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Paper 35
Entered: October 21, 2016

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,
Petitioner,

v.

PAICE LLC & THE ABELL FOUNDATION, INC.,
Patent Owner.

Case IPR2015-00787
Patent 7,237,634 B2

Before SALLY C. MEDLEY, KALYAN K. DESHPANDE, and CARL M. DeFRANCO, *Administrative Patent Judges*.

MEDLEY, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Inter Partes Review
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

We have jurisdiction to hear this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we dismiss the *inter partes* review with respect to claim 215 and determine that Petitioner has shown by a preponderance of the evidence that claims 238, 241, 252–256,

259, 261, 262, 267, 281, 282, 285, 287, and 288 of U.S. Patent No. 7,237,634 B2 are unpatentable.

A. Procedural History

Petitioner, Ford Motor Company, filed a Petition requesting an *inter partes* review of claims 33, 34, 35, 38, 53, 54, 215, 238, 241, 252–256, 259, 261, 262, 267, 281, 282, 285, 287, and 288 of U.S. Patent No. 7,237,634 B2 (Ex. 1750, "the '634 patent"). Paper 1 ("Pet."). Patent Owner, Paice LLC & The Abell Foundation, Inc., filed a Preliminary Response in both unredacted and redacted forms. Papers 9, 10 ("Prelim. Resp."). Upon consideration of the Petition and Preliminary Response, on October 26, 2015, we instituted an *inter partes* review of claims 215, 238, 241, 252–256, 259, 261, 262, 267, 281, 282, 285, 287, and 288, pursuant to 35 U.S.C. § 314. Paper 12 ("Dec.").

Subsequent to institution, Patent Owner filed a Patent Owner Response (Paper 17 ("PO Resp.")) and Petitioner filed a Reply (Paper 25 ("Pet. Reply")).[1] An oral hearing was held on June 28, 2016, and a transcript of the hearing is included in the record (Paper 34 ("Tr.")).

B. Related Proceedings

The '634 patent is involved in *Paice LLC v. Ford Motor Co.*, No. 1-14-cv-00492, filed on February 19, 2014, in the United States District Court for the District of Maryland. Pet. 2. Petitioner twice filed an earlier Petition for *inter partes* review of the '634 patent, and we instituted trial in

[1] In addition, Patent Owner filed a Motion for Observation on Cross-Examination (Paper 27) and Petitioner filed a Response to Motion for Observation on Cross-Examination (Paper 30), both of which have been considered.

both proceedings and subsequently entered final written decisions. *Ford Motor Co. v. Paice LLC & The Abell Foundation, Inc*., Case IPR2014-00904 (Papers 13 and 41), and *Ford Motor Co. v. Paice LLC & The Abell Foundation*, Inc., Case IPR2014-01416 (Papers 9 and 26). The '634 patent also is involved in the following *inter partes* review proceedings: IPR2015-00606, IPR2015-00722, IPR2015-00758, IPR2015-00784, IPR2015-00785, IPR2015-00790, IPR2015-00791, IPR2015-00799, IPR2015-00800, and IPR2015-00801.

C. The '634 Patent (Ex. 1750)

The '634 patent describes a hybrid vehicle with an internal combustion engine, at least one electric motor, and a battery bank, all controlled by a microprocessor that directs torque transfer between the engine, the motor, and the drive wheels of the vehicle. Ex. 1750, 17:17–56, Fig. 4. The microprocessor compares the vehicle's torque requirements and the engine's torque output against a predefined setpoint and uses the results of the comparison to control the vehicle's mode of operation, e.g., straight-electric, engine-only, or hybrid. *Id*. at 40:16–49. The microprocessor utilizes a hybrid control strategy that operates the engine only in a range of high fuel efficiency, which occurs when the instantaneous torque required to drive the vehicle, or road load (RL), reaches a setpoint (SP) of approximately 30% of the engine's maximum torque output (MTO). *Id*. at 20:61–67; *see also id*. at 13:64–65 ("the engine is never operated at less than 30% of MTO, and is thus never operated inefficiently"). Operating the engine in a range above the setpoint but substantially less than the maximum torque output maximizes fuel efficiency and reduces pollutant emissions of the vehicle. *Id*. at 15:55–58.

D. Illustrative Claims

Petitioner challenges independent claim 215 and dependent claim 238, which depends directly from claim 215. Petitioner also challenges independent claim 241 and dependent claims 252–256, 259, 261, and 262, which depend either directly or indirectly from claim 241. Petitioner also challenges independent claim 267 and dependent claims 281, 282, 285, 287, and 288, which depend either directly or indirectly from claim 267.

Claims 215 and 241 are reproduced below:

> 215. A method for controlling a hybrid vehicle, comprising:
>
> determining instantaneous road load (RL) required to propel the hybrid vehicle responsive to an operator command;
>
> operating at least one electric motor to propel the hybrid vehicle when the RL required to do so is less than a setpoint (SP);
>
> operating an internal combustion engine of the hybrid vehicle to propel the hybrid vehicle when the RL required to do so is between the SP and a maximum torque output (MTO) of the engine, wherein the engine is operable to efficiently produce torque above the SP, and wherein the SP is substantially less than the MTO; and
>
> operating both the at least one electric motor and the engine to propel the hybrid vehicle when the torque RL required to do so is more than the MTO; and
>
> regeneratively charging a battery of the hybrid vehicle when instantaneous torque output of the engine>the RL, when the RL is negative, and/or when braking is initiated by an operator of the hybrid vehicle.

Ex. 1750, 79:10–31.

> 241. A method for controlling a hybrid vehicle, comprising:
>
> determining instantaneous road load (RL) required to propel the hybrid vehicle responsive to an operator command;
>
> operating at least one electric motor to propel the hybrid vehicle when the RL required to do so is less than a setpoint (SP);
>
> operating an internal combustion engine of the hybrid vehicle to propel the hybrid vehicle when the RL required to do so is between the SP and a maximum torque output (MTO) of the engine, wherein the engine is operable to efficiently produce torque above the SP, and wherein the SP is substantially less than the MTO; and
>
> operating both the at least one electric motor and the engine to propel the hybrid vehicle when the torque RL required to do so is more than the MTO; and
>
> controlling said engine such that combustion of fuel within the engine occurs substantially at a stoichiometric ratio, wherein said controlling the engine comprises limiting a rate of change of torque output of the engine; and
>
> if the engine is incapable of supplying instantaneous torque required to propel the hybrid vehicle, supplying additional torque from the at least one electric motor.

Id. at 81:33–58.

Independent claim 267 is similar in scope to claim 215 except it does not include the "regeneratively charging a battery of the hybrid vehicle" language. Instead, that claim adds "rotating the engine before starting the engine such that its cylinders are heated by compression of air therein." *Id.* at 84:10–11.

E. Grounds of Unpatentability

We instituted an *inter partes* review of claims 215, 238, 241, 252–256, 259, 261, 262, 267, 281, 282, 285, 287, and 288 on the following grounds:

Reference[s]	Basis	Challenged Claim(s)
Ibaraki '882 [2] and the general knowledge of a POSA	§ 103	215
Ibaraki '882, Vittone[3], and the general knowledge of a POSA	§ 103	241, 252–256, 259, 261, and 262
Ibaraki '882, Yamaguchi[4], and the general knowledge of a POSA	§ 103	238, 267, 281, 282, 285, 287, and 288

II. ANALYSIS

A. Petitioner Estoppel

On March 10, 2016, we rendered a final written decision of claim 215 of the '634 patent in IPR2014-01416. *Ford Motor Co. v. Paice LLC & The Abell Foundation*, Inc., Case IPR2014-01416 (PTAB March 10, 2016) (Paper 26). Patent Owner argues that, pursuant to 35 U.S.C. § 315(e)(1), Petitioner may not maintain its challenge of claim 215. PO Resp. 17. Petitioner responds that it is not estopped because it was necessary for it to file multiple petitions to address the '634 patent's many dependent claims,

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[2] U.S. Patent No. 5,789,882, issued Aug. 4, 1998 (Ex. 1752) ("Ibaraki '882").
[3] Oreste Vittone, *Fiat Conceptual Approach to Hybrid Car Design*, The 12th International Electric Vehicle Symposium (EVS-12), Vol. 2, pp. 458–469 (1994) (Ex. 1753) ("Vittone").
[4] U.S. Patent No. 5,865,263, issued Feb. 2, 1999 (Ex. 1754) ("Yamaguchi").

such as dependent claim 238, which depends from independent claim 215. Pet. Reply 4.

Under 35 U.S.C. § 315(e)(1), a petitioner who has obtained a final written decision on a patent claim in an *inter partes* review may not maintain a subsequent proceeding with respect to that same claim on a ground that it "reasonably could have raised" in the original proceeding. Specifically, section 315(e)(1) provides:

> (e) Estoppel.—
>
> (1) Proceedings before the office.—The petitioner in an inter partes review of a claim in a patent under this chapter that results in a final written decision under section 318(a) . . . may not request or maintain a proceeding before the Office with respect to that claim on any ground that the petitioner raised or reasonably could have raised during that inter partes review.

On March 10, 2016, a final written decision was entered in IPR2014-01416, in which we determined that claim 215 of the '634 patent is unpatentable. Petitioner in this proceeding is the same Petitioner in IPR2014-01416. The grounds raised by Petitioner in IPR2014-01416 against claim 215 is not the same as the ground raised against claim 215 in this proceeding. Nonetheless, Ibaraki '882 was cited during prosecution that led to the '634 patent and is listed on the face of the '634 patent. Ex. 1750. Petitioner does not argue that it reasonably could not have raised its challenge to claim 215 based on Ibaraki '882 in IPR2014-01416. Pet. Reply 4. We determine that Petitioner reasonably could have raised this challenge in IPR2014-01416. Accordingly, Petitioner is estopped under 35 U.S.C. § 315(e)(1) from maintaining the ground based on Ibaraki '882 against claim 215. We dismiss the *inter partes* review with respect to claim 215.

Although we determine it is necessary to address the parties' contentions with respect to independent claim 215 because claim 238 depends from claim 215, we do not otherwise provide a final written decision on the merits with respect to claim 215, or again hold that claim to be unpatentable.

B. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b). Under the broadest reasonable construction standard, claim terms are generally given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definition for a claim term must be set forth with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

Petitioner proposes a construction for "road load" or RL. Pet. 10. In our Decision to Institute, we interpreted road load (RL). Dec. 9–10. We also interpreted the terms "mode I," "low-load operation mode I," "high-way cruising operation mode IV," "acceleration operation mode V," and "abnormal and transient conditions." *Id.* at 12–14. Neither party has indicated that our interpretations of any of these terms were improper and we do not perceive any reason or evidence that now compels any deviation from our initial interpretations. Accordingly, the following constructions apply to this Decision:

Claim Term	Construction
road load or RL	the amount of instantaneous torque

	required to propel the vehicle, be it positive or negative
mode I or low-load operation mode I	a mode of operation of the vehicle, in which all torque provided to the wheels is supplied by an electric motor
high-way cruising operation mode IV	a mode of operation in which all torque provided to the wheels is supplied by the internal combustion engine
acceleration operation mode V	a mode of operation in which torque provided to the wheels is supplied by the internal combustion engine and at least one electric motor

For purposes of this decision, we find it necessary to construe "setpoint" and the "operating limitations" found in claims 215, 241, and 267.

Setpoint (SP)

The term "setpoint" or "SP" is recited in independent claims 215, 241, and 267. Petitioner proposes that "setpoint" or "SP" be construed, in the context of these claims, as "predetermined torque value." Pet. 10–11. Patent Owner argues that "setpoint" or "SP" be construed as "a definite, but potential variable value at which a transition between operating modes may occur." PO Resp. 7.[5]

We agree with Petitioner that the claims compare the setpoint either to an engine torque value or a torque based "road load" value. Pet. 10–11.

[5] In our Decision to Institute, and upon taking into consideration the parties' arguments and supporting evidence, we interpreted "setpoint" or "SP" to mean "predetermined torque value that may or may not be reset." Dec. 12. Petitioner agrees with that interpretation, while Patent Owner does not. Pet. Reply 2; PO Resp. 7–11.

Each of claims 215, 241, and 267 recites a condition "when the RL required to do so is less than a setpoint (SP)." Ex. 1750, 79:16–17, 81:39–40, 83:66–67. Each of claims 215, 241, and 267 further recites a range established by the setpoint at one end, and the maximum torque output of the engine at the other end, by the language "when the RL required to do so is between the SP and a maximum torque output (MTO) of the engine." *Id*. at 79:19–21, 81:42–44, 84:2–4.

Nothing in the Specification precludes a setpoint from being reset, after it has been set. A setpoint for however short a period of time still is a setpoint. Accordingly, we construe "setpoint" and "SP" as "predetermined torque value that may or may not be reset."

Patent Owner argues that the claims and the Specification of the '634 patent "make clear that a 'setpoint' is not simply a numerical value divorced from the context of the control system," and that "'setpoint' serves the crucial function of marking the transition from one claimed mode to another, and in particular, the transition from propelling the vehicle with the motor to propelling the vehicle with the engine." PO Resp. 8. This argument is misplaced. Although such use of a setpoint is described by other language in the Specification, it is not an intrinsic property of a setpoint and is not a necessary and required use of all setpoints. In that regard, we further note the following passage in the Specification of the '634 patent, which supports not reading a mode switching requirement (i.e., transition requirement) into the term "setpoint":

> the values of the sensed parameters in response to which the operating mode is selected may vary . . ., so that *the operating mode is not repetitively switched simply because one of the sensed parameters fluctuates around a defined setpoint*.

Ex. 1750, 19:67–20:6 (emphasis added).

It is improper to add an extraneous limitation into a claim, i.e., one that is added wholly apart from any need for the addition to accord meaning to a claim term. *See, e.g., Hoganas AB v. Dresser Indus., Inc*., 9 F.3d 948, 950 (Fed. Cir. 1993); *E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co*., 849 F.2d 1430, 1433 (Fed. Cir. 1988). It is important not to import into a claim limitations that are not a part of the claim. *Superguide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004). For example, a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment. *Id*.; *see also In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993). That is no different even if the patent specification describes only a single embodiment. *Liebel-Flarsheim Co. v. Medrad Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004).

Patent Owner brings to our attention that the U.S. District Court for the Eastern District of Texas and the U.S. District Court for the District of Maryland both have construed "setpoint" to mean "a definite, but potentially variable value at which a transition between operating modes may occur." PO Resp. 7 n.1. We note that that construction also does not require that an operating mode be changed at a setpoint, as Patent Owner urges. Instead, the construction of the district courts sets forth that a transition between operating modes "may occur" at a setpoint, which is consistent with our construction here.

Patent Owner additionally argues that "setpoint" should not be limited to a torque value, because the Specification makes clear that it also can be

the state of charge of a battery. PO. Resp. 10–11. Patent Owner cites to the following passage in the Specification:

> [T]he microprocessor tests sensed and calculated values for system variables, such as the vehicle's instantaneous torque requirement, i.e., the "road load" RL, the engine's instantaneous torque output ITO, both being expressed as a percentage of the engine's maximum torque output MTO, *and the state of charge of the battery bank BSC*, expressed as a percentage of its full charge, *against setpoints*, and uses the results of the comparisons to control the mode of vehicle operation.

Ex. 1750, 40:18–26 (emphasis added). This argument also is misplaced. As we noted above, independent claims 215, 241, and 267 require a comparison of the setpoint either to an engine torque value or a torque based "road load" value. Thus, in the context of these claims, and claims dependent therefrom, a setpoint must be a torque value, and not some state of charge of a battery.

For reasons discussed above, we construe "setpoint" and "SP" as "predetermined torque value that may or may not be reset."

The "operating" limitations

Patent Owner asserts that the challenged claims require a comparison of road load (RL) to setpoint (SP) and also to maximum torque output (MTO). PO Resp. 11–16. The assertion is based on the requirements in claim 215 of (1) operating at least one electric motor to propel the hybrid vehicle "when the RL required to do so is less than a setpoint (SP)," (2) operating an internal combustion engine of the hybrid vehicle to propel the hybrid vehicle "when the RL required to do so is between the SP and a maximum torque output (MTO) of the engine," and (3) operating both the at least one electric motor and the engine to propel the hybrid vehicle "when

the torque RL required to do so is more than the MTO." Claims 241 and 267 include essentially the same recitations.

In the above discussion of the construction of setpoint, we already noted that claims 215, 241, and 267 each require a comparison of road load to a setpoint because of the claim recitations "when the RL required to do so is less than a setpoint (SP)" and "when the RL required to do so is between the SP and a maximum torques output (MTO) of the engine." For similar reasons, claims 215, 241, and 267 each require a comparison of road load to a maximum torque output (MTO) because of the recitation "when the torque RL required to do so is more than the MTO." Petitioner has not advanced any cogent reasoning why no such comparison is required by the claims. We determine that the claims require a comparison of road load (RL) to a setpoint (SP) and also to a maximum torque output (MTO). That, however, does not mean the claims exclude the comparison of other parameters.

C. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

In that regard, an obviousness analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 550 U.S. at 418; *see Translogic*, 504 F.3d at 1259.

The level of ordinary skill in the art is reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978).

D. Claim 215

As discussed above, we dismiss the *inter partes* review with respect to claim 215. Claim 238, however, depends from claim 215 and necessarily includes all of the limitations of claim 215. Accordingly, we first address the contentions made by Petitioner as to how Ibaraki '882 renders obvious claim 215.

Petitioner contends that claim 215 is unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882 and the general knowledge of a person of ordinary skill in the art. Pet. 12–35, 37. To support its contentions, Petitioner provides detailed explanations as to how the prior art meets each claim limitation of claim 215. *Id*. Petitioner also relies upon a Declaration of Dr. Gregory W. Davis, who has been retained as an expert witness by Petitioner for the instant proceeding. Ex. 1755. For the reasons that follow, and notwithstanding Patent Owner's arguments, which we address below, we are persuaded by Petitioner's showing, which we adopt as our own, that claim 215 is unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882 and the general knowledge of a person of ordinary skill in the art.

Ibaraki '882

Ibaraki '882 describes a drive control apparatus and method for a hybrid vehicle equipped with two drive power sources consisting of an electric motor and engine such as an internal combustion engine. Ex. 1752, 1:9–14. Drive control apparatus includes controller 128 that includes a drive source selecting means 160. Drive source selecting means is adapted to select one or both of engine 112 and motor 114 as the drive power source or sources according to a drive source selecting data map stored in memory means 162. *Id.* at 20:38–43, Figs. 8 and 9. In particular, controller 128 has a MOTOR DRIVE mode in which motor 114 is selected as the drive power source, an ENGINE DRIVE mode in which the engine 112 is selected as the drive power mode source, and an ENGINE-MOTOR DRIVE mode in which both the engine 112 and the motor 114 are selected as the drive power sources. *Id.* at 20:43–49.

Figure 11, reproduced below, depicts a graph which represents a predetermined relationship between the vehicle drive torque and running speed V and the three drive modes. *Id.* at 20:50–53.

FIG. 11

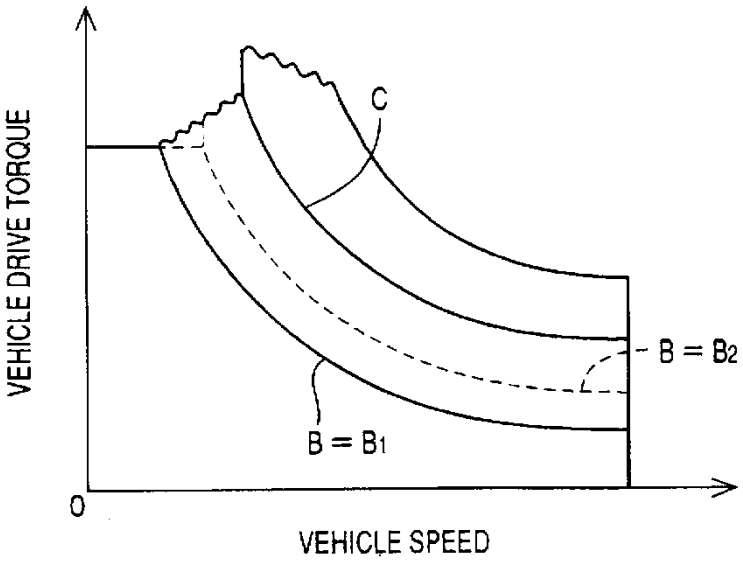


Figure 11 shows a graph which represents a predetermined relationship between the vehicle drive torque and running speed.

Drive source selecting means 160 (Fig. 9) selects the MOTOR DRIVE mode when the vehicle running condition as represented by the current vehicle drive torque and speed V is held within the range below the first boundary line B. When the vehicle running condition is held within the range between the first and second boundary lines B and C, the drive source selecting means 160 selects the ENGINE DRIVE mode. When the vehicle running condition is in the range above the second boundary line C, the drive source selecting means 160 selects the ENGINE[-MOTOR] DRIVE mode. *Id.* at 20:59–21:1. Ibaraki '882 describes that the boundary line B may be adjusted from B_1 to B_2 so as to enlarge the range in which the MOTOR DRIVE mode is selected. *Id.* at 21:2–4. Ibaraki '882 further

describes an ELECTRICITY GENERATING DRIVE mode where the engine provides surplus power that is greater than the vehicle drive torque. The surplus power from the engine is used to operate the electric motor as a generator to regeneratively charge the battery. *Id.* at 23:1–30.

Claim 215

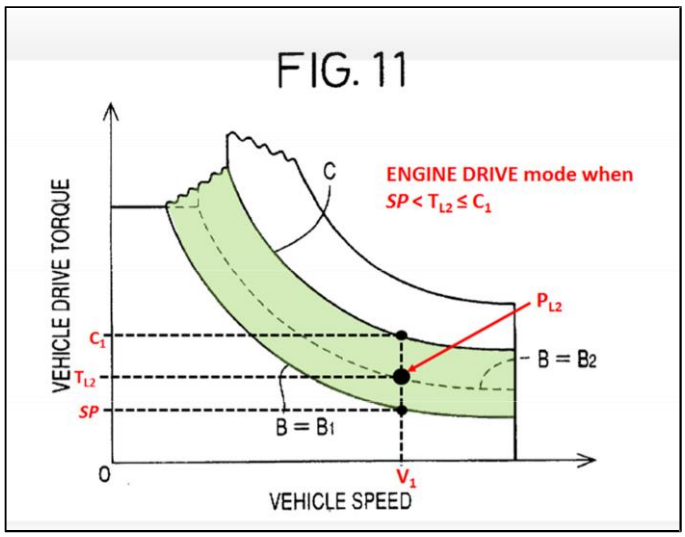
Claim 215 recites a method for controlling a hybrid vehicle. Petitioner contends that Ibaraki '882 describes a drive control apparatus for controlling a hybrid vehicle that may be propelled by an internal engine and electric motor. Pet. 12, 37; Ex. 1752, 1:9–14; Ex. 1755 ¶¶ 148–150. We are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882 describes a method for controlling a hybrid vehicle.

Claim 215 recites "determining instantaneous road load (RL) required to propel the hybrid vehicle responsive to an operator command." Petitioner contends, with supporting evidence, that a person having ordinary skill in the art would have understood that the "vehicle drive torque" values described in Ibaraki '882 represent instantaneous road load (torque) required to propel the vehicle responsive to operator command (accelerator pedal operating amount and rate of change of accelerator pedal operating amount). Pet. 17, 38; Ex. 1755 ¶¶ 168–173. We are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882 describes this limitation.

Claim 215 recites "operating at least one electric motor to propel the hybrid vehicle when the RL required to do so is less than a setpoint (SP)." Petitioner relies on annotated graphs, along with Dr. Davis' testimony, explaining that Ibaraki '882 describes different operating modes, where the vehicle is operated by motor alone (MOTOR DRIVE mode), when the road load (RL) is less than the setpoint (SP) along boundary B. Pet. 18–20, 37;

Ex. 1752, 19:55–20:9, 20:43–62; Ex. 1755 ¶¶ 180–188. We are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882 describes operating at least one electric motor to propel the hybrid vehicle when the road load required to do so is less than a setpoint (SP).

Claim 215 recites "operating an internal combustion engine of the hybrid vehicle to propel the hybrid vehicle when the RL required to do so is between the SP and a maximum torque output (MTO) of the engine." Petitioner contends that Ibaraki '882 describes an internal combustion engine (engine 112 in Fig. 8) that may be operated to propel the hybrid vehicle during an ENGINE DRIVE mode in which engine 112 is selected as the drive power source. Pet. 20; Ex. 1752, 20:43–53; 19:18–27; Ex. 1755 ¶¶ 194–197. Petitioner contends, with respect to Ibaraki '882 Figure 11, that the engine drive mode lies between the two boundary lines B and C. Ibaraki '882 describes that the controller uses the data map of Figure 11 to select ENGINE DRIVE mode when the vehicle running condition as represented by the current vehicle drive torque and speed V is held within the range between boundary lines B and C. Ex. 1752, 20:49–58. In support of its contentions, Petitioner relies on the following annotated Ibaraki '882 Figure 11, reproduced below. Pet. 22.



Ibaraki '882 Figure 11 as annotated in the Petition (Pet. 22)

Petitioner explains, with supporting evidence, that at a given vehicle speed (annotated as V_1), a given setpoint (annotated as SP from) along boundary B is known, and that the setpoint marks the transition between the MOTOR DRIVE mode and the ENGINE DRIVE mode. As long as the current vehicle drive torque are below torque point C_1, Petitioner contends the vehicle will operate in the ENGINE DRIVE mode. Pet. 22–23; Ex. 1752, 20:55–62; 23:66–24:30; Ex. 1755 ¶¶ 200–203.

With respect to the maximum torque output limitation, Petitioner contends, with supporting evidence, that a person having ordinary skill in the art would have recognized that an IC engine, like that described in Ibaraki '882, necessarily has a maximum torque output (MTO), above which the IC engine cannot produce additional torque. Pet. 22–23; Ex. 1755 ¶ 202. Petitioner further contends that because the range of torque setpoints along boundary B represents the lower-bound of the ENGINE DRIVE mode, a person having ordinary skill in the art would have understood that the maximum torque output must be greater than any setpoint along boundary

line B and that the MTO would be equal to or greater than torque point C_1. *Id.* We are persuaded by Petitioner's showing, and adopt it as our own, based on the relevant knowledge at the time of the invention that Ibaraki '882, based on the relevant knowledge at the time of the invention, describes operating an internal combustion engine of the hybrid vehicle to propel the hybrid vehicle when the RL required to do so is between the SP and a maximum torque output (MTO) of the engine.

Claim 215 further recites "wherein the engine is operable to efficiently produce torque above the SP." Petitioner contends, with supporting evidence, that at the time of the invention, it was known that for hybrid vehicles, a key point is to operate the IC engine at more efficient operating points. Pet. 23; Ex. 1762, 12; Ex. 1755 ¶¶ 128–130. Petitioner also points out that Ibaraki '882 itself describes that an object of its invention is to provide a drive control apparatus for a hybrid vehicle which permits effective reduction in the fuel consumption amount or exhaust gas amount of the engine, and in the context of the ENGINE DRIVE mode. Pet. 23–24; Ex. 1752, 2:52–56, 25:1–10. Petitioner contends that a person having ordinary skill in the art would have known that reduced fuel consumption is characteristic of improved IC engine efficiency. Pet. 24; Ex. 1755 ¶¶ 128–130, 208; Ex. 1763, 2. We are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882, based on the relevant knowledge at the time of the invention, meets the recitation that the engine is operable to efficiently produce torque above the SP.

Claim 215 recites "wherein the SP is substantially less than the MTO." Petitioner asserts that, based on a description in the '634 patent (claim 15), "substantially less than the MTO" includes a SP which is less

than approximately 70% of the MTO. Pet. 24. Petitioner further contends, with supporting evidence, that since an IC engine cannot operate or provide torque above its MTO, the setpoints used to delineate the start of the ENGINE DRIVE mode are substantially less than the MTO of the engine. Pet. 24; Ex. 1755 ¶ 217. Dr. Davis explains that the points along curve B of Figure 11, for example, would have been understood by a person of ordinary skill in the art to be setpoints below the MTO. Ex. 1755 ¶ 222. Dr. Davis further explains that a person having ordinary skill in the art would have understood that the MTO at vehicle speed must at least be equal to point C_1 (from annotated Figure 11 above), and if it were not, then the IC engine could not alone drive the vehicle within the entire ENGINE DRIVE mode range. *Id.* ¶¶ 222–224. Dr. Davis further explains why a person having ordinary skill in the art would have understood that the setpoint (from the annotated figure above shown as B_1 or SP) is substantially less than point C_1, because SP is no more than half of the vehicle drive torque of C_1. *Id.* We are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882, based on the relevant knowledge at the time of the invention, meets the recitation that the SP is substantially less than the MTO.

Claim 215 recites "operating both the at least one electric motor and the engine to propel the hybrid vehicle when the torque RL required to do so is more than the MTO." For this limitation, Petitioner relies on the ENGINE-MOTOR DRIVE mode of Ibaraki '882, and explains that the "current vehicle drive torque" (shown as T_{L3} per annotated Figure 11) is the "instantaneous torque required to propel the vehicle" (or road load) at this "vehicle running condition." Pet. 27–29. Petitioner further explains, with supporting evidence, that Ibaraki '882 would operate the vehicle in the

ENGINE-MOTOR DRIVE mode when a point (P_{L3}) denotes that the "current vehicle drive torque" (T_{L3}) at a given vehicle speed (V_1) is above the torque point (C_1), which would be above the IC engine's MTO. Pet. 27–30; Ex. 1752, 20:55–62, 26:28–33; Ex. 1755 ¶¶ 238–244.

In particular, Dr. Davis testifies:

> 238. It is also my opinion that a person having ordinary skill in the art would have understood the torque point C_1 along the predetermined "boundary line C" would be equal to or possibly less than the maximum torque output (MTO) at that given vehicle speed (V_1). First, an IC engine **cannot** operate above the engine's MTO. Because the IC engine alone operates in the "ENGINE DRIVE mode" when the vehicle drive torque is between "boundary line B" and "boundary line C" the MTO cannot be less than the torque point C_1 at that given vehicle speed. It follows that the maximum torque output (MTO) of the engine is at minimum equal to the torque point C_1 when operated at a vehicle speed V_1, because the engine is still operating alone until the torque exceeds the point C_1.
>
> 239. Ibaraki '882 states that the "ENGINE-MOTOR DRIVE mode" is selected "when the vehicle load is comparatively high." (Ex. 1752 [Ibaraki '882] at 26:28–33.)
>
> 240. It is my opinion that a person of ordinary skill in the art would have understood that high "vehicle loads" would include vehicle drive torques above the engine's maximum torque output (MTO). It is also my opinion that a person having ordinary skill would have understood that a hybrid vehicle control strategy would at some point allow the IC engine to provide output torque near and potentially including its MTO. Otherwise, the system would be artificially limiting the performance of the vehicle. In other words, the hybrid vehicle would not be providing the full output capabilities of the IC engine and the motor under high loads. Thus, within the ENGINE-MOTOR DRIVE mode the system would eventually allow the IC engine to provide torque at its MTO and also allow

> the additional supplemental torque to be provided from the electric motor.
>
> 241. A person of ordinary skill in the art would have understood that it would be obvious to use the electric motor to provide additional output torque above the engine's maximum torque output (MTO) during such high vehicle load situations. As discussed above in the State of the Art in ¶¶ 128–134 the control techniques for using the motor above the engine's MTO were well known.

Ex. 1755 ¶¶ 238–241.

Ibaraki '882 describes that the ENGINE-MOTOR drive mode is selected when the "vehicle load is comparatively high." Ex. 1752, 26:28–33. We give substantial weight to Dr. Davis's testimony that the torque point C_1 along the predetermined "boundary line C" would be equal to or possibly less than the maximum torque output (MTO) at vehicle speed (V_1). Ex. 1755 ¶ 238. We further give substantial weight to Dr. Davis's testimony that at such high vehicle load situations it would have been obvious to use the electric motor to provide additional output torque above the engine's maximum torque output. *Id.* at ¶ 241. Dr. Davis's testimony is consistent with the teachings of Ibaraki '882 and the state of the art at the time of the invention. *See, e.g.*, Ex. 1762, 3. We are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882, based on the relevant knowledge a person of ordinary skill in the art would have had at the time of the invention, meets the recitation of operating both the at least one first electric motor and the engine to propel the hybrid vehicle when the torque RL required to do so is more than the MTO.

Claim 215 recites "regeneratively charging a battery of the hybrid vehicle when instantaneous torque output of the engine [is greater than] the

RL, when RL is negative, and/or when braking is initiated by an operator of the hybrid vehicle." Petitioner accounts for the regeneratively charging a battery language, by citing to a description in Ibaraki '882 of an ELECTRICITY GENERATING DRIVE mode where the engine provides surplus power that is greater than the vehicle drive torque. The surplus power from the engine is used to operate the electric motor as a generator to regeneratively charge the battery. Pet. 38; Ex. 1752, 17:65–18:19; 23:6–32; Ex. 1755 ¶¶ 286–289. We are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882, based on the relevant knowledge a person of ordinary skill in the art would have had at the time of the invention, meets the above quoted language.

