 10 as showing an example of a prestored relationship of the emission amount of NOx for the engine, which is empirically determined on the basis of the load state of the engine expressed by the engine rotation speed and the engine torque. *Id.* ¶ 88; *see also id.* ¶ 32 (associating the NOx emission amount map of Figure 10 with the engine). Appellant does not persuasively distinguish the NOx emissions value obtained "using an engine out (or feedgas) NOx model" disclosed in Appellant's Specification from Kamada's NOx emission amount, read in using the engine NOx map of Figure 10. Spec. ¶¶ 8, 36 (disclosing, "A NOx out prediction model typically relates the level of NOx produced by an engine to a function of engine speed, engine torque and intake Lambda (representing excess air or oxygen content of the intake."). Thus, Appellant does not specifically identify error in the Examiner's finding that the NOx emission amount from Kamada's Figure 10 map is a "NOx feedgas emissions" as set forth in claims 1 and 8. Moreover, Nakagawa, on which the Examiner relies for its teaching of a model for determining the NOx emission value based on engine torque, engine speed, and EGR, explicitly characterizes the NOx value calculated by the engine NOx emission volume model as "the concentration of NOx at the lean NOx catalyst inlet (the amount of NOx flowing into the lean NOx catalyst[)]." Nakagawa ¶ 53; Final Act. 5.

Appellant's second contention, that Kamada lacks disclosure or suggestion that the NOx map of Figure 10 is based on EGR ratio, is inapposite given the rejection before us. The Examiner found that Kamada discloses “the NOx feedgas emissions determined by a NOx model based on engine speed and engine torque” (i.e., the NOx model of Figure 10), “but does not explicitly disclose the NOx feedgas emissions determined by a NOx model based on the EGR ratio.” Final Act. 5. The Examiner relied on Nakagawa for a teaching to determine “NOx feedgas emissions by a NOx model based on engine speed, engine torque, and an EGR ratio,” as well as a teaching that such a model “is necessary for accurate diagnosing of the performance of an NOx catalyst, to prevent deterioration of combustion due to unexpected fluctuation in the amount of NOx emissions from the engine.” *Id.* (citing Nakagawa ¶¶ 5, 53); *see* Nakagawa ¶ 53 (teaching a lean NOx catalyst model that “calculates the concentration of NOx at the lean NOx catalyst inlet” using inputs including “the engine torque, engine speed, and EGR rate and air-fuel ratio”). Thus, Appellant’s statement that none of the secondary references is relied upon for this feature is factually incorrect. Appellant does not address, much less identify any error in, either the Examiner’s findings regarding the teachings of Nakagawa or the Examiner’s determination that it would have been obvious to combine Nakagawa’s teachings with Kamada “to prevent deterioration of combustion due to unexpected fluctuations in the amount of NOx emissions from the engine.” *See* Appeal Br. 6–9; Final Act. 5.

Appellant additionally relies on the arguments presented against the rejection of claim 13 in contesting the rejection of claims 1 and 8. Appeal Br. 7–8. For the reasons discussed above, these arguments do not apprise us of error in the rejection of claim 13 and, likewise, fail to apprise us of error in the rejection of claims 1 and 8.

Thus, Appellant does not apprise us of error in the rejection of claims 1 and 8. Accordingly, we sustain the rejection of claims 1 and 8 as unpatentable over Kamada, Wildgen, and Nakagawa.

Dependent Claims 2–7, 9–12, and 14–20

In contesting the rejections of dependent claims 2–7, 9–12, and 14–20, Appellant relies solely on their dependence from one of claims 1, 8, or 13. Appeal Br. 9. For the reasons discussed above, these arguments fail to apprise us of error in the rejections of claims 1, 8, and 13, and, thus, also fail to apprise us of error in the rejections of their dependent claims. Accordingly we sustain the rejections of claims 2–7, 9–12, and 14–20 under 35 U.S.C. § 103.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
13	102(a)(1)	Kamada	13	
1, 2, 7–9, 16, 18, 19	103	Kamada, Wildgen, Nakagawa	1, 2, 7–9, 16, 18, 19	
3	103	Kamada, Wildgen, Nakagawa, Takeshima	3	
4, 11	103	Kamada, Wildgen, Nakagawa, Ortmann	4, 11	
5, 12	103	Kamada, Wildgen, Nakagawa, Ewert	5, 12	
6	103	Kamada, Wildgen, Nakagawa, Ewert, Burckhardt	6	
10	103	Kamada, Wildgen, Nakagawa, Hata	10	
14	103	Kamada, Hata	14	
15	103	Kamada, Nakagawa	15	
17	103	Kamada, Ortmann	17	
20	103	Kamada, Soliman	20	
Overall Outcome			1–20	

TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED