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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 IPR2015-00784
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 claims 1 and 16, and determine that Petitioner

has shown by a preponderance of the evidence that claims 2, 3, 6–12, 17, 19, 23, 27, 30, and 66 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 1–3, 5–12, 16, 17, 19, 23, 27, 30, and 66 of U.S. Patent No. 7,237,634 B2 (Ex. 1550, "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 29, 2015, we instituted an *inter partes* review of claims 1–3, 6–12, 16, 17, 19, 23, 27, 30, and 66, 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 both proceedings, and subsequently entered final written decisions. *Ford*

[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.

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, IPR2015-00785, IPR2015-00787, IPR2015-00790, IPR2015-00791, IPR2015-00799, IPR2015-00800, and IPR2015-00801.

C. The '634 Patent (Ex. 1550)

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. 1550, 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 Claim

Petitioner challenges independent claim 1 and dependent claims 2, 3, 6–12, 16, 17, 19, 23, 27, 30, and 66, which depend directly or indirectly from claim 1. Claim 1 is illustrative:

> 1. A hybrid vehicle, comprising:
>
> one or more wheels;
>
> an internal combustion engine operable to propel the hybrid vehicle by providing torque to the one or more wheels;
>
> a first electric motor coupled to the engine;
>
> a second electric motor operable to propel the hybrid vehicle by providing torque to the one or more wheels;
>
> a battery coupled to the first and second electric motors, operable to: provide current to the first and/or the second electric motors; and accept current from the first and second electric motors; and
>
> a controller, operable to control the flow of electrical and mechanical power between the engine, the first and the second electric motors, and the one or more wheels;
>
> wherein the controller is operable to operate the engine when torque required from the engine to propel the hybrid vehicle and/or to drive one or more of the first or the second motors to charge the battery is at least equal to a setpoint (SP) above which the torque produced by the engine is efficiently produced, and wherein the torque produced by the engine when operated at the SP is substantially less than the maximum torque output (MTO) of the engine.

Ex. 1550, 58:2–27.

E. Grounds of Unpatentability

We instituted an *inter partes* review of claims 1–3, 6–12, 16, 17, 19, 23, 27, 30, and 66 on the following grounds:

Reference[s]	Basis	Challenged Claim(s)
Ibaraki '882 [2] and the general knowledge of a person of ordinary skill in the art ("POSA")	§ 103	1–3, 12, 16, 17, 19, 27, 30, and 66
Ibaraki '882, Frank,[3] and the general knowledge of a POSA	§ 103	6–11
Ibaraki '882, Jurgen,[4] Lateur,[5] and the general knowledge of a POSA	§ 103	23

II. ANALYSIS

A. Petitioner Estoppel

On December 10, 2015, we rendered a final written decision of claims 1 and 16 of the '634 patent in IPR2014-00904. *Ford Motor Co. v. Paice LLC & The Abell Foundation*, Inc., Case IPR2014-00904 (PTAB December 10, 2015) (Paper 41). Patent Owner argues that, pursuant to 35 U.S.C. § 315(e)(1), Petitioner may not maintain its challenge of claims 1 and 16. PO Resp. 16–17. Petitioner responds that it was necessary for it to file multiple petitions to address the large number of dependent claims, and that in doing so, it was necessary to re-challenge claims 1 and 16. Pet. Reply 4.

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[2] U.S. Patent No. 5,789,882, issued Aug. 4, 1998 (Ex. 1552) ("Ibaraki '882").
[3] U.S. Patent No. 6,116,363, issued Sep. 12, 2000 (Ex. 1553) ("Frank").
[4] Ronald Jurgen, *Automotive Electronics Handbook*, 1995 (Ex. 1554) ("Jurgen").
[5] U.S. Patent No. 5,823,280, issued Oct. 20, 1998 (Ex. 1555) ("Lateur").

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 December 10, 2015, a final written decision was entered in IPR2014-00904, in which we determined that claims 1 and 16 of the '634 patent are unpatentable. Petitioner in this proceeding is the same Petitioner in IPR2014-00904. The grounds raised by Petitioner in IPR2014-00904 against claims 1 and 16 were not the same as the grounds raised against those claims 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. 1550. Petitioner does not argue that it reasonably could not have raised its challenge to claims 1 and 16 based on Ibaraki '882 in IPR2014-00904. Pet. Reply 4. We determine that Petitioner reasonably could have raised this challenge in IPR2014-00904. Accordingly, Petitioner is estopped under 35 U.S.C. § 315(e)(1) from maintaining the grounds based on Ibaraki '882 against claims 1 and 16. We dismiss the *inter partes* review with respect to claims 1 and 16.

Although we determine it necessary to address the parties' contentions

with respect to independent claim 1 because claims 2, 3, 6–12, 17, 19, 23, 27, 30, and 66 depend from claim 1, and dependent claim 16, because claims 17 and 19 depend from claim 16, we do not otherwise provide a final written decision on the merits with respect to claims 1 and 16, or again hold those claims 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 constructions for the following claim terms: "road load," "mode I," "low-load mode I," "high-way cruising mode IV," and "acceleration mode V." Pet. 6–9. In our Decision to Institute, we interpreted these terms. Dec. 5–6, 8–10. Neither party has indicated that our interpretations 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 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 mode IV	a mode of operation in which all torque provided to the wheels is supplied by the internal combustion engine
acceleration 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 1 and 16.