Patent Owner's Contentions

Patent Owner makes three arguments with respect to claim 215: (1) Ibaraki '882 does not compare road load to setpoint; (2) Ibaraki '882 does not compare road load to MTO; and (3) Ibaraki '882 does not disclose a setpoint that is substantially less than MTO. PO Resp. 17–48. We address each argument in the order presented by Patent Owner.

Patent Owner argues Ibaraki '882 describes comparing power to power thresholds to determine the operational mode of the vehicle instead of comparing road load to a setpoint, both of which are torque values. *Id.* at 18–34. We have considered all of Patent Owner's arguments and supporting evidence to which we are directed with respect to the contention, but are not persuaded by Patent Owner's arguments.

It is undisputed that "power" is determined as the multiplicative product of "torque" and "speed." Ex. 1755 ¶ 166; Ex. 2706 ¶ 46. A comparison directed to a selected power point on Figure 11 of Ibaraki '882

necessarily makes a comparison with regard to the torque value associated with the selected power point on the figure, regardless of whether a comparison also is made with respect to speed. In Ibaraki '882 the drive source selecting means selects the MOTOR DRIVE mode, for example, "*when* the vehicle running condition *as represented by the current vehicle drive torque and speed V* is held within the range below the first boundary line B." Ex. 1752, 20:60–62 (emphasis added). Thus, a comparison ("*when* the vehicle running condition *as represented by*") is made based on the constituent parts of the power value of the current vehicle drive torque and speed. We agree with Patent Owner that the claims require a comparison of road load (RL) to a setpoint (SP) and also to a maximum torque output (MTO), but that does not mean the claims exclude the comparison of other parameters, such as speed. Indeed, they do not. The scope of these claims does not dictate that the only comparison made is with respect to torque, and that no other types of comparisons are involved.

Ibaraki '882 describes selecting an operating mode based on a drive source selecting data map as illustrated in Figure 11. The drive source selecting means selects the MOTOR DRIVE mode, for example, "when the vehicle running condition as represented by *the current vehicle drive torque and speed V* is held within the range below the first boundary line B." Ex. 1752, 20:60–62 (emphasis added). The point corresponding to the required drive power P_L of Figure 11 (annotated above) satisfies the claimed road load, because P_L includes the constituent parts of torque and speed. Ex. 1755 ¶¶ 165–169. Furthermore, the boundary line B is a line below which the MOTOR DRIVE mode is selected, and thus, the points along boundary line B of torque and speed satisfy the setpoint limitation. *Id.* ¶¶ 182–188.

Again, the claims do not preclude the comparison of more than two components, as long as torque is one of the components.

Patent Owner argues that the '634 patent specification describes that the instantaneous torque necessary to propel the vehicle is independent of vehicle speed. PO Resp. 20; Ex. 1750, 12:55–61. But that passage is in the "DISCUSSION OF THE PRIOR ART" section of the '634 patent. Patent Owner has not shown that that description applies to every embodiment described in the '634 patent. In any event, there is nothing in the claims themselves that precludes speed from also being considered in determining the mode of operation of the hybrid vehicle. Indeed, the '634 also contemplates including not just the torque value in the comparison, but also speed. *See, e.g.*, Ex. 1750, Fig. 4, 59:3–5.

Patent Owner argues that Ibaraki '882 does not compare road load to MTO to determine if both the electric motor and engine are required to propel the vehicle. PO Resp. 34–44. Patent Owner argues that Ibaraki '882 does not mention MTO, or use MTO in mode selection control strategy. *Id.* at 34. But Petitioner does not assert that Ibaraki '882 mentions or discusses MTO. Rather, as explained above, Petitioner asserts that Ibaraki '882 would operate the vehicle in the ENGINE-MOTOR DRIVE mode when a point (P_{L3}) denotes that the "current vehicle drive torque" (T_{L3}) at a given vehicle speed (V_1) is above the torque point (C_1), which would be above the IC engine's MTO. Pet. 27–30; Ex. 1752, 20:55–62, 26:28–33; Ex. 1755 ¶¶ 238–244. Thus, Petitioner asserts that a person having ordinary skill in the art at the time of the invention would have understood the MTO to correspond to, for example, point C_1 in the annotated Figure 11.

Moreover, Dr. Davis testifies that a person of ordinary skill in the art would have understood that it would have been obvious "to use the electric motor to provide additional output torque above the engine's maximum torque output (MTO) during such high vehicle load situations [as described in Ibaraki '882]." Ex. 1755 ¶ 241. In support of that assertion, he explains, with supporting evidence, that it was well known to use both the motor and engine above the engine's MTO. *Id.* Accordingly, even to the extent that Ibaraki '882 alone does not describe explicitly operating the engine and motor "when the torque RL required to do so is more than the MTO," based on the record before us, doing so would have been an obvious modification to make to the Ibaraki '882 control system. "[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 417 (2007).

Patent Owner does not rebut sufficiently Dr. Davis's testimony that a person of ordinary skill in the art would have understood that it would have been obvious to use the electric motor to provide additional output torque above the engine's maximum torque output (MTO) during the high vehicle load situations described in Ibaraki '882. For this reason alone, we are not persuaded by Patent Owner's arguments that Petitioner fails to show by a preponderance of the evidence that Ibaraki '882, based on the knowledge of a person of skill in the art, taught or suggested operating both the motor and engine above the engine's MTO.

In any event, we also address Patent Owner's arguments that the curve C of Figure 11 of Ibaraki '882, or any given point along that curve, such as

C_1, does not correspond to MTO. In particular, Patent Owner argues that a typical MTO for an engine would be shaped like a bell curve, as opposed to the inverse shaped parabola of boundary line C of Ibaraki '882 Figure 11. PO Resp. 35–38. But as Petitioner points out, this argument and Patent Owner's supporting evidence are based on a Patent Owner presented Figure 11 that is not the same as the actual figure of Ibaraki '882. *See, e.g.*, Pet. Reply 6–11. Patent Owner's proposed Figure 11, which Mr. Hannemann bases his testimony upon, is labeled "engine speed" along the X axis. The X axis of Figure 11 of Ibaraki '882 is labeled "vehicle speed." Moreover, the flat portion on the far left of Figure 11 of Ibaraki '882 is shown as a slope in Patent Owner's rendition of the figure. *See, e.g., id.* at 7. Based on this alone, we do not determine the evidence to which we are directed by Patent Owner to be particularly helpful or reliable. As such, the Patent Owner's arguments are not persuasive for this additional reason. On the other hand, and as explained above, we give substantial weight to Dr. Davis's testimony that a person having ordinary skill in the art would have understood that the torque point C_1 would be equal to or possibly less than the maximum torque output (MTO) at that given vehicle speed (V_1). Ex. 1755 ¶ 238.

