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Paper 28
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,
Petitioner,

v.

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

Case IPR2015-00801
Patent 7,237,634 B2

Before JAMESON LEE, SALLY C. MEDLEY, and
CARL M. DEFRANCO, *Administrative Patent Judges*.

LEE, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background

Ford Motor Company ("Petitioner") filed a Petition (Paper 1, "Pet.") for *inter partes* review of U.S. Patent No. 7,237,634 B2 ("the '634 patent"). Paper 1. The Petition challenges the patentability of claims 80, 111, 114, 144, 241, 264, 266, 267, 278–280, and 282–291 of the '634 patent. In an Initial Decision, we instituted *inter partes* review of each of these claims, except for claims 80 and 114. Paper 12 ("Dec. Inst.").

Paice LLC and The Abell Foundation, Inc. ("Patent Owner") filed a Patent Owner Response (Paper 15), and Petitioner filed a Reply (Paper 17). Oral hearing was held on June 29, 2016. A transcript of the oral hearing is included in the record. Paper 27 ("Tr."). Neither party filed a motion to exclude evidence. In addition, Patent Owner filed a Motion for Observation on Cross-Examination (Paper 21) and Petitioner filed a Response to Motion for Observation on Cross-Examination (Paper 23). Both submissions have been considered.

For reasons discussed below, we determine that Petitioner has shown by a preponderance of the evidence that each of claims 111, 144, 241, 264, 266, 267, 278–280, and 282–291 is unpatentable.

B. Related Matters

Petitioner and Patent Owner collectively identify the following civil actions in which the '634 patent has been asserted: (1) *Paice LLC et al. v. Ford Motor Company*, Case No. 1-14-cv-00492 (D. Md.); (2) *Paice LLC et al. v. Hyundai Motor America, et al.*, Case No. 1:2012-cv-00499 (D. Md.).

Papers 1, 5. The ’634 patent also is the patent involved in the following *inter partes* review proceedings: IPR2014-00904, IPR2014-01416, IPR2015-00606, IPR2015-00722, IPR2015-00758, IPR2015-00784, IPR2015-00787, IPR2015-00790, IPR2015-00791, IPR2015-00799, IPR2015-00785, and IPR2015-00800.

C. The ’634 Patent

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. 1851, 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.

Independent claims 80, 241, and 267 are illustrative and are reproduced below:

> 80. A method for controlling a hybrid vehicle, comprising:
>
> determining instantaneous road load (RL) required to propel the hybrid vehicle responsive to an operator command;
>
> monitoring the RL over time;
>
> 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
>
> wherein said operating the internal combustion engine to propel the hybrid vehicle is performed when: the RL>the SP for at least a predetermined time; or the RL>a second setpoint (SP2), wherein the SP2 is a larger percentage of the MTO than the SP; 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.

Id. at 65:11–33.

> 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;

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.

267. 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

rotating the engine before starting the engine such that its cylinders are heated by compression of air therein.

Id. at 83:60 to 84:11.

D. Evidence Relied Upon

Prior Art References		Date	Exhibit
Severinsky ’970	U.S. Patent. No. 5,343,970	Sept. 6, 1994	Ex. 1854
Yamaguchi	U.S. Patent No. 5,865,263	Feb. 2, 1999	Ex. 1855
Lateur	U.S. Patent No. 5,823,280	Oct. 20, 1998	Ex. 1856
Suga	U.S. Patent No. 5,623,104	Apr. 22, 1997	Ex. 1857
Vittone	Oreste Vittone et al., *Fiat Conceptual Approach to Hybrid Car Design*, The 12th International Electric Vehicle Symposium (EVS-12), Vol. 2, pp. 458–469 (1994)	1994	Ex. 1858
Frank	U.S. Patent. No. 5,842,534	Dec. 1, 1998	Ex. 1859

Petitioner also relies on the declarations of Jeffrey L. Stein, Ph.D. Ex. 1852 (“first declaration”), Ex. 1889 (“reply declaration”).

E. The Asserted Grounds of Unpatentability

References	Basis	Claims Challenged
Severinsky ’970 and Yamaguchi	§ 103(a)	267, 278–280, 282, 284, 285, 289, and 290
Severinsky ’970, Yamaguchi, and Lateur	§ 103(a)	283, 286, 287, and 288

References	Basis	Claims Challenged
Severinsky ’970, Yamaguchi, and Suga	§ 103(a)	291
Severinsky ’970 and Vittone	§ 103(a)	241
Severinsky ’970, Vittone, and Yamaguchi	§ 103(a)	264
Severinsky ’970, Vittone, and Suga	§ 103(a)	266
Severinsky ’970, Frank, and Yamaguchi	§ 103(a)	111 and 144

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142–46 (2016). Even under the rule of broadest reasonable interpretation, claim terms generally also are 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. *See In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Only terms which are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). 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).

"road load (RL)"

The term "road load" or "RL" is recited in each of independent claims 80, 114, 241, and 267. The Specification defines "road load" as "the vehicle's instantaneous torque demands, i.e., that amount of torque required to propel the vehicle at a desired speed," and further notes that it "can be positive or negative, i.e., when decelerating or descending a hill, in which case the negative road load . . . is usually employed to charge the battery bank." Ex. 1851, 12:44–61. Accordingly, we construe "road load" and "RL" as "the amount of instantaneous torque required to propel the vehicle, be it positive or negative." This construction is the same as that proposed by Petitioner. Pet. 7. Patent Owner does not propose a different construction.

"setpoint (SP)"

The term "setpoint" or "SP" is recited in each of independent claims 80, 114, 241, and 267. Petitioner proposes that "setpoint" or "SP" be construed, in the context of these claims, as "predetermined torque value." Pet. 8. In that regard, Petitioner correctly notes that the claims compare the

setpoint either to an engine torque value or a torque based "road load" value. Pet. 7. Each of claims 80, 114, 241, and 267 recites a condition "when the RL required to do so is less than a setpoint (SP)." Ex. 1851, 65:17–18, 68:41–42, 81:39–40; 83:66–67. Each of claims 80, 114, 241, and 267 further defines 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 65:20–22, 68:47–49, 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 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. 5. The 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 in a mode switching 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. 1851, 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*, 9 F.3d at 950; *E.I. du Pont de Nemours*, 849 F.2d at 1433. It is important not to import into a claim limitations that are not a part of the claim. *SuperGuide Corp. v. DirecTV Enters., 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 urges that "setpoint" should be construed as "a definite, but potentially variable value at which a transition between operating modes may occur." PO Resp. 4. 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 sets forth that a transition between operating modes "may occur" at a setpoint, which is consistent with our construction.

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. 8. 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. 1851, 40:18–26 (emphasis added). The argument also is misplaced. As we noted above, each independent claim 80, 114, 241, and 267 requires 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."

"mode I,"
"low-load operation mode I,"
"high-way cruising operation mode IV,"
"acceleration operation mode V"

Claim 285 depends from independent claim 267. Claim 285 recites limitations referring to "low-load operation mode I," "high-way cruising operation mode IV," and "acceleration operation mode V." Claim 286 depends from claim 285 and recites a limitation referring to "mode I." The Specification of the '634 patent sets forth a definition for these modes.

With regard to "mode I," the Specification states:

> As noted, during low-speed operation, such as in city traffic, the vehicle is operated as a simple electric car, where *all torque* is provided to road wheels 34 by traction motor 25 operating on electrical energy supplied from battery bank 22. This is referred to as "mode I" operation (see FIG. 6), and is illustrated in FIG. 8(*a*).

Ex. 1851, 35:63–36:1 (emphasis added).

Petitioner proposes a construction for "mode I" that disregards the "all torque" requirement quoted above. Pet. 9. Patent Owner does not propose a construction. We construe "mode I," in accordance with the above-quoted description in the Specification, as "a mode of operation of the vehicle, in which all torque provided to the wheels are supplied by an electric motor." We construe "low-load operation mode I" and "operating mode I," the same as we do "mode I," because it is evident that "low-load operation mode I" and "operating mode I" are each just another name for "mode I."

With regard to "high-way cruising operation mode IV," the Specification states:

> When the operator releases pressure on the accelerator pedal, indicating that a desired cruising speed has been reached, traction motor 25 is accordingly depowered. The highway cruising mode is referred to as "mode IV" operation, and the flow of energy and torque are as illustrated in FIG. 8(*c*).

Ex. 1851, 36:31–36. Figure 8(c) shows that all power to the wheels are supplied from the internal combustion engine. Additionally, the Specification states: "[d]uring highway cruising, region IV, where the road load is between about 30% and 100% of the engine's maximum torque

output, the engine alone is used to propel the vehicle." *Id*. at 37:42–44. Petitioner's proposed construction disregards the exclusivity of the power source. Pet. 9. Patent Owner does not propose a construction. We construe "high-way cruising mode IV" as "a mode of operation in which all torque provided to the wheels are supplied by the internal combustion engine."

With regard to "acceleration operation mode V," the Specification states:

> If extra torque is needed during highway cruising, e.g., for acceleration or hill-climbing, either or both of motors 21 and 25 can be powered. This "mode V" operation is illustrated in FIG. 8(*d*); energy flows from tank 38 to engine 40, and from battery bank 22 to traction motor 25, and possibly also to starting motor 21; torque flows from either or both motors and engine to wheels 34.

Ex. 1851, 36:37–43. The Specification further states:

> If the operator then calls for additional power, e.g., for acceleration or passing, region V is entered; that is, when the microprocessor detects that the road load exceeds 100% of the engine's maximum torque output, it controls inverter/charger 27 so that energy flows from battery bank 22 to traction motor 25, providing torque propelling the vehicle in addition to that provided by engine 40. Starting motor 21 can similarly be controlled to provide propulsive torque.

Id. at 38:1–8. Patent Owner does not propose a construction. We construe "acceleration operation 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."

That the Claims Require a Comparison of Road Load (RL) to Setpoint (SP) and to MTO

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. 8–10. The assertion is based on the requirements in claim 80 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," and essentially the same recitations in claims 114, 241, and 267.

In the above discussion of the construction of setpoint, we already noted that claims 80. 114, 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 the SP" and "when the RL required to do so is between the SP and a maximum torque output (MTO) of the engine." For similar reason, claims 80, 114, 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.

"abnormal and transient conditions"

Claim 290 depends from independent claim 267 and additionally requires: "operating the engine at torque output levels less than the SP under abnormal and transient conditions to satisfy drivability and/or safety considerations." Ex. 1851, 86:5–7. The term "abnormal and transient conditions" is not defined or described in any particularity in the Specification.

Petitioner asserts that the term "abnormal and transient conditions" is defined in the parent application of the '634 patent, i.e., Application 10/382,577, which issued as U.S. Patent No. 7,104,347 B2 ("the '347 patent"). Pet. 9. The source of the alleged definition is claim 22 of the '347 patent, which reads, in pertinent part: "said [abnormal and transient conditions] comprising starting and stopping of the engine and provision of torque to satisfy drivability or safety considerations." Ex. 1866, 60:17–21. The quoted claim language from the '347 patent does not present a definition but merely identifies open-ended examples of "abnormal and transient conditions," i.e., (1) starting and stopping of the engine, and (2) provision of torque to satisfy drivability or safety considerations. Moreover, it is unclear what is abnormal or transient about "provision of torque to satisfy drivability or safety considerations."

Patent Owner urges that the Board make clear that "abnormal and transient conditions" does not include "city traffic and reverse operation." PO Resp. 10–11. Patent Owner notes that it had made that distinction in the prosecution history of a related patent, i.e., U.S. Patent No. 8,214,097 B2

(Ex. 2801, 238). *Id.* It is, however, unsupported to exclude operation in city traffic and reverse operation in their entirety including any abnormal and transient condition which may occur within them. It is also uncertain precisely what constitutes city traffic. More importantly, in the prosecution history of U.S. Patent No. 8,214,097 B2 that has been cited by Patent Owner, there is language clearly including starting the engine as an abnormal and transient condition: "The 'abnormal and transient conditions' referred to are such conditions as starting the engine, during which operation it must necessarily be operated at less than SP for a short time." Ex. 2801, 238. Thus, there has been no disavowal, whatsoever, by Patent Owner of starting the engine as an abnormal and transient condition, let alone a clear and unmistakable disavowal that is required to narrow the claim scope by prosecution history. *See Omega Eng'g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1325–26 (Fed. Cir. 2003) ("Consequently, for prosecution disclaimer to attach, our precedent requires that the alleged disavowing actions or statements made during prosecution be both clear and unmistakable.").

For the foregoing reasons, we are unpersuaded by the above-noted contentions of either Petitioner or Patent Owner. Nevertheless, it is not necessary that we expressly construe "abnormal and transient conditions" beyond determining that examples of such conditions include starting and stopping of the engine. In the context of the Specification of the '634 patent, we regard both starting the engine and stopping the engine as an "abnormal and transient condition."

B. Level of Ordinary Skill in the Art

Patent Owner does not explicitly take a position on the level of ordinary skill in the art. Neither does Petitioner in the Petition itself, except to say that "[t]he level of ordinary skill in the art is evidenced by the references." Pet. 4. Petitioner's expert, Dr. Stein, expresses a certain required level of technical education and experience for one with ordinary skill in the art. Ex. 1852 ¶ 42. We determine that no express finding on a specific corresponding level of technical education and experience is necessary, and that 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).

C. Differences Between the Claimed Invention and Prior Art

Patent Owner asserts that Petitioner has not adequately identified differences between the claimed invention and the prior art, and that it is unclear from the Petition whether, for certain claim elements, Petitioner is saying that Severinsky '970 discloses the claim element or simply renders obvious the claim element. PO Resp. 12–13. In that regard, Patent Owner refers to claim 267 as an example. *Id.* We are unpersuaded by Patent Owner's contention. Petitioner's identification in its claim charts of a disclosure from a prior art reference in a corresponding location opposite a reproduced claim limitation is a representation that that disclosure meets the associated claim limitation.

Patent Owner takes issue with the meaning of Petitioner's statements expressing that one with ordinary skill in the art "would have understood" the prior art's disclosure in a certain way. *Id.* at 13. According to Patent Owner, such statements are confusing because Patent Owner does not know whether the statement is based on principles of anticipation or obviousness. *Id.* We disagree. There is no requirement that the prior art must use the same words as those of a claim element in order to be deemed as teaching or disclosing that claim element. Identity of terminology is not required, for a claim element to be met directly by the prior art, without resort to obviousness. *See In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009); *In re Bond*, 910 F.2d 831, 832 (Fed. Cir. 1990). Even in a non-obviousness setting, it is proper to take into account not only the literal and specific teachings of the reference, but also the inferences which one skilled in the art would reasonably be expected to draw therefrom. *In re Preda*, 401 F.2d 825, 826 (CCPA 1968). Petitioner's assertions regarding what one with ordinary skill in the art "would have understood" conveys the understanding of one with ordinary skill in the art with respect to what is disclosed by the prior art, not what would have been obvious over the prior art. Prior art references must be "considered together with the knowledge of one of ordinary skill in the pertinent art." *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (quoting *In re Samour*, 571 F.2d 559, 562 (CCPA 1978)).

D. Claims 267, 278–280, 282, 284, 285, 289, and 290 as Obvious over Severinsky '970 and Yamaguchi

We have reviewed the arguments and evidence presented by Petitioner, and determine that, notwithstanding the arguments of Patent Owner, which we discuss below, Petitioner has established, by a preponderance of the evidence, that the subject matter of claims 267, 278–280, 282, 284, 285, 289, and 290 would have been obvious over the combined teachings of Severinsky '970 and Yamaguchi, and thus the claims are unpatentable.

Severinsky '970 describes a hybrid vehicle that operates in a plurality of modes, including: (1) a low-speed, electric motor mode in which "inefficiency and pollution" of the engine is eliminated (e.g., city driving); (2) a high-speed, engine mode in which the engine operates "near maximum efficiency" (e.g., highway cruising); (3) a hybrid mode in which both the engine and the electric motor power the vehicle when road load exceeds maximum torque output of the engine (e.g., accelerating or hill climbing); and (4) a battery charging mode in which the engine operates a generator to recharge the battery (e.g., braking or coasting). Ex. 1854, 6:26–48, 7:8–26.

Severinsky '970 describes:

> A microprocessor receives control inputs from the driver of the vehicle and monitors the performance of the electric motor and the internal combustion engine, the state of charge of the battery, and other significant variables. *The microprocessor determines whether the internal combustion engine or the electric motor or both should provide torque to the wheels* under various monitored operating conditions.

Id. at 6:19–23 (emphasis added). Severinsky '970 further describes:

> More particularly, according to the invention, *the internal combustion engine is operated only under the most efficient conditions* of output power and speed. When the engine can be used efficiently to drive the vehicle forward, e.g., in highway cruising, it is so employed. Under other circumstances, e.g. *in traffic, the electric motor alone drives the vehicle* forward and the internal combustion engine is used only to charge the batteries as needed.

Id. at 7:8–16 (emphasis added).

Severinsky'970 discloses that to maximize efficiency, it uses a controller that operates the engine "only in the near vicinity of its *most efficient operational point*, that is, such that it produces *60-90% of its maximum torque* whenever operated." *Id*. at 20:63–67 (emphasis added). According to Severinsky '970, that alone will yield improvement in fuel economy on the order of 200–300%. *Id*. at 20:67–68.

1. Claim 267

In what Petitioner regards as limitation [267.0], claim 267 recites: "A method for controlling a hybrid vehicle, comprising." For that recitation, Petitioner cites to Severinsky '970 which is titled "Hybrid Electric Vehicle" and which claims a "method of operating a hybrid vehicle" in its claim 15. Pet. 11. Petitioner also cites to declaration paragraphs 129–133 of the first declaration of Dr. Stein (Ex. 1852). *Id.* We find that this limitation is disclosed by Severinsky '970.

In what Petitioner regards as limitation [267.1], claim 267 recites: "determining instantaneous road load (RL) required to propel the hybrid vehicle responsive to an operator command." For that recitation, Petitioner cites (Pet. 11) to the following text of Severinsky '970 as well as declaration

paragraphs 134–152 of the first declaration of Dr. Stein (Ex. 1852): "[A]t all times the microprocessor 48 may determine the load (if any) to be provided to the engine by the motor, **responsive to the load imposed by the vehicle's propulsion requirements**, so that the engine 40 can be operated in its most fuel efficient operating range." Pet. 11 (citing Ex. 1854, 17:11–15) (emphases added). Petitioner explains:

> Severinsky '970 discloses a microprocessor 48 that "responds to operator commands" and controls engine 40 and motor 20 "to ensure that appropriate torque is delivered to the wheels 34 of the vehicle." (Severinsky '970, Ex. 1854, 14:15–18, 12:60–13:2; Stein, Ex. 1852, ¶¶ 138–140, *see also* ¶ 147.) The microprocessor can "ensure that appropriate torque is delivered to the wheels 34 of the vehicle" only by determining the torque required at that time, *i.e.*, the "*instantaneous road load (RL)*." (Stein, Ex. 1852, ¶¶ 138–141.) While Severinsky '970 may not use the term "*road load*," a POSA would have understood that Severinsky '970 teaches determining the instantaneous torque required to propel the vehicle because it ensures delivering the appropriate torque to the wheels. *Id.*

Pet. 11–12. Petitioner further explains the different operating modes for a hybrid vehicle as is disclosed by Severinsky '970. *Id.* at 12. We are persuaded, notwithstanding the arguments of Patent Owner which we address below, that limitation [267.1] is disclosed by Severinsky '970 even though the description in Severinsky '970 does not employ exactly the same language.

For instance, Severinsky '970 describes that microprocessor 48 is provided with all information relevant to the performance of the system, and appropriately controls torque transfer unit 28, internal combustion engine 40,

and electric motor 20 "*to ensure that appropriate torque is delivered to the wheels 34 of the vehicle*." Ex. 1854, 12:64–13:2 (emphasis added). Severinsky '970 also describes that microprocessor 48 monitors the operator's inputs and the vehicle's performance, and activates electric motor 20 when torque in excess of the capabilities of engine 40 is required. *Id.* at 14:15–18.

Throughout its disclosure, Severinsky '970 describes having the vehicle in various modes of operation depending on the magnitude of the torque required to drive the vehicle. In one mode, electric motor 20 provides "all of the torque needed to move the vehicle." *Id*. 10:66–68. In another mode, the internal combustion engine and electric motor together provide "all torque required to drive the vehicle." *Id.* at 13:66–68. In still another mode, the microprocessor activates electric motor 20 when torque in excess of the capability of engine 40 is required. *Id*. at 14:15–18.

Petitioner's technical witness, Dr. Stein, testifies that one with ordinary skill in the art would have understood Severinsky '970 as disclosing that microprocessor 48 determines the torque required to propel the vehicle based on operator's inputs and vehicle performance, and then compares the torque required to the engine's capabilities before activating electric motor 20, if the required torque is beyond the maximum torque output of the engine. Ex. 1852 ¶ 139. Dr. Stein also testifies that one with ordinary skill in the art would have understood Severinsky '970 as disclosing that microprocessor 48 monitors the instantaneous torque required

to propel the vehicle so that motor 20 can be controlled to supply additional torque. *Id.* ¶ 141.

Accordingly, we find that limitation [267.1] is disclosed by Severinsky '970.

Claim 267 recites in what Petitioner identifies (Pet. 14) as limitation [267.2] the step of "operating at least one electric motor to propel the hybrid vehicle when the RL required to do so is less than a setpoint (SP)," and in what Petitioner identifies (Pet. 14) as limitation [267.3] the step of "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." We are persuaded, notwithstanding the arguments of Patent Owner which we address below, that limitation [267.2] and limitation [267.3] are each disclosed by Severinsky '970 even though the description in Severinsky '970 does not employ exactly the same language.

Severinsky '970 states: "[t]he internal combustion engine is run only in the near vicinity of its most efficient operational point, that is, such that it produces 60–90% of its maximum torque whenever operated." Ex. 1854, 20:63–67. Severinsky '970 also states that when the engine can be used efficiently, it is so employed, and that under other circumstances, the electric motor alone drives the vehicle. *Id.* at 7:11–16. Dr. Stein's testimony

confirms that Severinsky '970 makes such disclosures. Ex. 1852 ¶¶ 159–160, 170–171.

Dr. Stein explains that in Severinsky '970, because the engine is not operated below 60% of MTO (maximum torque output of the engine), 60% MTO is a "setpoint" at or above which the engine is operated to propel the vehicle, and that when road load is between this setpoint and 90% MTO, the engine alone produces the required torque. Ex. 1852 ¶¶ 159–161. Dr. Stein also explains that the 60% MTO referred to in Severinsky is a setpoint below which only the electric motor is operated to propel the vehicle. *Id.* In particular, Dr. Stein states that a person of ordinary skill in the art would have understood that Severinsky '970 discloses "a predetermined torque value or setpoint" that is 60% of the engine's maximum torque output. *Id.* ¶ 161. Dr. Stein further explains that the 60% of MTO setpoint is substantially less than the MTO, citing claim 15 of the '634 patent, which indicates that 70% of MTO qualifies as substantially less than the MTO. *Id.* ¶¶ 190–192. Dr. Stein also explains that in the context of the '634 patent, which regards a range of 30–50% of MTO as varying substantially, 20% qualifies as substantial in the context of the '634 patent. *Id.* ¶¶ 188–189.

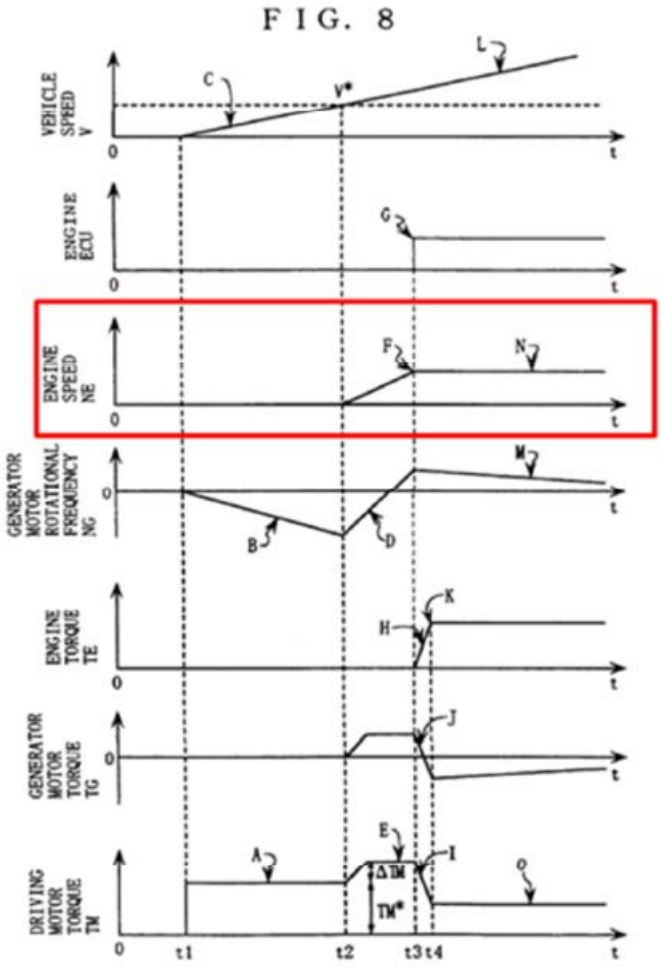
Accordingly, we find that limitation [267.2] and limitation [267.3] are each disclosed by Severinsky '970.

Claim 267 recites in what Petitioner identifies (Pet. 22) as limitation [267.4] the step of "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." As is pointed out by Petitioner (Pet. 22), Severinsky

’970 describes: “Microprocessor 48 monitors the operator’s inputs and the vehicle’s performance, and activates electric motor 20 when torque in excess of the capabilities of engine 40 is required” (Ex. 1854, 14:15–18). In that connection, the ’634 patent itself states: “Where the road load exceeds the engine’s maximum torque for a relatively short period less than T, the traction motor (and possibly also the starting motor) are used to provide additional torque, *as in the [Severinsky] ’970 patent* and above. Ex. 1851, 44:65–45:2 (emphasis added). Dr. Stein testifies and explains why Severinsky ’970 discloses limitation [267.4]. Ex. 1852 ¶¶ 194–199.

Accordingly, we find that limitation [267.4] is disclosed by Severinsky ’970.

Claim 267 recites in what Petitioner identifies (Pet. 22) as limitation [267.5] the step of “rotating the engine before starting the engine such that its cylinders are heated by compression of air therein.” For what Petitioner identifies as limitation [241.5], Petitioner relies on the teachings of Yamaguchi (Pet. 22–24). Specifically, Petitioner refers to an annotated version of Figure 8 of Yamaguchi, including a red box as the annotation, as illustrating “rotating the engine to a predetermined speed (e.g., 600 rpms, as indicated by arrow F, within the red box) before allowing the engine to be started at time t3.” Pet. 22–23. Petitioner also cites to column 8, lines 62–65, of Yamaguchi, and paragraphs 203–204 of Dr. Stein’s first declaration for support. Pet. 23. The annotated version of Figure 8 of Yamaguchi is reproduced below:



Yamaguchi, Ex. 1855, Figure 8 (annotated)

Figure 8 of Yamaguchi illustrates a time chart for various operating parameters of a disclosed embodiment of Yamaguchi's hybrid vehicle. Ex. 1855, 3:50–52. Yamauchi states: "At time t3, when the engine rotational speed NE exceeds the predetermined value NE*, for example 600 rpm (Arrow F in FIG. 8), the engine ECU is switched to ON to allow the engine to ignite (Arrow G)." *Id.* at 8:65. Petitioner further explains, citing the testimony of Dr. Stein:

> Rotating the engine generates heat from the compression of air within the cylinders. (Stein, Ex. 1852 ¶ 205; Pulkrabek, Ex. 1869 at 16.) Yamaguchi's disclosure of high-speed rpm rotation prior to ignition would, however, make it clear to a POSA that rotation of the engine compresses air within the cylinders which generates heat within the cylinders. *Id.* Accordingly, Yamaguchi's disclosure that the engine is rotated to 600 rpm prior to ignition is sufficient to teach "*rotating the engine before starting the engine such that its cylinders are heated by compression of air therein.*" *Id.* at ¶¶ 205–207.

Pet. 23–24. For the foregoing reasons, we find that Yamaguchi discloses limitation [267.5].

With regard to a rationale for one with ordinary skill in the art to combine the applicable teachings of Yamaguchi with the control method disclosed by Severinsky '970, we find that Petitioner has persuasively articulated, on pages 24–25 of the Petition, reasoning with rational underpinnings, notwithstanding the arguments of Patent Owner which we address below. For instance, Petitioner explains that it was well known in the art that engine cold starts cause emission problems and reduction of fuel economy, and that it was well known in the art that in engine cold starts, the engine must run rich, a condition at which it is difficult to maintain stoichiometric ratio, to achieve sufficient evaporation of fuel. Pet. 24. Petitioner's position is supported by the cited testimony of Dr. Stein (Ex. 1852 ¶¶ 84, 308). Dr. Stein also has testified that it was well known as of 1988 that catalytic converters included three-way catalyst systems for reducing emissions of hydrocarbon ("HC"), carbon monoxide ("CO"), and nitrogen oxide ("NO_x"), and that it also was well known that three-way

catalyst systems operate most effectively if the engine is operated very close to the stoichiometric air/fuel ratio. Ex. 1852 ¶ 79. In summary, we find that because one of the objectives of Severinsky '970 is to provide an improved parallel hybrid electric vehicle to produce "reduced pollutant emissions" (Ex. 1854, 5:24–36), one of ordinary skill in the art would have had reason to adopt, within the method of Severinsky '970, Yamaguchi's teaching of rotating the engine prior to starting the engine, which heats up the engine by compression of air.

2. Claims 278–280, 282, 284, 285, 289, and 290

Each of claims 278–280, 282, 284, 285, 289, and 290 depends directly from claim 267. By way of dependency from claim 267, each incorporates all of the limitations of claim 267, which have been addressed above. As for the additional limitations added to those of claim 267, Petitioner persuasively accounts for claims 278 and 279 on pages 25–27 of the Petition, for claims 280 and 282 on pages 27–29 of the Petition, for claim 285 on pages 29–31 of the Petition, for claim 289 on pages 31–32 of the Petition, and for claim 290 on pages 32–33 of the Petition.

In particular, we address what Petitioner regards as limitation [285.2] ("wherein said operating the at least one electric motor to drive the hybrid vehicle composes a low-load operation mode I") and limitation [285.3] ("wherein said operating the internal combustion engine of the hybrid vehicle to propel the hybrid vehicle composes a high-way cruising operation mode IV"). For limitation [285.2], Petitioner cites (Pet. 30) to paragraph 279 of the first declaration of Dr. Stein (Ex. 1852), which quotes the

following disclosure from Severinsky '970: "Typically at low speeds or in traffic, the electric motor alone drives the vehicle, using power stored in batteries." Ex. 1854, Abstr. For limitation [259.3], Petitioner cites (Pet. 30) to paragraph 283 of the first declaration of Dr. Stein (Ex. 1852), which quotes the following disclosure from Severinsky '970: "FIG. 5 depicts operation of the system in a highway cruising mode wherein, as indicated above, all torque required to drive the vehicle at normal highway speeds (e.g. above about 45 mph) is provided by the internal combustion engine 40 supplied with combustible fuel 36 via EFI unit 56." Ex. 1854, 13:66–14:3. Dr. Stein also identifies claim 3 of Severinsky '970, which states, in pertinent part: ". . . a high speed/cruising mode, wherein all energy is supplied by combustible fuel and all torque by said engine." Ex. 1852 ¶ 283 (citing Ex. 1854, 22:45–47). We note further that Severinsky '970 states: "and in steady state highway cruising, the internal combustion engine alone drives the vehicle." Ex. 1854, Abstr. We agree with Petitioner's analysis and reliance on the cited passages.

Accordingly, we find that Severinsky '970 discloses the limitations added by each of claims 278–280, 282, 284, 285, 289, and 290, relative to claim 267.

E. Claims 283, 286, 287, and 288 as Obvious over Severinsky '970, Yamaguchi, and Lateur

We have reviewed the arguments and evidence presented by Petitioner, and determine that, notwithstanding the arguments of Patent Owner which we discuss below, Petitioner has established, by a preponderance of the evidence, that the subject matter of claims 283, 286,

287, and 288 would have been obvious over the combined teachings of Severinsky '970, Yamaguchi, and Lateur, and thus the claims are unpatentable.

Claims 283 and 287 each depends from claim 267. Claim 286 depends from claim 285 which depends from claim 267. Claim 288 depends from claim 287. By way of their dependency from claim 267, direct or indirect, each of claims 283, 286, 287, and 288 incorporates all of the limitations of claim 267, which have been addressed above. As for the limitations added to those of claim 267, Petitioner relies on the teachings of Lateur and persuasively accounts for claim 283 on pages 33–34 of the Petition, for claim 286 on pages 34–35 of the Petition, for claim 287 on pages 37–38 of the Petition, and for claim 288 on page 38 of the Petition. As explained by Petitioner (Pet. 40–44), who relies on the cited testimony of Dr. Stein (Ex. 1852), we find that the added limitations of claims 283, 286, 287, and 288 are all disclosed by Lateur, notwithstanding the arguments of Patent Owner, which are discussed below.

For instance, claim 283 further recites "receiving operator input specifying a desired cruising speed" and "controlling instantaneous engine torque output and operation of the at least one electric motor in accordance with variation in the RL to maintain the speed of the hybrid vehicle according to the desired cruising speed." Petitioner identifies (Pet. 33) this description in Lateur:

> A plurality of switch inputs are provided within the operator compartment of the vehicle to allow the operator to control the drive system 10. A speed "cruise" control switch 36 is one of

> them. It is provided for producing a "cruise control on" signal or a "cruise control off" signal in response to a selection made by the operator.

Ex. 1856, 4:25–30. Petitioner also identifies (Pet. 33–34) this description in Lateur:

> Microprocessor 26 determines whether the speed control switch is producing a "cruise control on" signal or a "cruise control off" signal. If the "cruise control on" signal is received, then the microprocessor determines the present speed and load on output shaft 62 by sensing the characteristics of the current flowing to the motor/generators 12, 14. Such microprocessor determines whether the operator desires to accelerate, decelerate, or **maintain the present speed** by checking the signals from the brake pedal and accelerator sensors 40, 42.

Pet. 33–34 (citing Ex. 1856, 9:47–57) (emphases added by Petitioner).

Petitioner further identifies (Pet. 34) this description in Lateur:

> Similarly, when microprocessor 26 determines that the present speed should be maintained but the load required to maintain that speed changes, e.g., the vehicle starts going up a hill, microprocessor 26 sends a signal to power controller 16 causing it to make the appropriate changes to the current flowing in the first and second motor/generators 12, 14 to change the torque being applied to output shaft 62 such that the desired speed is maintained.

Pet. 34 (citing Ex. 1856, 10:36–43) (emphasis added by Petitioner). Citing the testimony of Dr. Stein, Petitioner also explains that Lateur discloses that the microprocessor controls the instantaneous output of the engine to remain constant, if the engine already is operating. Pet. 34 (citing Ex. 1852 ¶¶ 332–334). We credit the testimony of Dr. Stein, that "during speed control /

cruise control, Lateur discloses that the microprocessor controls the engine torque output to be generally constant, if it is operating." Ex. 1852 ¶ 334.

With regard to a rationale for one with ordinary skill in the art to combine the applicable teachings of Lateur with the control method disclosed by Severinsky '970, we find that Petitioner has articulated, on pages 35–37 and 39–40 of the Petition, persuasive reasoning with rational underpinnings to support its proposed manner of combining teachings.

For instance, with respect to claim 283, Petitioner explains, and we agree, that cruise control is a driver convenience that also improves fuel efficiency, and that because the objectives of Severinsky '970 include providing operating convenience while achieving substantial fuel economy, it would have been obvious to one with ordinary skill in the art to adopt the cruise control feature of Lateur in the control method of Severinsky '970. Pet. 35–36. With respect to claim 286, Petitioner explains, and we agree, that one with ordinary skill in the art would have understood that application of Lateur's engine warm-up technique would further the stated goal of Severinsky '970 to reduce harmful emissions. *Id.* at 37. With respect to claims 287 and 288, Petitioner explains, and we agree, that one with ordinary skill in the art "would have been motivated to replace the bevel-gear based torque transfer unit 38 of Severinsky '970 with the planetary-gear based variable-ratio torque transfer unit 18 of Lateur to provide a more flexible HEV architecture for operating the engine at its most efficient operation region." Pet. 39–40.

F. Claim 291 as Obvious over
Severinsky ’970, Yamaguchi, and Suga

We have reviewed the arguments and evidence presented by Petitioner, and determine that, notwithstanding the arguments of Patent Owner which we discuss below, Petitioner has established, by a preponderance of the evidence, that the subject matter of claim 291 would have been obvious over the combined teachings of Severinsky ’970, Yamaguchi, and Suga, and thus claim 291 is unpatentable.

Claim 291 depends directly from claim 267. The limitations incorporated from base claim 267 are accounted for by the combined teachings of Severinsky ’970 and Yamaguchi, as addressed above. Claim 291 further recites “wherein the at least one electric motor is sufficiently powerful to provide acceleration of said vehicle sufficient to conform to the Federal urban cycle driving fuel mileage test without use of torque from the engine to propel the vehicle.” Ex. 1851, 86:8–12. For that limitation, Petitioner relies on the combined teachings of Severinsky ’970 and Suga. Pet. 40–42.

Petitioner first explains that Severinsky ’970 discloses operation in city traffic or reversing, where electric motor 20 provides all of the torque needed to move the vehicle. Pet. 40 (citing Ex. 1854, 10:52–68). Then, Petitioner explains that one with ordinary skill in the art would have understood “Federal urban cycle driving fuel mileage test” as recited in claim 291 as referring to the “Federal Urban Driving Schedule (FUDS).” FUDS is also referred to as the “LA4 cycle,” and is a drive schedule that simulates a vehicle driving along a specified route through downtown Los

Angeles. Ex. 1852 ¶¶ 382–387. As further noted by Petitioner (Pet. 40–41), Suga discloses testing an electric motor under the requirements of FUDS. Petitioner reasons that it would have been obvious to one with ordinary skill in the art to test the electric motor of Severinsky '970, because it is intended for use by itself without the engine in city traffic, to see if it complies with FUDS, and to select a motor of sufficient power so that it would comply. Pet. 41–42. The reasoning provided has rational underpinnings and is persuasive. We determine that the limitation added by claim 291 is met by the combined teachings of Severinsky '970 and Suga.

G. Claim 241 as Obvious over Severinsky '970 and Vittone

We have reviewed the arguments and evidence presented by Petitioner, and determine that, notwithstanding the arguments of Patent Owner, which we discuss below, Petitioner has established, by a preponderance of the evidence, that the subject matter of claim 241 would have been obvious over the combined teachings of Severinsky '970 and Vittone, and thus claim 241 is unpatentable.

Petitioner identifies claim 241 as setting forth limitations [241.0], [241.1], [241.2], [241.3], [241.4], [241.5], and [241.6]. Pet. 44–45. Limitations [241.0], [241.1], [241.2], and [241.4] are the same as limitations [267.0], [267.1], [267.2], and [267.3] as discussed above, which are met by the disclosure of Severinsky '970.

Claim 241 recites in what Petitioner identifies (Pet. 45) as limitation [241.5] the step of "controlling said engine such that combustion of fuel within the engine occurs substantially at a stoichiometric ratio, wherein said

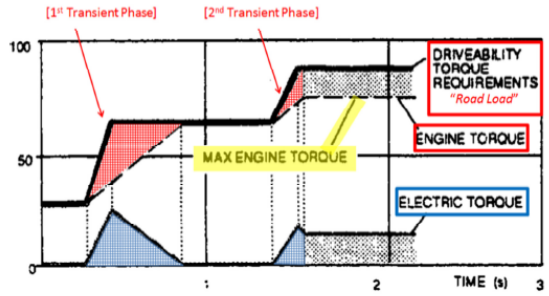
controlling the engine comprises limiting a rate of change of torque output of the engine." For what Petitioner identifies as limitation [241.5], Petitioner relies on the combined teachings of Severinsky '970 and Vittone Pet. 45–50.

Petitioner explains that Severinsky '970 sets forth a desire to lower harmful emissions in all three HC, CO, and NOx. Pet. 46 (citing Ex. 1854, [12]:12–22). Petitioner also explains that it was well known[1] as of 1988 to use a three-way catalyst system for reducing emissions of HC, CO, and NO_x, and that it also was well known that such systems are most effective if the engine is operated very close to the stoichiometric air/fuel ratio, relying on the declaration testimony of Dr. Stein. *Id.* (citing Ex. 1852 ¶¶ 79–80, 86). Additionally, Petitioner cites to this description in Vittone:

> The thermal engine defined for this application (1242 c.c.) is taken from the series production and features an injection system MPI, which allows better potential in terms of emission control. The software of the electronic unit (WEBER LAW) has been modified to implement new control strategies in the transients and to achieve the stoichiometric control over the whole working range.

Pet. 45 (citing Ex. 1858, 28 (emphasis added by Petitioner)). The new strategies are illustrated in Figure 8 of Vittone. Specifically, Petitioner refers (Pet. 47) to a color annotated version of Figure 8 of Vittone, reproduced below, as illustrating new control strategies for transients.

[1] We take this to mean well known to one with ordinary skill in the art.



Vittone, Ex. 1858, Figure 8 (annotated)

Figure 8 illustrates Vittone's "steady state" management of the transient phases to achieve emission reduction, during which adequate torque demand is assured by reliance on electric motor support. Ex. 1858, 29. As is explained by Petitioner:

> The thick, solid line in Figure 8 labeled "DRIVEABILITY TORQUE REQUIREMENTS" represents the total traction torque required to drive the vehicle over time, or equivalently "*road load.*" (Vittone Ex. 1858 at 28, 29, 33; Stein Ex. 1852, ¶¶ 490, 503.) The dashed line represents the engine output torque. Vittone illustrates two transient phases in Figure 8 and includes vertical dotted lines to identify different portions of the transient phases. . . . The "steady-state" management of the engine during transient phases is illustrated by the limited rate of change of the engine output torque in Figure 8.

Pet. 47–48. As shown, the dashed line does not follow the solid line in the transient phases, but rises at a smaller slope than does the solid line. Thus, in Vittone the rate of change of the engine's actual torque output is limited, as is required by limitation [241.5].

Petitioner has articulated persuasive reasoning with rational underpinnings to combine the above-noted teachings of Vittone with the operational mode switching method of Severinsky '970. Specifically, Severinsky '970 sets forth a desire to lower harmful emissions in HC, CO,

and NOx. Ex. 1854, 12:12–22. Petitioner explains: "Vittone solves the [emission] problem with quick transients in engine load by limiting the rate of change of engine torque input to help stabilize the air-fuel ratio at the stoichiometric target, which improves fuel economy and reduces noxious emissions." Pet. 49. We are persuaded by Petitioner that one with ordinary skill in the art would have known to combine the operational mode switching of Severinsky '970 with Vittone's strategies for steady-state management of transient conditions, "to obtain the predictable results expressly taught in Vittone, improved control of the stoichiometric air-fuel ratio which results in improved fuel economy and reduced emissions." Pet. 49. The position is supported by the declaration testimony of Dr. Stein. Ex. 1852 ¶ 519. For the foregoing reasons, we find that limitation [241.5] is met by the combined teachings of Severinsky '970 and Vittone. The arguments of Patent Owner to the contrary are unpersuasive, and will be discussed below.

Claim 241 recites in what Petitioner identifies (Pet. 45) as limitation [241.6] the step of "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." For what Petitioner identifies as limitation [241.6], Petitioner relies on the combined teachings of Severinsky '970 and Vittone, as is the case with limitation [241.5]. Pet. 45–50. Specifically, Petitioner cites to this description in Vittone: "A further contribution to the emission reduction is achieved through the 'steady state' management of the thermal engine in transient phases, <u>while the torque</u>

demand is assured by the electric motor support. (Fig. 8)." Pet. 45 (citing Ex. 1858, 29 (emphasis added by Petitioner)). Petitioner also explains, with respect to Vittone's Figure 8 reproduced above:

> During the second transient phase shown in Figure 8, the engine is "*incapable of supplying instantaneous torque required to propel the hybrid vehicle*" because the driveability torque requirements (i.e., "*road load*") are greater than the maximum engine torque. Thus, the ECU controls the motor to supply additional torque, as shown by the blue crosshatch. (Stein, Ex. 1852, ¶ 505.)

Pet. 48. We agree with Petitioner. Limitation [241.6] is met by Vittone in connection with its strategy, discussed above, that limits the rate of change of the torque output of the engine. Using the electric motor to make up for the deficiency caused by limiting the rate of change of the engine's torque output is a part of Vittone's strategy that limits the rate of change of the engine torque. The same reasoning for combining Vittone's teaching on limiting the engine's rate of change of torque with the method of Severinsky '970 accounts for applying, in Severinsky '970, Vittone's teaching about supplying additional torque from the electric motor if the engine is incapable of supplying the instantaneous torque required to propel the vehicle.

For the foregoing reasons, we find that limitation [241.6] is met by the combined teachings of Severinsky '970 and Vittone.

H. Claim 264 as Obvious over Severinsky '970, Vittone, and Yamaguchi

We have reviewed the arguments and evidence presented by Petitioner, and determine that, notwithstanding the arguments of Patent Owner, which we discuss below, Petitioner has established, by a

preponderance of the evidence, that the subject matter of claim 264 would have been obvious over the combined teachings of Severinsky '970, Vittone, and Yamaguchi, and thus claim 264 is unpatentable.

Claim 264 depends directly from claim 241, and thus incorporates, by reason of its dependency form claim 241, all of the limitations of claim 241. Those limitations already have been addressed above in the context of claim 241, as met by the combined teachings of Severinsky '970 and Vittone. With respect to its base claim 241, claim 264 further recites: "rotating the engine before starting the engine such that its cylinders are heated by compression of air therein." This limitation is the same as limitation [267.5] already discussed above as met by the combined teachings of Severinsky '970 and Yamaguchi. Accordingly, we find that the limitation added by claim 264, relative to its base claim 241, is met by the combined teachings of Severinsky '970 and Yamaguchi.

I. Claim 266 as Obvious over Severinsky '970, Vittone, and Suga

We have reviewed the arguments and evidence presented by Petitioner, and determine that, notwithstanding the arguments of Patent Owner, which we discuss below, Petitioner has established, by a preponderance of the evidence, that the subject matter of claim 266 would have been obvious over the combined teachings of Severinsky '970, Vittone, and Suga, and thus claim 266 is unpatentable.

Claim 266 depends directly from claim 241, and thus incorporates, by reason of its dependency form claim 241, all of the limitations of claim 241. Those limitations already have been addressed above in the context of claim

241, as met by the combined teachings of Severinsky '970 and Vittone. With respect to its base claim 241, claim 266 further recites: "wherein the at least one electric motor is sufficiently powerful to provide acceleration of said vehicle sufficient to conform to the Federal urban cycle driving fuel mileage test without use of torque from the engine to propel the vehicle." That limitation is the same as the limitation added by claim 291 relative to its base claim 267, and has been addressed above in the context of claim 291 as met by the combined teachings of Severinsky '970 and Suga. We find that the limitation added by claim 266, relative to its base claim 241, is met by the combined teachings of Severinsky '970 and Suga.

J. Claims 111 and 144 as Obvious over Severinsky '970, Frank, and Yamaguchi

We have reviewed the arguments and evidence presented by Petitioner, and determine that, notwithstanding the arguments of Patent Owner which we discuss below, Petitioner has established, by a preponderance of the evidence, that the subject matter of claims 111 and 144 would have been obvious over Severinsky '970, Frank, and Yamaguchi, and thus the claims are unpatentable.

Claim 111 depends from claim 80, and claim 144 depends from claim 114. Thus, claim 111 incorporates all the limitations of claim 80, and claim 144 incorporates all the limitations of claim 114. We focus first on the limitations incorporated from claims 80 and 114.

1. Claims 80 and 114

Because there is substantial overlap between claim 80 and claim 241, many of our findings with regard to the limitations of claim 241, as

discussed above, also apply with respect to claim 80. Specifically, claim 80 recites the same limitations as what has been identified by Petitioner as limitation [241.0], limitation [241.1], limitation [241.2], limitation [241.3], and limitation [241.4]. We already have determined above that Severinsky '970 discloses each of those limitations. In addition to those limitations, claim 80 further recites what Petitioner identifies as limitation [80.2] and limitation [80.5]:

[80.2]—"monitoring the RL over time"; and

[80.5]—"wherein said operating the internal combustion engine to propel the hybrid vehicle is performed when: the RL>the SP for at least a predetermined time; or the RL>a second setpoint (SP2), wherein the SP2 is a larger percentage of the MTO than the SP."

For limitation [80.2], Petitioner relies on the disclosure of Severinsky '970. Pet. 52. Specifically, as noted by Petitioner, Severinsky '970 states: "at all times the microprocessor 48 may determine the load (if any) to be provided to the engine by the motor, responsive to the load imposed by the vehicle's propulsion requirements, so that the engine 40 can be operated in its most fuel efficient operating range." Ex. 1854, 17:11–15. Petitioner's position is supported by the testimony of Dr. Stein. Ex. 1852 ¶¶ 602–609. We are persuaded by Petitioner's analysis and evidence. Accordingly, we find that Severinsky '970 discloses limitation [80.2].

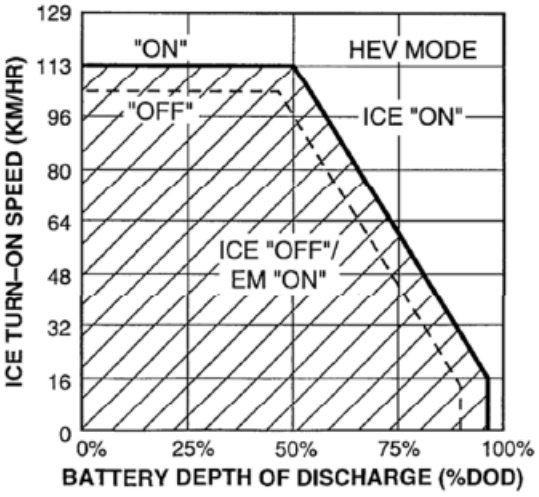
For limitation [80.5], Petitioner relies on the disclosure of Frank. Pet. 52–53. Specifically, Petitioner identifies as limitation [80.5][a] the condition "the RL>the SP for at least a predetermined time," and as

limitation [80.5][b] the alternate condition "the RL>a second setpoint (SP2), wherein the SP2 is a larger percentage of the MTO than the SP." Pet. 53.

Petitioner explains:

> Limitation [80.5][a] claims hysteresis via time-delay, and limitation [80.5][b] claims hysteresis via two setpoints (like the thermostat example above).
>
> Frank discloses a method for controlling a parallel HEV and both hysteresis techniques for turning on and off the engine "to prevent frequent cycling" of the engine. In one strategy, Frank discloses that "a single threshold could be used in combination with a time delay between the [engine] 'on' and 'off' modes to prevent frequent cycling [of the engine]." (Frank, Ex. 1859, 7:66–8:11; Stein, Ex. 1852 ¶ 659.)
>
> In another strategy, and with reference to Figure 4 below, Frank discloses "separate 'on' and 'off' thresholds", which are shown as solid and dashed curves respectively. Frank explains that "[t]he control band between the 'on' threshold curve and the 'off' threshold curve prevents undesirable or excessive cycling of the ICE 14." (Frank, Ex. 1859, 7:66–8:11; Stein, Ex. 1852, ¶ 659.)

FIG. – 4



Frank, Ex. 1859, Fig. 4

Pet. 53–54. Petitioner's position is supported by the cited testimony of Dr. Stein. We find that Frank discloses both alternative conditions provided in limitation [80.5], i.e., limitation [80.5][a] and limitation [80.5][b], except that in Frank the setpoint or threshold is based on vehicle speed rather than road load. That remaining difference, however, is accounted for by Petitioner's proposed combination of Severinsky '970 and Frank, as explained below, because Severinsky '970 discloses determining a vehicle's modes of operation based on road load. Specifically, Severinsky '970 discloses a torque-based setpoint, as already discussed above, for operating the engine.

With regard to a rationale for one with ordinary skill in the art to combine the applicable teachings of Frank concerning limitation [80.5][a] and limitation [80.5][b] with the control method disclosed by Severinsky '970, we find that Petitioner has articulated, on pages 53–55 of the Petition, sufficient reasoning with rational underpinnings. For instance, Petitioner explains that limitations [80.5][a] and [80.5][b] reflect a well-known on-off "hysteresis" control technique, which prevents repeated on/off switching or "chattering" when a system is near its setpoint, relying on the testimony of Dr. Stein. Pet. 53 (citing Ex. 1852 ¶¶ 96–101, 658–659). Petitioner further explains:

> It would have been obvious to a POSA to use either of the well-known hysteresis strategies described in Frank with Severinsky '970's "setpoint *(SP)*" of 60% MTO, when switching between motor mode and engine mode. (Stein, Ex. 1852, ¶¶ 660, 669.) For, example, regarding Frank's time delay strategy, it would have been obvious to a POSA to add a time delay to Severinsky

> ’970’s engine starting strategy, as taught by Frank, such that the engine was started after the “*RL*” was greater than the “*SP*” for a predetermined period of time, *e.g.*, 2-3 minutes. *Id.* at ¶ 660. Regarding Frank’s separate setpoints strategy, it would have been obvious to add a second setpoint “*SP2*” to Severinsky ’970’s control strategy, as taught by Frank, *e.g.*, 65% MTO – such that the engine is turned off when “*RL*” is less than a “*SP*” of 60% MTO; and the engine is turned on when “*RL*” is greater than a second setpoint “*SP2*” of 65% MTO, to prevent excess cycling of the engine. *Id.* at ¶ 669.)

Pet. 54–55.

With respect to claim 114, because there is substantial overlap between claim 114 and claim 80, many of our findings with regard to the limitations of claim 80, as discussed above, also apply with respect to claim 114. Specifically, claim 114 is the same as claim 80, except with regard to limitation [80.5]. Claim 114 includes limitation [80.5] only in part, by removing one of the two alternative conditions specified in limitation [80.5], i.e., “the RL>a second setpoint (SP2), wherein the SP2 is a larger percentage of the MTO than the SP.” Instead, the corresponding limitation in claim 114 simply reads:

> wherein said operating the at least one electric motor to propel the hybrid vehicle is performed when the RL<the SP for at least a predetermined amount of time.

The above-quoted limitation already is addressed above in the context of claim 80 as limitation [80.5][a]. For the same reasons, we find that Frank discloses the limitation and that Petitioner has articulated, on pages 53–55 of the Petition, sufficient reasoning with rational underpinnings on why Frank’s

teachings in that regard are combinable with the control method of Severinsky '970.

2. Claims 111 and 144

Claim 111 incorporates the limitations of claim 80 and further recites the step of: "rotating the engine before starting the engine such that its cylinders are heated by compression of air therein." Claim 144 incorporates the limitations of claim 114 and further recites the step of: "rotating the engine before starting the engine such that its cylinders are heated by compression of air therein." The limitation added by claims 111 and 144 relative to each's base claim is the same as limitation [267.5] as discussed above. We have determined that limitation [267.5] is met by the disclosure of Yamaguchi, and that Petitioner has articulated persuasive reasoning with rational underpinnings to apply that teaching of Yamaguchi within the control method of Severinsky '970. The same is true for the limitation added by claims 111 and 144, relative to claims 80 and 114, respectively.

K. Patent Owner's Contentions

Patent Owner organizes its arguments into eight sections appearing on pages 13–60 of the Patent Owner Response. We address them here, in the sequence presented by Patent Owner.

1.

On pages 13–26 of the Patent Owner Response, Patent Owner argues that Severinsky '970 does not disclose using road load to determine when to operate the engine. Patent Owner explains that, as properly construed, the claims require comparing the road load to a setpoint. *Id.* at 14. As discussed

above in the discussion of claim construction, we agree with Patent Owner that the claims require the comparison of road load to a setpoint. But we are unpersuaded that Severinsky '970 does not compare road load to a setpoint for selecting various operating modes of a hybrid vehicle. Petitioner has made specific accounting of those limitations, as discussed above.

Patent Owner appears to argue also that operating an electric motor when RL is less than the setpoint requires an affirmative step to turn the engine off. PO Resp. 14 n.1. The argument is misplaced. Such a limitation only requires operation of an electric motor and not the absence of operation of the engine. Similarly, a limitation requiring operation of the engine when the road load is between 60% and 90% of the MTO does not require the absence of engine operation outside of that range. In any event, Petitioner has accounted for the absence of engine operation when the road load is less than the setpoint, because in Severinsky '970, the engine is operated only when road load is between 60% and 90% of the MTO. Ex. 1854, 20:63–67.

Patent Owner points to various portions of Severinsky '970 that discuss selecting vehicle operational mode based on the speed of the vehicle. PO Resp. 13–17. Patent Owner argues that "the overwhelming number of [such] passages" indicate "that Severinsky only considers speed." *Id.* at 16.

The argument is misplaced. A prior art reference must be considered for everything it teaches by way of technology and is not limited to the particular invention it is describing and attempting to protect. *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985). It is also evident that what Severinsky '970 attempts to protect extends beyond

selecting operational mode by vehicle speed. The "acceleration/hill climbing mode" as recited in claim 3 of Severinsky '970 is not based on vehicle speed but on "need" for the engine to receive assistance from the electric motor. Ex. 1854, 5:48–52, 6:43–45, 9:47–57. We note further this description in the Objects and Summary portion of Severinsky '970, which expresses a framework that clearly extends beyond considerations for speed: "More particularly, according to the invention, the internal combustion engine is operated only under the *most efficient conditions of output power and speed*." *Id.* at 7:8–10 (emphasis added).

Thus, the disclosures in Severinsky '970 about having speed as a basis for selecting vehicle operating modes does not nullify or undermine the otherwise express disclosures of Severinsky '970 for selecting operating modes based on road load, as has been explained by Petitioner and discussed above. Patent Owner simply is incorrect to assert (PO Resp. 16–17) that Severinsky '970 "only describes using speed to determine when to operate the engine."[2]

Patent Owner argues (PO Resp. 19) that Petitioner misapplied the following passage from Severinsky '970: "Thus, at all times the microprocessor 48 may determine the load (if any) to be provided to the engine **by the motor**, responsive to the load imposed by the vehicle's

[2] Patent Owner's argument specifically pertaining to claims 278, 279, and 282 (PO Resp. 17 n.2) reiterates that Severinsky '970 uses speed, rather than road load, to determine operation of the engine, and lacks merit for the same reasons already discussed above.

propulsion requirements so that the engine 40 can be operated in its most fuel efficient operating range." Ex. 1854, 17:11–15 (emphasis by Patent Owner). According to Patent Owner, the passage relates to providing torque from the engine to the electric motor to charge the battery when the engine is already in operation, and thus is not the same as disclosing determining road load or using road load to control engine operation. PO Resp. 18. The argument is misplaced.

Petitioner did not rely on that passage as teaching comparing road load to a setpoint to determine the vehicle's operational mode. As discussed above, Petitioner relies on that passage only to account for the claim limitations of "determining instantaneous road load (RL) required to propel the hybrid vehicle responsive to an operator command" and "monitoring the RL over time." Also as discussed above, Petitioner relies on other disclosure from Severinsky '970 to meet the claim limitation of comparing road load to a setpoint to determine an operational mode of the vehicle. Also, although the load provided to the engine by the motor is not road load, "the load imposed by the vehicle's propulsion requirements" is road load. Petitioner correctly focused on the load imposed by the vehicle's propulsion requirements, and not the load provided to the engine by the motor.

Patent Owner argues that because the highway cruising mode and the low speed mode of Severinsky '970 are based on speed as a determinant, a person of ordinary skill in the art "can only" infer that the "high-speed acceleration and/or hill climbing mode" is also initiated on speed, not road load. PO Resp. 21. The argument is misplaced. First, as discussed above,

Severinsky ’970 does not just disclose speed as a determinant for entering the low speed/reversing mode and the highway cruising mode, but also discloses the level of road load, as compared to a setpoint, as a determinant. Second, Severinsky ’970 describes: “Microprocessor 48 monitors the operator’s inputs and the vehicle’s performance, and activates electric motor 20 when torque in excess of the capabilities of engine 40 is required.” Ex. 1854, 14:15–18. Thus, Severinsky ’970 expressly adds the motor when the engine alone is not enough to provide sufficient torque. Patent Owner asserts that Petitioner ignores that the name of the operating mode, as referenced in Severinsky ’970 in connection with Figure 6, is “*high speed* acceleration and/or hill climbing mode.” PO Resp. 21. But that argument is not dispositive, because Severinsky ’970 also refers to that mode simply as an “acceleration/hill climbing mode” without the modifier “high-speed.” Ex. 1854, 11:4–5. Note also that in claim 3 of Severinsky ’970, the expressly claimed mode of operation is “an acceleration/hill climbing mode,” not “a high speed acceleration /hill climbing mode.”

Regardless of whether the modifier “high-speed” is used, Severinsky ’970 expressly describes a condition of torque as the trigger for entering the mode, i.e., “when torque in excess of the capabilities of engine 40 is required.” Ex. 1854, 14:15–18. Also, it is self-evident that hill climbing may occur at either low or high speed. We are unpersuaded by Patent Owner that high speed is required for Severinsky ’970 to enter the mode of operation that uses both the engine and the electric motor. In that regard, note that the term “and/or” is used in Severinsky ’970 to join “high speed

acceleration" and "hill climbing." Thus, the aspect of Severinsky '970 that enters a mode of operation using both the engine and the motor, triggered solely by hill climbing, is sufficient to meet the limitation at issue, without regard to acceleration. Based on the disclosure of Severinsky '970, the words "high speed" as a modifier modifies only acceleration, and not hill climbing. Severinsky '970 does not distinguish high speed hill climbing from hill climbing.

Additionally, we disagree with Patent Owner's suggestion (PO Resp. 21) that recognizing that "acceleration/hill climbing" can occur at any speed stems from hindsight in light of the disclosure of the '634 patent. It stems, instead, from the disclosure of Severinsky '970 as discussed above and also from a plain and direct reading of the text itself.

Patent Owner argues that Severinsky '970 discloses only monitoring accelerator pedal position, which alone is not determinative of road load. PO Resp. 21. The argument is misplaced, because it assumes that all the technical details of how to perform a task must be expressly described in a prior art reference before that reference can be relied on as teaching the performance of that task. The assumption is incorrect. Patent Owner does not allege, and the evidence does not show, that one with ordinary skill in the art would not have known how to determine road load based on accelerator pedal input and other ascertainable information. Patent Owner's focusing on pedal position misses the mark. Petitioner has not asserted that pedal position itself, without anything more, equates to road load.

Patent Owner argues that "Severinsky '970 never states that road load is evaluated or used to effect mode switching." PO Resp. 23. The argument is misplaced and ineffective, because Petitioner's reasoning and analysis is not based on any such express statement in Severinsky '970. It is simply not necessary that the same exact words are used in a prior art reference.

Patent Owner argues that to ensure that appropriate torque is delivered to the wheels of the vehicle, as is described in Severinsky '970, does not mean determining instantaneous road load required to propel the vehicle, because providing torque to the wheels does not require determining road load. PO Resp. 23–24. The argument is misplaced, because the disclosure in Severinsky '970 is to ensure that "appropriate torque" is delivered to the wheels, not just generally providing torque to the wheels. As discussed above, Severinsky '970 describes a mode of vehicle operation that uses an electric motor when road load required to propel the vehicle is less than a setpoint, and a mode of vehicle operation that uses an internal combustion engine when the road load required to propel the vehicle is between a setpoint and the maximum torque output (MTO) of the engine. Ensuring that "appropriate torque" is delivered to the wheels, where the various modes of vehicle operation are based on the level of road load, does constitute probative evidence that instantaneous road load is determined.

Patent Owner argues "the Board should not be distracted by Ford's discussion of an alleged 'motor-engine transition' based on road load." PO Resp. 24 (citing Pet. 20–21). On pages 20–21 of the Petition, Petitioner points to a certain description in Severinsky '970 about motor-engine

transition as confirming that road load determines the transition between operating modes. Specifically, Petitioner points to description that begins with having the vehicle operating in low speed circumstances such as in city traffic or reversing, and that further states:

> Under these circumstances, electric motor 20 provides all of the torque needed to move the vehicle. Other combinations of torque and energy flows required under other circumstances are detailed below in connection with FIGS. 5–9. For example, if the operator continues to command acceleration, an acceleration/hill climbing mode illustrated in FIG. 6 may be entered, **followed by** a highway cruising mode illustrated in FIG. 5.