Setpoint (SP)

The term "setpoint" or "SP" is recited in independent claim 1, and, thus, necessarily is included in dependent claims 2, 3, 6–12, 16, 17, 19, 23, 27, 30, and 66. Petitioner proposes that "setpoint" or "SP" be construed, in the context of these claims, as "predetermined torque value." Pet. 7–8. Patent Owner argues that "setpoint" or "SP" be construed as "a definite, but potentially variable value at which a transition between operating modes may occur." PO Resp. 7.[6]

We agree with Petitioner that the claims compare the setpoint either to an engine torque value or a torque based "road load" value. Pet. 7–8. Claim 1 recites a condition "when torque required from the engine to propel the

[6] 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. 8. Petitioner agrees with that interpretation, while Patent Owner does not. Pet. Reply 2; PO Resp. 7–11.

hybrid vehicle and/or to drive one or more of the first or the second motors to charge the battery is at least equal to a setpoint (SP)." Ex. 1550, 58:19–23. Claim 16 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 SP<the RL<the MTO, the engine is operable to provide torque to propel the hybrid vehicle." *Id*. at 59:24–25.

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 rest 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. 1550, 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. 1550, 40:18–26 (emphasis added). This argument also is misplaced. As we noted above, independent claim 1 requires a comparison of the setpoint to an engine torque value. Thus, in the context of claim 1, 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) or torque requirements to setpoint (SP) and to maximum torque output (MTO). PO Resp. 11–16. The assertion is based on the requirements of (1) operating a second electric motor to propel the hybrid vehicle "when the RL<the SP," (claim 16) (2) operating an internal combustion engine of the hybrid vehicle "when torque required from the engine to propel the hybrid vehicle and/or to drive one or more of the first or second motors to charge the battery is at least equal to a setpoint (SP)," (claim 1), (3) operating in a highway cruising mode IV "when the SP<the RL<the MTO, the engine is operable to provide torque to propel the hybrid vehicle," (claim 16), and (4) operating the engine, and the first electric

motor, and/or the second electric motor to propel the hybrid vehicle "when the RL>the MTO" (claim 16).

In the above discussion of the construction of setpoint, we already noted that, for example, claim 1 requires a comparison of torque to a setpoint because of the claim recitation "when torque required from the engine to propel the hybrid vehicle and/or to drive one or more of the first or the second motors to charge the battery is at least equal to a setpoint (SP)." For similar reasons, claim 16 requires a comparison of road load to a maximum torque output (MTO) because of the recitation "when the SP<the RL<the MTO, the engine is operable to provide torque to propel the hybrid vehicle" and "when the RL>the MTO." Petitioner has not advanced any cogent reasoning why no such comparison is required by the claims. We determine that claims 1 and 16 require a comparison of torque or road load (RL) to a setpoint (SP) and claim 16 also requires a comparison with road load to 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. Claims 1 and 16

As discussed above, we dismiss the *inter partes* review with respect to claims 1 and 16. Only dependent claims 2, 3, 6–12, 17, 19, 23, 27, 30, and 66 are before us. Each of claims 2, 3, 6–12, 17, 19, 23, 27, 30, and 66, however, ultimately depends from claim 1 and necessarily include all of the limitations of claim 1. In addition, each of claims 17 and 19 depends from claim 16 and necessarily includes all of the limitations of claim 16. Accordingly, we first address the contentions made by Petitioner as to how Ibaraki '882 renders obvious claims 1 and 16.

Petitioner contends that claims 1 and 16 are 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. 9–26, 32–40. To support its contentions, Petitioner provides detailed explanations as to how the prior art meets each claim limitation of claims 1 and 16. *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. 1556. 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 claims 2, 3, 6–12, 17, 19, 23, 27, 30, and 66, which depend from claim 1 are unpatentable under 35 U.S.C. § 103(a).

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. 1552, 1:9–14. Ibaraki '882 describes that when the electric motor (14, Fig. 1 or 114, Fig. 8) functions also as an electric generator, a separate electric generator may be provided in addition to the electric motor. *Id.* at 26:34–38. Ibaraki '882 further describes an electric energy storage device or battery 22. *Id.* at Fig. 1. 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