Patent Owner argues that Ibaraki '882 does not disclose a setpoint that is substantially less than MTO. PO Resp. 45–48. Patent Owner's arguments are similar to those addressed above with respect to the contention, for example, that point C_1 from Figure 11 does not correspond to MTO. *See, e.g., id.* at 47 n. 9. The arguments have been addressed, and for reasons already provided, we are not persuaded by Patent Owner's arguments that that point C_1 from Figure 11 does not correspond to MTO. Moreover,

Petitioner, directing attention to paragraph 217 of Dr. Davis's declaration, also explains that the Ibaraki '882 setpoint must be substantially less than the MTO because, otherwise, the IC engine would hardly ever be used as a primary drive source for the disclosed vehicle. Pet. 24; Ex. 1755 ¶ 217. Patent Owner argues that such an assertion is based on an unreasonably broad construction which essentially reads the "substantially less than the maximum torque output" limitation out of the claim. PO Resp. 47. But, as explained previously above, substantially less includes anything less than 70% of MTO. Thus, we are not persuaded by Patent Owner's argument.

E. Claims 238, 267, 281, 282, 285, 287, and 288

Petitioner contends that claims 238, 267, 281, 282, 285, 287, and 288 are unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882, Yamaguchi, and the general knowledge of a person having ordinary skill in the art. Pet. 54–60. To support its contention, Petitioner provides detailed explanations as to how the prior art meets each claim limitation of claims 238, 267, 281, 282, 285, 287, and 288. *Id.* Petitioner also relies upon the Declaration of Dr. Davis for support. Ex. 1755.

Independent claim 267 is similar to claim 215 discussed above except it does not include the regeneratively charging step. Unlike claim 215, independent claim 267 includes "rotating the engine before starting the engine such that its cylinders are heated by compression of air therein." Claim 238, which depends from independent claim 215, also includes this limitation.

Petitioner accounts for the rotating the engine language, by first explaining, with supporting evidence, that it was well-known and desirable at the time of the invention to preheat the engine to reduce engine emissions

during a cold start. Pet. 54; Ex. 1755 ¶¶ 406–407. Petitioner relies on Yamaguchi for its description of preheating the engine by rotating the engine of a hybrid vehicle 600 rpm before starting it. Pet. 54; Ex. 1754, 8:62–65. Petitioner also articulates reasoning with rational underpinnings on why a person of ordinary skill in the art at the time of the invention would have combined Yamaguchi with Ibaraki '882. Pet. 54–55. For example, Petitioner explains, with supporting evidence, that by pre-heating the Ibaraki '882 engine, the vehicle would have a less rich fuel-air mixture at start-up, which would minimize vehicle exhaust emissions and waste less fuel during engine starts, thereby promoting the objective of Ibaraki '882 of reducing fuel consumption and exhaust gas amount. *Id.*; Ex. 1754, 1:34–35; Ex. 1790, 52, 62; Ex. 1755 ¶¶ 421–422.

Notwithstanding Patent Owner's arguments, which we address below, we are persuaded by Petitioner's showing, which we adopt as our own, that Ibaraki '882 in combination with Yamaguchi reasonably would have suggested the limitations of claims 238 and 267 and that the combination would have been obvious for the reasons provided by Petitioner. Here, a person of ordinary skill in the art would have recognized that heating the engine of the Ibaraki '882 hybrid vehicle prior to starting it would have resulted in the predictable result of minimizing vehicle exhaust emissions and wasting less fuel during engine starts.

Each of claims 281, 282, 285, 287, and 288 depends from independent claim 267. Notwithstanding Patent Owner's arguments, which we address below, we have considered Petitioner's showing for these claims and are persuaded by such showing. For example, claim 287, which depends from claim 267, recites that the hybrid vehicle comprises "a variable-ratio

transmission disposed between the engine and the wheels of the hybrid vehicle." Claim 288, which depends from claim 267, further recites "wherein said variable-ratio transmission comprises a planetary gearbox." For claims 287 and 288, Petitioner contends that Ibaraki '882 describes, in Figures 1 and 8, a transmission 16 and a transmission 116 that are disposed between the engine and the wheels of the hybrid vehicle. Pet. 52, 59; Ex. 1752, 11:6–21, 19:23–28. Petitioner further contends, with supporting evidence, that the transmission is a "variable-ratio" transmission that comprises a planetary gear mechanism. Pet. 52–53; Ex. 1752, 18:34–56, 19:28–32; Ex. 1755 ¶¶ 391–402. Petitioner has shown by a preponderance of the evidence that claims 281, 282, 285, 287, and 288 would have been obvious based on Ibaraki '882, Yamaguchi, and the relevant knowledge of a person having ordinary skill in the art.

Patent Owner's Contentions

We already have considered Patent Owner's arguments that Ibaraki '882 "neither discloses nor renders obvious the road load, setpoint, and MTO limitations of the challenged claims." PO Resp. 54. We are not persuaded by such arguments for reasons provided above.

Patent Owner argues that Petitioner fails to establish that a person having ordinary skill in the art would have been motivated "to combine Yamaguchi's engine rotation with Ibaraki '882." PO Resp. 55. We disagree. Petitioner provides a reasonable rationale to combine Yamaguchi's engine rotation to the Ibaraki '882 hybrid vehicle. A person having ordinary skill in the art at the time of the invention would have known that rotating the Ibaraki '882 engine before starting the engine would have led to the predictable result of having a less rich fuel-air mixture at

start-up, which would minimize vehicle exhaust emissions and waste less fuel during engine starts. Pet. 54–55; Ex. 1754, 1:34–35; Ex. 1790, 52, 62; Ex. 1755 ¶¶ 421–422.

F. Claims 241, 252–256, 259, 261, and 262

Petitioner contends that claims 241, 252–256, 259, 261, and 262 are unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882, Vittone, and the general knowledge of a person of ordinary skill in the art. Pet. 38–53. To support its contentions, Petitioner provides detailed explanations as to how the prior art meets each claim limitation of claims 241, 252–256, 259, 261, and 262. *Id.* Petitioner also relies upon the Declaration of Dr. Davis for support. Ex. 1755.

Independent claim 241 is similar to independent claim 215 discussed above except it does not include the regeneratively charging step. Unlike claim 215, claim 241 includes the following additional limitations: (1) "controlling said engine such that combustion of fuel within the engine occurs substantially at a stoichiometric ratio, wherein said controlling the engine comprises limiting a rate of change of torque output of the engine" and (2) "if the engine is incapable of supplying instantaneous torque required to propel the hybrid vehicle, supplying additional torque from the at least one electric motor." With respect to these two additional limitations, Petitioner contends that they are described in Vittone. Pet. 43–44.