Pet. 21 (citing Ex. 1854, 10:68–11:6 (emphasis added by Petitioner)). According to Patent Owner, nothing in the above-quoted text suggests transitioning from motor propulsion to acceleration/hill climbing mode. PO Resp. 24. We are unpersuaded. The above-quoted text indicates clearly that the vehicle "may" enter acceleration/hill climbing mode from operations drawing power only from the electric motor, and that the highway cruising mode is entered sometime thereafter. Patent Owner asserts that Petitioner's view would have the same torque level falling within both the condition that it exceeds the maximum torque output of the engine and the condition that it is between a setpoint and the maximum torque output of the engine. PO Resp. 25. We are unpersuaded. The "followed by" language in the above-quoted text is read, reasonably, only to indicate that torque in excess of that which can be provided by the engine is no longer required. Note that a vehicle cannot accelerate in perpetuity and must cease to accelerate at some

time. The quoted language does not mean the vehicle eventually is in both hill climbing mode and highway cruising mode at the same time.

Patent Owner argues that Petitioner has relied on the acceleration/hill climbing mode to satisfy both the operational mode in which road load is more than the maximum torque output of the engine and the operational mode in which road load is between a setpoint and the engine's maximum torque output. PO Resp. 26 n.5. We are unpersuaded. Petitioner has not relied on the acceleration/hill climbing mode as satisfying the limitation of operating the internal combustion engine when road load is between a setpoint and the maximum torque output of the engine. *See*, *e.g.*, Pet. 14–17.

2.

On pages 26–34 of the Patent Owner Response, Patent Owner argues that the disclosure in Severinsky '970 about an operating range that is at 60% to 90% of the engine's maximum output torque, within which only the internal combustion engine is operated and not the electric motor, is only an "aspirational" disclosure and that Severinsky '970 really only discloses operational modes based on vehicle speed and not road load. According to Patent Owner, all the disclosures referring to specific torque level and ranges are only aspirational in the sense that they are high level goals or objectives to be reached, rather than real teachings about torque based control strategy.

The argument is unpersuasive, as well as misplaced. Patent Owner has not pointed to any language in Severinsky '970 that conveys uncertainty with respect to having operational ranges based on road load. Patent Owner has not pointed to any language in Severinsky '970 that expresses a lack of

expectation of success with respect to operational ranges based on road load. Also, Patent Owner has not alleged that one with ordinary skill in the art would not have known how to implement the operational ranges expressed in Severinsky '970 in terms of road load. We have no reason to discount or ignore the teachings in Severinsky '970 about having operational ranges based on road load. As we discussed above, a prior art reference must be considered for everything it teaches by way of technology and is not limited to the particular invention it is describing and attempting to protect. *EWP Corp.*, 755 F.2d at 907; *see also Smith & Nephew, Inc. v. Rea*, 721 F.3d 1371, 1378 (Fed. Cir. 2013) ("The Board's conclusion that . . . is the result of not reading the prior art for all that it teaches."). In the absence of an issue with regard to enablement of prior art teachings, there are not two classes of disclosure, one deemed "aspirational" and disregardable on the basis that it is described in the prior art reference less frequently, more indirectly, or by use of different words. Simply put, a prior art reference is good for all it teaches by way of technology. Petitioner has explained, persuasively:

> Limitations [267.2] and [267.3] [a] address, respectively, operating a motor when road load is "*less than a setpoint (SP),*" and operating an engine when road load is "*between the SP and a maximum torque output (MTO) of the engine*." As shown in the chart above and discussed more fully below, Severinsky '970 discloses operating an engine when it "can be used efficiently," and operating a motor when the engine cannot be used efficiently. Severinsky '970 teaches that when the torque required to propel the vehicle (*i.e., road load*) exceeds 60% of MTO, "the engine can be used efficiently" and "it is so employed." "Under other circumstances," *i.e.*, when *road load*

> is less than 60% of MTO, "the electric motor alone drives the vehicle." Based on this disclosure, a POSA would have understood that Severinsky '970 describes limitations [267.2] and [267.3][a].

Pet. 14–15.

On pages 35–36 of the Patent Owner Response, Patent Owner argues that an engine's output torque is the amount of torque produced by the engine, and thus is unrelated to the input torque, i.e., the instantaneous torque required to propel the vehicle, i.e., road load. Although that is true, it does not help the Patent Owner, because Patent Owner has not shown where in Petitioner's analysis did Petitioner regard output torque of the engine as the input road load to be compared to a setpoint, to determine an operational mode of the vehicle. Patent Owner contends that it is illogical for Petitioner to regard the output torque of the engine as the parameter used to start the engine, because such an approach is circular. PO Resp. 36. But Patent Owner has not shown where Petitioner has taken such an approach. As discussed above, according to the Petitioner, road load (RL) is determined from the vehicle's propulsion requirements. Pet. 11, 14. Also as discussed above, according to Petitioner, that determined road load is compared to a setpoint that is a portion of the maximum torque output of the engine, to determine whether the engine should be used. Pet. 14–17. If that is regarding engine output as a parameter for determining whether engine power should be used, it is what the claims of the '634 patent require.

On pages 37–39 of the Patent Owner response, Patent Owner argues that Severinsky '970 does not disclose the limitations pertaining to

"abnormal and transient conditions." According to Patent Owner, "abnormal and transient conditions" exclude anything and everything that occurs in city traffic, including starting the engine. *Id*. The argument turns on a proper construction of "abnormal and transient condition." As discussed above, however, we reject Patent Owner's proposed construction of "abnormal and transient conditions" to exclude starting the engine. As properly construed, "abnormal and transient conditions" includes starting the engine, whether or not in city traffic. Consequently, Patent Owner's arguments about claim limitations relating to "abnormal and transient conditions" are without merit.

3.

On pages 40–45 of the Patent Owner Response, Patent Owner argues that it is impermissible for Petitioner, when discussing the content of Severinsky '970, to cite to and rely on statements within the Specification of the '634 patent that characterize the disclosure of Severinsky '970, and expresses disagreement with how Petitioner indicates the Specification of the '634 patent has characterized the content of Severinsky '970. For reasons discussed below, both arguments are unpersuasive.

At issue are express statements within the Specification of the '634 patent. They are as important as statements made by applicants for patent during prosecution of a patent application before an Examiner, if not more. On what a prior art reference discloses, statements within the Specification of the patent being challenged, to the extent that they specifically address the subject, are not determinative but are probative on how one with ordinary

skill in the art at the time of filing of the involved patent would have read and understood the disclosure of the prior art. Also, such statements can be used by Petitioner to discredit or undermine Patent Owner's arguments to the contrary. The authority cited by Patent Owner, *Clearwater Sys. Corp. v. Evapco, Inc.*, 394 Fed. Appx. 699, 705 (Fed. Cir. 2010) (nonprecedential), is inapposite and distinguishable from the facts of this case. In *Clearwater*, the Federal Circuit determined that a district court erred, in a summary judgment ruling, by comparing the claimed invention only to what is described in the specification of the involved patent about prior art, rather than to the prior art itself. That is not the case here. Petitioner has based its analysis on a direct comparison of the claims with the disclosure of Severinsky '970, as discussed above.

Petitioner cites to the following text in the Specification of the '634 patent about Severinsky '970 as supporting its position that Severinsky '970 discloses selecting a vehicle operational mode based on road load:

> Turning now to detailed discussion of the inventive control strategy according to which the hybrid vehicles of the invention arte operated: as in the case of the hybrid vehicle system shown in the [Severinsky] '970 patent, and as discussed in further detail below, the vehicle of the invention is operated in different modes depending on the **torque required**, the state of charge of the batteries, and other variables[.]

Pet. 13 (citing Ex. 1351, 35:3–9 (emphases added by Petitioner)).

The cited text is probative on the subject of whether Severinsky '970 relies on road load or only vehicle speed to select an operational mode of the vehicle, and does support Petitioner's position on the subject more so than it

does Patent Owner's position. We are unpersuaded by Patent Owner's contention (PO Resp. 40) that the cited text merely indicates that the control strategy of the '634 patent applies to both the parallel hybrid disclosed in Severinsky '970 as well as the series-parallel embodiment disclosed by the '634 patent.

Petitioner cites to the following text in the Specification of the '634 patent about Severinsky '970 as supporting its position that Severinsky '970 discloses selecting a vehicle operational mode based on road load:

> Where the **road load** exceeds the engine's maximum torque for a relatively short period less than T, the traction motor (and possibly also the starting motor) are used to provide additional torque, as in the [Severinsky] '970 patent and above.

Pet. 13 (citing Ex. 1351, 44:65–45:2) (emphases added by Petitioner). The above-quoted text is probative on the subject of whether Severinsky '970 relies on road load or only vehicle speed to select an operational mode of the vehicle, and does support Petitioner's position on the subject more so than it does Patent Owner's position. We are unpersuaded by Patent Owner's contention (PO Resp. 40–41) that the cited text merely refers to the control strategy in the '634 patent and not anything in Severinsky '970.

Petitioner cites to the following text in the Specification of the '634 patent about Severinsky '970 as supporting its position that Severinsky '970 discloses selecting a vehicle operational mode based on road load:

> **According to an important aspect of the invention of the [Severinsky] '970 patent**, substantially improved efficiency is afforded by operating the internal combustion engine only at a relatively high output torque levels, typically at least 35% and preferably at least 50% of peak torque. **When the vehicle**

> **operating conditions require torque of this approximate magnitude, the engine is used to propel the vehicle**; when less torque is required, an electric motor powered by electrical energy stored in a substantial battery bank drives the vehicle; when more power is required than provided by either the engine or the motor, both are operated simultaneously. **The same advantages are provided by the system of the present invention**. . . .

Pet. 18 (citing Ex. 1851, 25:11–24 (emphases added by Petitioner)). The above-quoted text is probative on the subject of whether Severinsky '970 relies on road load or only vehicle speed to select an operational mode of the vehicle, and does support Petitioner's position on the subject more so than it does Patent Owner's position. Patent Owner argues that the reference to 35% and 50% peak torque value is not in the disclosure of Severinsky '970. PO Resp. 41–42. The contention is misdirected. Petitioner is not relying on that aspect of the above-quoted text. Rather, Petitioner relies on the emphasized portions in the above-quoted text as indicating that "torque" is the parameter for determining when to use the engine.

Patent Owner argues, with respect to claim 285, that Petitioner relies on what is referred to in Severinsky '970 as "low speed" mode of operation to satisfy the claim recitation of "a low-load operation mode I," and that Petitioner's reliance on the '634 patent does not remedy that deficiency. PO Resp. 42. The argument is both misplaced and unpersuasive. First, we have construed "low-load operation mode I" as "a mode of operation of the vehicle, in which all torque provided to the wheels are supplied by an electric motor." As explained above, that is met by the disclosure of Severinsky '970 outside of its claims, notwithstanding that Severinsky '970

has referred to a "low speed running mode of operation" in claim 16. Pet. 14 (citing Ex. 1854, 7:11–16, 20:63–67). Moreover, "low-load operation mode I" does not exclude low-speed operations. The evidence of record does not show that low-load and low-speed are mutually exclusive. Also, Petitioner has identified portions within the Specification of the '634 patent itself that describes "mode I" operation as "low-speed operation." Pet. 31 (citing Ex. 1851, 35:63–36:4).