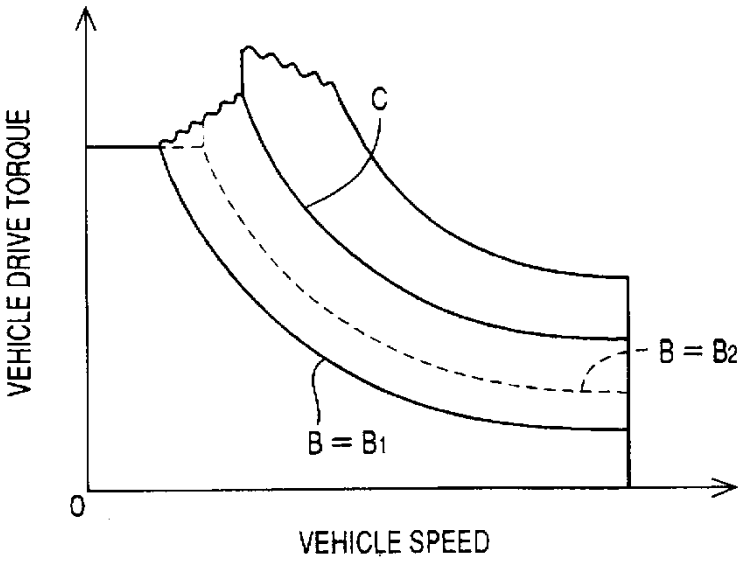


Figure 11 shows a graph which represents a predetermined relationship between the vehicle drive torque and running speed.

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 1

Claim 1 recites 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. 9; Ex. 1552, 1:9–14; Ex. 1556 ¶¶ 181–184. We are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882 describes this limitation.

Claim 1 recites "one or more wheels." Petitioner directs attention to a passage in Ibaraki '882 that describes that power from the internal combustion engine and motor are "simultaneously or selectively transferred to a transmission 16, and to right and left drive wheels via an output device." Pet. 10; Ex. 1552, 11:12–16; Ex. 1556 ¶¶ 185–187. The "drive wheels" are also shown in Figure 8. We are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882 describes one or more wheels.

Claim 1 recites "an internal combustion engine operable to propel the hybrid vehicle by providing torque to the one or more wheels." For this claim 1 phrase, Petitioner contends that Ibaraki '882 describes that the power of the internal combustion engine "simultaneously or selectively [is] transferred to a transmission 16, and to right and left drive wheels via an output device." Pet. 11; Ex. 1552, 11:12–15, 19:24–28; Ex. 1556 ¶ 190. Petitioner further contends, directing attention to the testimony of Dr. Davis, that a person having ordinary skill in the art would have understood that when power is transferred from the internal combustion engine to the

transmission, and then to the wheels as described in Ibaraki ’882, the power is transferred by the torque from the engine crankshaft, which is applied to the drive shaft and ultimately the drive wheels. Ex. 1556 ¶ 191. We are persuaded by Petitioner’s showing, and adopt it as our own, that Ibaraki ’882 describes an internal combustion engine operable to propel the hybrid vehicle by providing torque to the one or more wheels.

Claim 1 recites “a first electric motor coupled to the engine” and “a second electric motor operable to propel the hybrid vehicle by providing torque to the one or more wheels.” Petitioner contends that in addition to the electric motor disclosed in Figure 8 of Ibaraki ’882, Ibaraki ’882 also describes adding a separate electric generator for generating electricity, directing attention to Ibaraki ’882 claim 1 which describes a drive control apparatus for a vehicle having an electric generator and an electric motor. Pet. 11–12; Ex. 1552, Claim 1. Petitioner also relies on descriptions in Ibaraki ’882 which describes that the electric generator and electric motor may be provided as separate elements. Pet. 12; Ex. 1552, 5:27–29; 26:34–38. Petitioner contends, with supporting evidence, that a person having ordinary skill in the art would have understood the described separate generator to be an electric motor. Pet. 13; Ex. 1556 ¶ 199. Petitioner provides annotated Figures 1 and 8 from Ibaraki ’882 and modifies them to include the separate electric generator. In essence the annotated figures show an added generator coupled to the internal combustion engine. Pet. 13. Petitioner contends that a person having ordinary skill in the art would have understood that the separate generator (first electric motor) would have necessarily been coupled to the internal combustion engine in order for the engine to operate the generator to generate electricity as described. Pet. 13–

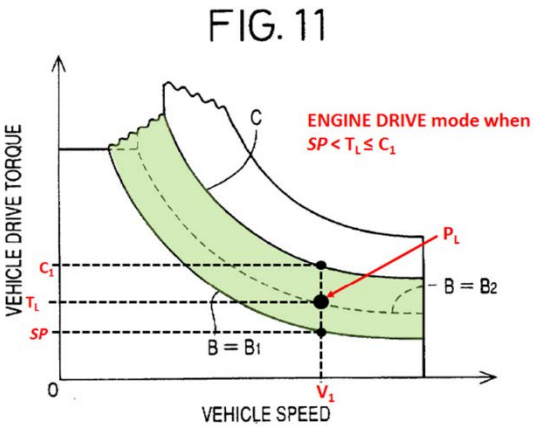
14; Ex. 1556 ¶ 200. Lastly, Petitioner contends that a person having ordinary skill in the art would have understood that the second electric motor (*e.g.*, 114 of Figure 8) is operable to propel the vehicle by providing torque to the one or more wheels. Pet. 16–17; Ex. 1556 ¶¶ 210–212. We are persuaded 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 the first and second electric motors.

Claim 1 recites "a battery coupled to the first and second electric motors, operable to: provide current to the first and/or the second electric motors; and accept current from the first and second electric motors." Petitioner contends that Ibaraki '882 describes an electric energy storage device 22 or 136 in the form of a battery. Pet. 17; Ex. 1552, 11:31–33, 19:55–57. Petitioner further contends that the battery (either 22 or 136) is coupled to the second motor (i.e., electric motor 14, 114) so that the battery can accept current from the motor for charging of the battery and provide current for propelling the vehicle. Pet. 17; Ex. 1552, 11:37–41, 19:63–67; Ex. 1556 ¶¶ 215, 218–219, 221–223. Petitioner further contends that the first electric motor (e.g., the described electric generator, or the one of the two or more electric motors for driving the wheels of the vehicle) provides and accepts current from the battery. Pet. 18–19; Ex. 1556 ¶ 227. 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 a battery coupled to the first and second electric motors as claimed.

Claim 1 recites "a controller, operable to control the flow of electrical and mechanical power between the engine, the first and the second electric motors, and the one or more wheels." Petitioner contends that Ibaraki '882 describes a controller 26, or controller 128, which includes drive source selecting means used to select whether the vehicle is placed in MOTOR DRIVE mode, ENGINE DRIVE mode, or ENGINE-MOTOR DRIVE mode. Pet. 19–20; Ex. 1552, 12:8–11, 20:38–49. Petitioner contends that Ibaraki '882 further describes that the drive source selecting means of the controller selects between the engine drive mode, motor drive mode, and electricity generating mode in a hybrid vehicle with a first and second electric motor. Pet. 20; Ex. 1552, Claim 1. Petitioner argues that it would have been obvious to a person having ordinary skill in the art that the first electric motor would have been connected to the controller 128, and that the controller 128 would have provided control signals instructing the first electric motor to operate in a generator mode. Pet. 21; Ex. 1556 ¶ 232. 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 the controller as claimed.

Claim 1 further recites "wherein the controller is operable to operate the engine when torque required from the engine to propel the hybrid vehicle and/or to drive one or more of the first or the second motors to charge the battery is at least equal to a setpoint (SP) above which the torque produced by the engine is efficiently produced." Petitioner asserts that because of the "and/or" language, the phrase is met if Ibaraki '882 discloses that "the controller is operable to operate the engine when the torque required from

the engine to propel the hybrid vehicle is at least equal to a setpoint (SP) above which the torque produced by the engine is efficiently produced." Pet. 21. We agree with that interpretation of the phrase, and Patent Owner does not contend otherwise. Petitioner contends that Ibaraki '882 describes that the drive source selecting means of the controller is used to select whether the vehicle is operated in ENGINE DRIVE mode or MOTOR DRIVE mode. Pet. 24; Ex. 1552, 12:8–11, 20:38–50; Ex. 1556 ¶¶ 245–246. Petitioner produces Ibaraki '882 Figure 11 with annotations, as seen below.



Ibaraki '882 Figure 11 as annotated in the Petition

Petitioner contends, for example, that in Figure 11 of Ibaraki '882, a drive source selecting data map includes a threshold boundary line B that includes multiple setpoints along the line, *e.g.*, B_1. Pet. 23; Ex. 1552, Fig. 11 (annotated). Petitioner contends that when the vehicle drive torque is between the setpoint SP and a torque point along boundary line C, *e.g.*, C_1, the vehicle is operated in an ENGINE DRIVE mode, and that when operated in that region, the engine consumes less fuel than when the engine is operated at torques below the setpoint. Pet. 23–24; Ex. 1552, 20:49–21:20; Ex. 1556 ¶ 243–244. Notwithstanding Patent Owner's arguments, which we

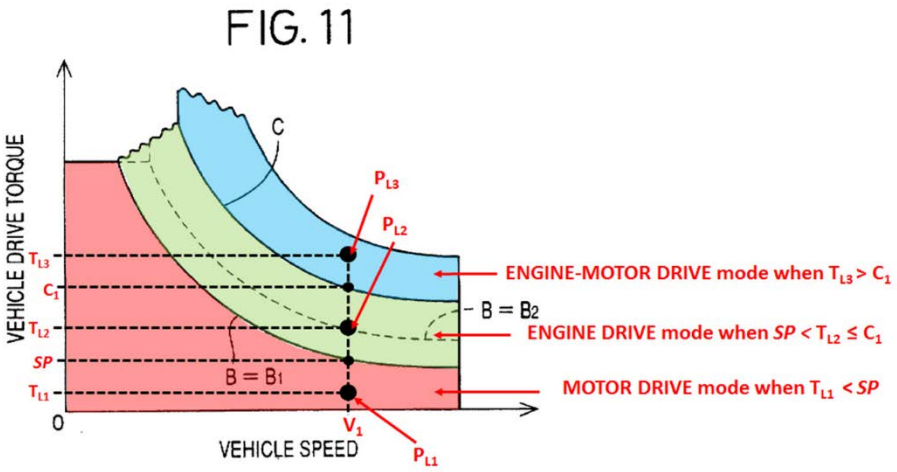
address below, we are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882, based on the relevant knowledge a person of ordinary skill in the art would have had at the time of the invention, meets the recitation of operating the engine in the manner claimed.

Claim 1 recites "wherein the torque produced by the engine when operated at the SP is substantially less than the maximum torque output (MTO) of the engine." 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. 24–25; Ex. 1556 ¶ 250. Dr. Davis 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). Ex. 1556 ¶ 254. 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, since SP is no more than half of the vehicle drive torque of C_1. *Id.* ¶ 254. Notwithstanding Patent Owner's arguments, which address below, 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 of the engine.

Claim 16

Claim 16 depends from claim 1 and recites "[t]he hybrid vehicle of claim 1, wherein the controller is operable to implement a plurality of

operating modes responsive to road load (RL) and the SP, wherein both the RL and the SP are expressed as percentages of the MTO of the engine when normally-aspirated, and wherein the operating modes comprise." For this claim phrase, Petitioner contends that Ibaraki '882 describes a plurality of operating modes based on the vehicle running condition as represented by current vehicle drive torque and speed. Pet. 33. Directing attention to an annotated Figure 11 from Ibaraki '882, Petitioner contends that the vehicle operates in a plurality of operating modes corresponding to values based on the current vehicle drive torque (T_{L1}, T_{L2}, T_{L3}), or road load, and a setpoint. Figure 11, annotated by Petitioner, is reproduced below, and explained by Dr. Davis. Pet. 34; Ex. 1556 ¶¶ 294–298.



Ibaraki '882 Figure 11 as annotated in the Petition

Dr. Davis explains that a torque setpoint along boundary B would have been known at the current vehicle speed and this setpoint marks a transition between the MOTOR DRIVE mode and the ENGINE DRIVE MODE. Ex. 1556 ¶ 296. Dr. Davis further explains that Ibaraki '882 uses the exemplary data map of Figure 11 to determine when to operate the

vehicle in a plurality of operating modes and that the operating modes are based on the determined road load (corresponding to T_{L1}, T_{L2}, T_{L3}) and the setpoint SP along boundary line B and that the torque points are the instantaneous road load required to propel the hybrid vehicle. *Id.* ¶¶ 294–298. Petitioner, directing attention to Dr. Davis's declaration, contends that a person having ordinary skill in the art would have understood that it would have been a design choice to express road load and the setpoint as percentages of the MTO of the engine. Pet. 34; Ex. 1556 ¶ 299. Notwithstanding Patent Owner's arguments, which we address below, 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 of operating the vehicle in a plurality of operating modes corresponding to values for the RL and the setpoint (SP) and that it would have been obvious to express the RL and SP as percentages of the MTO of the engine.

Claim 16 further recites "a low-load mode I, when the RL<the SP, the second electric motor is operable to provide torque to propel the hybrid vehicle." For that recitation, Petitioner cites to Ibaraki '882, and also Dr. Davis' declaration, explaining that the MOTOR DRIVE mode of Ibaraki '882 is used when the determined road load (vehicle drive torque) at a given speed is below the setpoint along boundary line B. Pet. 34–35; Ex. 1552, 20:55–63, 23:66–24:23; Ex. 1556 ¶¶ 303–304. We have construed "mode I" as "a mode of operation of the vehicle, in which all torque provided to the wheels are supplied by an electric motor." Notwithstanding Patent Owner's arguments, which we address below, we are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882 describes a low-load

mode I, when the RL<the SP, the second electric motor is operable to provide torque to propel the hybrid vehicle.

Claim 16 recites "a highway cruising mode IV, wherein, when the SP<the RL<the MTO, the engine is operable to provide torque to propel the hybrid vehicle, and wherein the controller is operable to start the engine if the engine is not running to enter the highway cruising mode IV." We have construed "highway cruising mode IV" as "a mode of operation in which all torque provided to the wheels are supplied by the internal combustion engine." Petitioner contends that the ENGINE DRIVE mode of Ibaraki '882 meets the limitation. Pet. 36–37; Ex. 1552, 20:43–66, 23:66–24:16; Ex. 1556 ¶¶ 308–311. Notwithstanding Patent Owner's arguments, which we address below, we are persuaded by Petitioner's showing, and adopt it as our own, that Ibaraki '882 meets this limitation.

Claim 16 recites "an acceleration mode V, wherein, when the RL>the MTO, the engine, the first electric motor, and/or the second electric motor is operable to provide torque to propel the hybrid vehicle, and wherein the controller is operable to start the engine if the engine is not running to enter the acceleration mode V." We have construed "acceleration mode V" as "a mode of operation in which torque provided to the wheels is supplied by the internal combustion engine and at least one electric motor." Petitioner contends that the ENGINE-MOTOR DRIVE mode of Ibaraki '882, based on the relevant knowledge at the time of the invention, meets the phrase. Pet. 37–40; Ex. 1552, 20:43–63; Ex. 1556 ¶¶ 314–319. Notwithstanding Patent Owner's arguments, which we address below, 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, describes an acceleration mode V as claimed.