In particular, Petitioner contends that it was a well-known objective of engine control strategies to operate at stoichiometric ratio in order to reduce emissions. Pet. 38; Ex. 1755 ¶ 297. Petitioner contends that Vittone describes controlling an engine for a hybrid vehicle to maintain stoichiometric control over the whole working range. Pet 38; Ex. 1753, 26.

Petitioner further contends that Vittone describes a driving torque management control strategy shown in Figure 8 that includes limiting a rate of change of torque output of the engine. Pet. 39–40; Ex. 1753, 27, Fig. 8; Ex. 1755 ¶¶ 302–306. Petitioner contends that Vittone's driving torque management control strategy controls the electric motor to provide additional propulsive torque requirements while the engine output is limited. Pet. 40–41; Ex. 1753, 27, Fig. 8; Ex. 1755 ¶¶ 307–309.

Petitioner articulates reasoning with rational underpinnings on why a person of ordinary skill in the art at the time of the invention would have combined Vittone with Ibaraki '882 and the knowledge of a POSA. Pet. 41–43. Petitioner explains, with supporting evidence, that a person having ordinary skill in the art would have understood that Vittone's control of the stoichiometric ratio during any transient conditions in the Ibaraki '882 system would have reduced exhaust emissions and increased fuel efficiency, and that the modification would have required a mere change in Ibaraki '882's software. Pet. 42; Ex. 1755 ¶¶ 310–319.

Notwithstanding Patent Owner's arguments, which we address below, we are persuaded by Petitioner's showing, which we adopt as our own, that Ibaraki '882 in combination with Vittone reasonably would have suggested the limitations of claim 241 and that the combination would have been obvious for the reasons provided by Petitioner.

Claims 252–256, 259, 261, and 262 depend from claim 241. Notwithstanding Patent Owner's arguments, which we address below, we have considered Petitioner's showing for these claims and are persuaded by such showing. For example, claim 261, which depends from claim 241, recites that the hybrid vehicle comprises "a variable-ratio transmission

disposed between the engine and the wheels of the hybrid vehicle." Claim 262, which depends from claim 261, further recites "wherein said variable-ratio transmission comprises a planetary gear mechanism." For claims 261 and 262, Petitioner contends that Ibaraki '882 describes, in Figures 1 and 8, a transmission 16 and a transmission 116 that are disposed between the engine and the wheels of the hybrid vehicle. Pet. 52, 59; Ex. 1752, 11:6–21, 19:23–28. Petitioner further contends, with supporting evidence, that the transmission is a "variable-ratio" transmission that comprises a planetary gear mechanism. Pet. 52–53; Ex. 1752, 18:34–56, 19:28–32; Ex. 1755 ¶¶ 391–402. Petitioner has shown by a preponderance of the evidence that claims 252–256, 259, 261, and 262 would have been obvious based on Ibaraki '882, Vittone, and the relevant knowledge of a person having ordinary skill in the art.

Patent Owner's Contentions

We already have considered Patent Owner's arguments that Ibaraki '882 "neither discloses nor renders obvious the road load, setpoint, and MTO limitations of the challenged claims." PO Resp. 48. We are not persuaded by such arguments as we explain above.

Patent Owner also argues that Vittone does not disclose controlling the engine by limiting a rate of change of torque output of the engine. PO Resp. 49–51. This argument is unpersuasive. Vittone describes that a contribution to the emission reduction is achieved through the "'steady state' management of the thermal engine in transient phases, while the torque demand is assured by the electric motor support (Fig. 8)." Ex. 1753, 27. Dr. Davis testifies that Vittone's disclosure of "steady state management" of the engine is referring to limiting the rate of change in engine output torque

during transient conditions to maintain stoichiometric combustion, which is illustrated in Figure 8 of Vittone. Ex. Ex. 1755 ¶ 304. We credit the testimony of Dr. Davis over Mr. Hannemann's testimony who opines that Figure 8 is not based on a control strategy. Mr. Hannemann's testimony does not take into account the description in Vittone as a whole. Instead, his testimony is based narrowly on certain passages of Vittone.

Patent Owner argues that Petitioner fails to establish a motivation to combine Vittone with Ibaraki '882. PO Resp. 52–54. We disagree as Petitioner clearly does provide a reasoned rationale for combining Vittone with Ibaraki '882. As explained above, Petitioner explains, with supporting evidence, that a person having ordinary skill in the art would have understood that Vittone's control of the stoichiometric ratio during any transient conditions in the Ibaraki '882 system would have reduced exhaust emissions and increased fuel efficiency, and that the modification would have required a mere change in Ibaraki '882's software. Pet. 42; Ex. 1755 ¶¶ 310–319. A person having ordinary skill in the art would have had a reasonable expectation that modifying Ibaraki '882's controller software to control the stoichiometric ratio as taught by Vittone would have been successful.

Patent Owner disagrees and argues that a person of ordinary skill in the art would not have been motivated to combine Ibaraki '882 with Vittone because the two disclosures are directed to very different hybrid control strategies, such that the engine control strategies of Vittone would not have worked with the engine control strategies of Ibaraki '882. PO Resp. 53–54; Ex. 2706 ¶¶ 107–110. Patent Owner's arguments and supporting evidence are narrowly based on incorporating physically all technicalities of Vittone

with Ibaraki '882. The test for obviousness is what the combined teachings of the references would have suggested to a person of ordinary skill in the art, not whether one reference may be bodily incorporated into the structure of another reference. *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). In particular, and in support of Patent Owner's arguments, Mr. Hannemann opines that a person of ordinary skill in the art would not have been motivated to modify the power-based engine control strategy of Ibaraki '882 to include the driver-controlled engine control strategy of Vittone. Ex. 2706 ¶ 110. Petitioner, however, does not propose using the whole system of Vittone with the system of Ibaraki'882. Rather, Vittone is relied on for its description of controlling the stoichiometric ratio of the engine during transient conditions to reduce exhaust emissions and increase fuel efficiency. Patent Owner's arguments and the supporting testimony of Mr. Hannemann are premised on the assumption of incorporating all features of Vittone into Ibaraki '882, which is not what Petitioner proposes.

III. CONCLUSION[6]

For all of the above reasons, we dismiss the *inter partes* review with respect to claim 215, and determine that Petitioner has shown by a preponderance of the evidence that claims 238, 241, 252–256, 259, 261, 262, 267, 281, 282, 285, 287, and 288 are unpatentable.

[6] In making the obviousness conclusions, we recognize that it is the subject matter of each claim, as a whole, that is evaluated, rather than just each individual limitation, separately. 35 U.S.C. § 103.

IV. ORDER

It is

ORDERED that the *inter partes* review is *dismissed* with respect to claim 215;

FURTHER ORDERED that claims 238, 241, 252–256, 259, 261, 262, 267, 281, 282, 285, 287, and 288 of the '634 patent are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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