Patent Owner's Contentions

Patent Owner makes three arguments with respect to claims 1 and 16: (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. 17–47. 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 (torque requirements) to a setpoint, both of which are torque values. *Id.* at 17–34. 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. 1556 ¶ 241, 295; Ex. 2506 ¶ 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. 1552, 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 certain of the challenged claims require a comparison of road load (RL) or torque 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. 1552, 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. 1556 ¶¶ 294–298. 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.* 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. 21; Ex. 1550, 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. 1550, 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 as required for claim 16. 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 a person having ordinary skill in the art would have understood would be above the IC engine's MTO. Pet. 37–40; Ex. 1552, 20:55–62, 26:28–33; Ex. 1556 ¶¶ 314–319. 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 that the "ENGINE-MOTOR mode" would have provided vehicle drive torque beyond that of the IC engine's MTO and the electric motor's MTO. Ex. 1556 ¶ 318. We give substantial weight to his testimony based on the record before us. *See, e.g.*, Pet. 5; Ex. 1556 ¶ 128 (citing Ex. 1568, 3). 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 and supporting evidence that a person of ordinary skill in the art would have understood that it would have been obvious that the "ENGINE-MOTOR mode" would have provided vehicle drive torque beyond that of the IC engine's MTO and the electric motor's MTO. 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). Ex. 1556 ¶ 317.

Patent Owner argues that Ibaraki '882 does not disclose a setpoint that is substantially less than MTO as recited per claim 1. PO Resp. 44–47. 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 46 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 also explains, directing attention to paragraph 250 of Dr. Davis's declaration, 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. 24–25; Ex. 1556 ¶ 250. 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 2, 3, 12, 17, 19, 27, 30, and 66

Petitioner contends that claims 2, 3, 12, 17, 19, 27, 30, and 66 are 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. 27–29, 31–32, and 40–47. To support its contentions, Petitioner provides detailed explanations as to how the prior art meets each claim limitation of these claims. *Id*. Petitioner also relies upon the Declaration of Dr. Davis for support. Ex. 1556.

We have reviewed the Petition, along with the supporting evidence, and determine that Petitioner has shown by a preponderance of the evidence that claims 2, 3, 12, 17, 19, 27, 30, and 66 are 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. Patent Owner does not argue for the separate patentability of any of claims 2, 3, 12, 17, 19, 27, 30, and 66.

Dependent claim 2 recites "wherein the controller is operable to stop the engine when the torque required to propel the vehicle is less than the SP." Claim 3, which depends from claim 1, is similar ("wherein the controller is operable to stop the engine when the torque required to propel the vehicle and/or charge the battery is less than the SP."). Petitioner contends that Ibaraki '882 operates in the ENGINE-DRIVE mode when the torque is greater than a threshold, and operates in the MOTOR-DRIVE mode when the torque is less than the threshold. Pet. 27–28. Petitioner argues that it would have been obvious to a person having ordinary skill in the art to shut down the IC engine when it is de-clutched during operation in MOTOR-DRIVE mode. Pet. 28–29; Ex. 1556 ¶¶ 264–266. The contentions are the same for claim 3. We determine that Petitioner has shown by a

preponderance of the evidence that claims 2 and 3 would have been obvious based on Ibaraki '882 and the relevant knowledge of a person having ordinary skill in the art.

As another example, claim 27, which depends from claim 1, recites "a variable-ratio transmission disposed between the engine and the one or more wheels of the hybrid vehicle." Claim 66, which depends from claim 27, further recites "wherein said variable-ratio transmission disposed between the engine and the one or more wheels of the hybrid vehicle comprises a planetary gear mechanism." For claims 27 and 66, 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. 45; Ex. 1552, 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. 46–47; Ex. 1552, 18:34–56, 19:28–32; Ex. 1556 ¶¶ 351–353. We determine that Petitioner has shown by a preponderance of the evidence that claims 27 and 66 would have been obvious based on Ibaraki '882 and the relevant knowledge of a person having ordinary skill in the art. We also reviewed the Petitioner's showings with respect to claims 12, 17, 19, and 30, and determine that the showing is persuasive.

In summary, and for each one of claims 2, 3, 12, 17, 19, 27, 30, and 66, 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, renders obvious each of claims 2, 3, 12, 17, 19, 27, 30, and 66. Patent Owner does not argue for the separate patentability of these claims.

F. Claims 6–11

Petitioner contends that claims 6–11 are unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882, Frank, and the general knowledge of a person of ordinary skill in the art. Pet. 47–55. To support its contention, Petitioner provides detailed explanations as to how the prior art meets each claim limitation of these claims. *Id.* Petitioner also relies upon the Declaration of Dr. Davis for support. Ex. 1556. 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 Ibaraki '882 in combination with Frank would have rendered obvious claims 6–11.

Claim 6 depends from claim 1, and claims 7–11 depend either directly or indirectly from claim 6. Claim 6 recites that the controller is operable to monitor road load (RL) over time. Claim 6 adds that the controller is further operable to control transition between propulsion of the vehicle by the motor(s) to propulsion of the engine responsive to RL reaching SP, wherein the transition only occurs (1) when RL>SP for at least a first length time, or (2) when RL>a second setpoint (SP2), where SP2>SP.

Petitioner contends that Ibaraki '882 Figure 10 is illustrative of how the Ibaraki '882 controller continually loops through the flow diagram of Figure 10 to determine the current operating mode ("operable to monitor road load (RL) over time"). Pet. 47–48; Ex. 1552, 10:66–67; Ex. 1556 ¶¶ 365–370. Petitioner explains that when road load is hovering at or around setpoint, Ibaraki '882 would be toggling between the MOTOR DRIVE and ENGINE DRIVE modes, and that toggling rapidly between the two modes would cause the system to start/stop the engine motor at an unacceptably

high frequency and engage/disengage the clutch mechanism at an unacceptably high frequency. Pet. 48; Ex. 1556 ¶¶ 377–380. Petitioner argues that a person having ordinary skill in the art would have realized that a time delay would have been needed to ensure the full transition between modes had occurred. Pet. 48; Ex. 1556 ¶ 381.

Petitioner cites to Frank for its disclosure of the use of a time delay in the on-off control of an internal combustion engine in a hybrid vehicle to reduce excessive cycling of the engine's being turned on and off repetitively. Pet. 48–49; Ex. 1553, 8:32–37. 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 Frank with Ibaraki '882 and the knowledge of a person having ordinary skill in the art. Pet. 49–51; Ex. 1556 ¶¶ 377–389. We are persuaded by Petitioner's showing, which we adopt as our own, that Ibaraki '882 in combination with Frank reasonably would have suggested the limitations of claim 6, and that the combination would have been obvious for the reasons provided by Petitioner. Indeed, in *KSR Int'l Co. v. Teleflex Inc.*, the Court explained that if a feature has been used to improve one device, and a person of ordinary skill in the art would have recognized that it would improve a similar device in that field or another, implementing that feature on the similar device is likely obvious. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). Here, a person of ordinary skill in the art would have recognized that Frank would have improved the control routine of Ibaraki '882 to achieve the predictable result of preventing the undesirable frequent cycling between operating modes.

We also have reviewed Petitioner's showings with respect to claims 7–11, which depend from claim 6, and are persuaded by such showings. For

example, claim 7, which depends from claim 6 recites "wherein if the engine is not started, the controller is operable to start the engine for the transition between propulsion of the hybrid vehicle by the first and/or the second electric motors to propulsion by the engine." Petitioner explains that the IC engine needs to run to drive the vehicle during the ENGINE DRIVE mode, and to the extent that the engine is not running when the vehicle is transitioned to the ENGINE DRIVE mode, a person having ordinary skill in the art would have understood that the IC engine must be started to drive the vehicle. Pet. 51; Ex. 1556 ¶¶ 391–393. We are persuaded by Petitioner's showing, which we adopt as our own, that Ibaraki '882 in combination with Frank reasonably would have suggested the limitations of claim 7, and that the combination would have been obvious for the reasons provided by Petitioner.

Claim 8 depends from claim 6 and recites "the controller is further operable to control transition from propulsion of the hybrid vehicle by the engine to propulsion by the first and/or the second electric motors such that the transition occurs only when the RL<the SP for at least a second length of time." Claim 9 depends from claim 8 and further recites that the "first length of time is the same as the second length of time." Claim 10 depends from claim 8 and recites that "the first length of time and the second length of time are predetermined." Petitioner accounts for claims 8–10 similar to how it accounted for claim 6. Pet. 52–54. We are persuaded by Petitioner's showing, which we adopt as our own, that Ibaraki '882 in combination with Frank reasonably would have suggested the limitations of claims 8–10, and that the combination would have been obvious for the reasons provided by Petitioner.

Claim 11 depends from claim 8 and recites "wherein the controller is further operable to stop the engine after the transition between propulsion of the hybrid vehicle by the engine to propulsion by the first and/or the second electric motors." Petitioner contends that Ibaraki '882 operates in the ENGINE-DRIVE mode when the torque is greater than a threshold, and operates in the MOTOR-DRIVE mode when the torque is less than the threshold. Pet. 55. Petitioner argues that it would have been obvious to a person having ordinary skill in the art to shut down the IC engine in MOTOR-DRIVE mode. Pet. 55; Ex. 1556 ¶ 418. We are persuaded by Petitioner's showing, which we adopt as our own, that Ibaraki '882 in combination with Frank reasonably would have suggested the limitations of claim 11, and that the combination would have been obvious for the reasons provided by Petitioner.

Patent Owner's Contentions

Patent Owner argues that Frank's hysteresis is speed based as opposed to road load based because Frank uses vehicle speed to determine when to turn the engine on and off. PO Resp. 48–49. As such, Patent Owner argues, Frank does not cure the alleged deficiencies with respect to Ibaraki '882, "which takes the 'instantaneous drive power' as the control variable, not road load." *Id.* at 49. Patent Owner's arguments are misplaced since Petitioner does not rely on Frank to teach a road load "control variable" for controlling the modes of operation of a hybrid vehicle, but instead relies on Ibaraki '882 in light of the relevant knowledge of a person having ordinary skill in the art at the time of the invention for the feature.

Patent Owner argues that with respect to claim 8, Frank describes a single time delay and that Petitioner fails to provide any explanation to

support its conclusory argument that it would have been obvious to a person having ordinary skill in the art to include a delay for a second length of time when transitioning between drive modes. PO Resp. 49–50. We are not persuaded by Patent Owner's argument. Frank describes a "time delay between the 'on' and 'off' *modes* to prevent frequent cycling." Ex. 1553, 8:35–37. A person having ordinary skill in the art would have understood that Frank provides a time delay when the engine is turned on and a time delay when the engine is turned off. Ex. 1556 ¶ 402. Thus, Petitioner sufficiently accounts for the features of claim 8.

Lastly, Patent Owner argues that Petitioner fails to present any rationale for combining Ibaraki '882's power-based system with Frank's speed-based hysteresis teaching. PO Resp. 50–51. We disagree. Petitioner does articulate a reason for adding Frank's time delay to the Ibaraki '882 system, explaining, with supporting evidence, that doing so would have prevented unwanted cycling that may occur when hybrid vehicles switch between operating modes. Pet. 49–51; Ex. 1556 ¶¶ 386–389.

G. Claim 23

Petitioner contends that claim 23 is unpatentable under 35 U.S.C. § 103(a) as obvious over Ibaraki '882, Jurgen, Lateur, and the general knowledge of a person having ordinary skill in the art. Pet. 55–59. To support its contention, Petitioner provides detailed explanations as to how the prior art meets each claim limitation of claim 23. *Id*. Petitioner also relies upon the Declaration of Dr. Davis for support. Ex. 1556. 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 Ibaraki ’882 in combination with Jurgen and Lateur would have rendered obvious claim 23.

Claim 23 depends directly from claim 1. Claim 23 recites that “the controller is operable to receive operator input of a desired cruising speed, and thereafter control instantaneous torque output of the engine and/or one or more of the first or the second motors in accordance with variation in the RL so as to maintain a substantially constant speed.” Petitioner contends that Ibaraki ’882 discloses a hybrid vehicle that includes a controller that receives operator input signals that include accelerator pedal operation, brake pedal operation and shift lever operation. Pet. 56; Ex. 1552, 20:10–33. Petitioner explains that although Ibaraki 882 does not describe receiving an operator input of a desired cruising speed from a cruise control device, both Lateur and Jurgen describe known cruise control devices. Pet. 56; Ex. 1555, 9:47–50; Ex. 1554, 47. For example, Lateur describes that microprocessor 26 determines whether the speed control switch is producing a cruise control on signal or a cruise control off signal. Ex. 1555, 9:47–50. Petitioner contends, with supporting evidence, that Ibaraki ’882 modified to include cruise control would have applied the same control strategy of Ibaraki ’882 Figure 11 to maintain substantially constant vehicle speed. Pet. 56–59; Ex. 1556 ¶¶ 422–430, 439–442.

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 Lateur and Jurgen with Ibaraki ’882 and the knowledge of a person having ordinary skill in the art. Pet. 56–59; Ex. 1556 ¶¶ 434–436. We are persuaded by Petitioner’s showing, which we adopt as our own, that Ibaraki ’882 in combination with Lateur and Jurgen reasonably would have

suggested the limitations of claim 23, 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 Lateur and Jurgen would have improved the control routine of Ibaraki '882 to achieve the predictable result of providing cruise control to maintain substantially constant vehicle speed.

Patent Owner's Contentions

Patent Owner argues that Jurgen's and Lateur's teachings are insufficient to render claim 23 obvious, because such disclosures are unrelated to controlling the engine output torque in accordance with variation in road load as required by claim 23. PO Resp. 51. Patent Owner's arguments are misplaced since Petitioner does not rely on Jurgen or Lateur to teach controlling the engine output torque in accordance with variation in road load, but instead relies on Ibaraki '882 in light of the relevant knowledge of a person having ordinary skill in the art at the time of the invention for the feature. Pet. 57. In particular, Petitioner explains that Ibaraki '882 executes drive modes for the vehicle based on torque as explained throughout the Petition.

Patent Owner argues that Petitioner's argument regarding the rationale to combine Lateur and Jurgen with Ibaraki '882 is conclusory and ignores the requirements of claim 23. PO Resp. 51–52. We disagree. Petitioner provides a rationale to combine which is not conclusory, nor does it ignore the requirements of the claim. Adding cruise control, a known feature at the time of the invention, to Ibaraki '882's system would have been obvious at the time of the invention for the reasons provided by Petitioner. *See, e.g.*, Pet. 56 (citing Ex. 1554, 47, cruise control may "improve the vehicle's fuel

efficiency value by limiting throttle excursions to small steps.")

III. CONCLUSION[7]

For all of the above reasons, we dismiss the *inter partes* review with respect to claims 1 and 16, and determine that Petitioner has shown by a preponderance of the evidence that claims 2, 3, 6–12, 17, 19, 23, 27, 30, and 66 are unpatentable.

IV. ORDER

It is

ORDERED that the *inter partes* review is dismissed with respect to claims 1 and 16;

FURTHER ORDERED that claims 2, 3, 6–12, 17, 19, 23, 27, 30, and 66 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.

[7] 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.

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