Patent Owner argues:

> The intrinsic record of the '634 patent also makes clear that Severinsky uses speed, not road load, as its control metric. For example, during prosecution of U.S. Patent No. 8,214,097 (a related patent), the Applicant made clear that Severinsky does not use road load and that "the '970 patent teaches making such 'mode switching' determinations based on the vehicle speed, not the road load RL." Ex. 2801 at 16–17 (emphasis in original); *see also Elkay Mfg. Co. v. Ebco Mfg. Co.*, 192 F.3d 973, 980 (Fed. Cir. 1999).

PO Resp. 42–43. We have reviewed the cited pages of Exhibit 2801 and are unable, however, to find the text referenced by Patent Owner. Also, U.S. Patent No. 8,214,097 is not in the priority chain of the '634 patent and thus is not intrinsic record of the '634 patent. Rather, statements within the Specification of the '634 patent are intrinsic record of the '634 patent. The argument is insufficient to alter the intrinsic record relied on by Petitioner.

Patent Owner argues that Petitioner has not articulated motivation for one with ordinary skill in the art to combine teachings from Severinsky '970 with the description set forth in the '634 patent. PO Resp. 44–45. The

argument is misplaced, because Petitioner has not used the Specification of the '634 patent as prior art.

Last, but importantly, we add that even without considering any of the characterizations in the Specification of the '634 patent about the disclosure of Severinsky '970, none of our findings on the substantive content of Severinsky '970 would change.

4.

On pages 45–46 of the Patent Owner Response, Patent Owner argues that there is not an adequate motivation for one with ordinary skill in the art to apply the teaching of Yamaguchi about warming the engine prior to starting the engine, in the hybrid vehicle of Severinsky '970. According to Patent Owner, Severinsky '970 teaches away from heating the engine, because it states: "To lower nitrogen oxide emissions, the engine will be operated at a lower temperature." PO Resp. 45–46 (citing Ex. 1854, 12:18–22). Further according to Patent Owner, because Severinsky '970 discloses lowering the operation temperature of the engine to reduce nitrogen oxide emissions, Severinsky '970 is incompatible with the teaching of Yamaguchi to warm up the engine prior to starting the engine. *Id.* at 46. Patent Owner's arguments are unpersuasive.

Severinsky '970 refers to lowering the operational temperature of the engine, not lowering the temperature of the engine before it is started. Patent Owner has not shown that the two are the same. We see nothing inconsistent between warming up the engine prior to starting the engine, and lowering the operational temperature of the engine during operation of the

engine to reduce nitrogen oxide emissions. We credit the testimony of Dr. Stein, who explains: "[T]he temperature of a cold engine is approximately equal to ambient temperatures, whereas engine coolant temperature is typically around 200 degrees F during operating conditions with engine parts such as cylinder walls, valve heads, piston heads, etc. being yet hotter." Ex. 1852 ¶ 316. Thus, Patent Owner has not shown warming up the engine prior to starting the engine is incompatible with operating the engine at a lower temperature once it is operational.

We also credit the testimony of Dr. Stein that Severinsky '970 discloses lowering the operational temperature of the engine to address deficiencies in its "lean-burn" strategy, and that one with ordinary skill in the art would have understood that the "lean-burn" strategy would not be applied in starting conditions prior to the engine becoming operational. Ex. 1852 ¶ 316; Ex. 1889 ¶ 28. Dr. Stein explains that one with ordinary skill in the art would have recognized that the engine may misfire if the air-fuel ratio is too lean, and "would have understood that the [lean-burn] strategy is not relevant during engine starting conditions when the engine temperatures are much lower than when the engine is operating and has come to its controlled operating temperatures." Ex. 1889 ¶ 28. Thus, there would be no reason to lower the temperature of the engine prior to starting the engine.

For these reasons, we are not persuaded that there is any disclosure in Severinsky '970 that disparages or advises against warming up the engine prior to starting the engine. Patent Owner's teaching away argument is unpersuasive.

5.

On pages 46–47 of the Patent Owner Response, Patent Owner argues that Lateur does not disclose using its cruise control feature to control the operational mode of the vehicle with respect to using the motor or the engine or both, and that Petitioner has not articulated sufficient rationale to combine the teachings of Lateur with those of Severinsky '970 and Yamaguchi. The argument is both misplaced and unpersuasive.

Petitioner has not asserted that Lateur discloses using road load to determine an operational mode of the vehicle. That teaching stems from Severinsky '970. One cannot show non-obviousness by attacking references individually where the ground of unpatentability is based on a combination of references. *In re Merck & Co. Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986); *In re Keller*, 642 F.2d 413, 426 (CCPA 1981). Lateur has been relied on simply for its teaching of having a cruise control feature in a hybrid vehicle, to satisfy the limitations of (1) receiving operator input specifying a desired cruising speed, and (2) controlling instantaneous engine torque output and operation of the at least one electric motor in accordance with variation in the RL to maintain the speed of the hybrid vehicle according to the desired cruising speed. Pet. 33–34.

Similarly, Patent Owner's assertion of lack of motivation to combine teachings also assumes that Lateur must disclose torque based determination of operation mode to be combinable with Severinsky '970. That is incorrect. It is only necessary that one with ordinary skill in the art, in light of Lateur, would have implemented a cruise control feature in Severinsky '970 for the

two references to be combinable in that regard. Severinsky '970 itself teaches determining vehicle operational mode depending on road load, and that is unchanged by adding a cruise control feature like that in Lateur.

6.

On pages 47–51 of the Patent Owner Response, Patent Owner argues that Petitioner has not articulated a sufficient basis for combining the teachings of Suga with the teachings of Severinsky '970 and Yamaguchi to yield the invention of claim 291. Patent Owner asserts that while claim 291 is directed to the power capabilities of a motor in hybrid vehicle, Suga is directed to a test procedure for an electric vehicle, not the design of a hybrid vehicle. *Id.* at 47–48. Patent Owner states: "Suga's teaching that electric vehicles (like conventional gasoline vehicles) can be tested in order to determine compliance with the Federal urban cycle driving fuel mileage test does not tell a POSA anything about how to choose the power capabilities of the motor in a hybrid system." *Id.* at 48. The argument is misplaced.

In an obviousness analysis, it is not necessary to find precise teachings in the prior art directed to the specific subject matter claimed, because inferences and creative steps that a person of ordinary skill in the art would employ can be taken into account. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). Thus, not all claim limitations have to be expressly stated in a prior art reference. For instance, if the electric motor submitted for testing under the Federal urban cycle driving fuel mileage test does not have enough power to meet the acceleration requirements of the test, one with ordinary skill in the art would have known to use a motor of

larger power capacity, sufficient to provide enough power capacity to meet the test, without need of an express teaching saying so. That is so notwithstanding that the test itself does not teach one how to design a motor.

As explained above, Severinsky '970 discloses operation in city traffic or reversing, where electric motor 20 provides all of the torque needed to move the vehicle. Pet. 40 (citing Ex. 1854, 10:52–68). As noted by Petitioner (Pet. 40–41), Suga discloses testing an electric motor under the requirements of FUDS. Petitioner reasons that it would have been obvious to one with ordinary skill in the art to test the electric motor of Severinsky '970, because it is intended for use by itself without the engine in city traffic, to see if it complies with FUDS, and to select a motor of sufficient power so that it would comply. Pet. 41–42. As explained above, the reasoning provided has rational underpinnings and is persuasive.

Patent Owner faults Petitioner for stating: "In the event that Severinsky '970's electric motor was insufficient to meet the FUDS acceleration requirements, it would have been a simple design choice to select a motor that does meet the FUDS acceleration requirements and validate the selection using the testing described by Suga." PO Resp. 49 (citing Pet. 42). According to Patent Owner, relying on "a simple design choice" reflects adoption of hindsight. *Id.* In the circumstances of this case, we disagree. As noted above, once passing FUDS is viewed or accepted as a proper objective or goal, upgrading the motor so that it has enough power capacity to pass the acceleration requirements of FUDS, if it does not already possess that level of power capacity, does not reflect reliance on

hindsight based on Patent Owner's own disclosure. We read Petitioner's reference to "simple design choice" as merely connoting how easily the change can be done, after a decision to make the change has been made. Petitioner has not alleged that the reason to make the change to a more powerful motor is that such a change easily can be made.

7.

On pages 51–54 of the Patent Owner Response, Patent Owner argues that Vittone does not disclose or render obvious limiting the rate of change of torque output of the engine as is recited in claim 241. The argument is unpersuasive.

Patent Owner asserts: "Figure 8 [of Vittone] is merely a representation of how the total traction torque is split between the engine and electric motor, it does not specify the management strategy of the internal combustion engine." PO Resp. 52. Patent Owner further asserts: "There is no disclosure in Vittone about a control strategy that *controls* the engine to limit the rate of change of the engine torque output." *Id.* at 52–53. But Figure 8 shows more than how the traction torque is split between the engine and the motor. Not all teachings of a reference need to be expressly stated in text. In this case, the drawing shows limiting the rate of change of engine torque. As discussed above, during the two transient periods shown in Figure 8, the dashed line representing actual engine torque output does not follow the solid line representing road load but rises at a smaller slope than does the solid line. Patent Owner additionally argues: "Engines have inherent transient characteristics that establish the natural ramp-up of the

engine. . . . At best, Figure 8 simply shows the ramp-up of the engine due to its inherent transient characteristics." *Id.* Although an engine does have certain inherent transient characteristics, we are unpersuaded that an engine has one and only one rate of increase of output torque or ramp-up rate, that cannot be limited at certain times during operation of the vehicle. Patent Owner has not identified testimony of its own expert, Mr. Hennemann, to that effect. Instead, we credit the following testimony of Dr. Stein:

> Generally, the rate of increase of the output torque of the engine will be higher with a faster input transient (*i.e.*, a large rate of increase in the amount of torque required) than a slower input transient unless the rate of increase of engine output torque is actively limited up to the inherent transient capabilities of the engine. For example, a fast input transient may result from a rapid depression of the accelerator pedal, whereas a slow input transient may result from a gradual depression.

Ex. 1852 ¶ 491. Patent Owner has provided no reason to assume that the two transient conditions illustrated in Figure 8 of Vittone reflect conditions where road load exceeds the inherent transient characteristic of the engine. It would be unreasonable to read Figure 8 of Vittone that way, unless those conditions are expressly stated. We are persuaded by Dr. Stein's explanation of Vittone's Figure 8. *See* Ex. 1852 ¶¶ 490, 503.

Also, we credit this testimony of Dr. Stein: "In its disclosure of 'steady state management' of the engine, Vittone is referring to limiting the rate of engine output torque during transient conditions. This is the basis of Vittone's driving torque management control strategy." *Id.* ¶ 488. Thus, even though management of the engine in transient phases may be

accomplished in many ways, the way disclosed by Vittone is limiting the rate of change of engine output torque.

Replying to Patent Owner's argument, Petitioner notes that in Vittone's Figure 8, the two solid lines in the transient phases have different slopes relative to each other. Reply 19–20. It is not sufficiently clear from Figure 8 that the solid lines in the transient phases have different slopes. Therefore, we do not base any finding on Petitioner's assertion that the solid lines in the transient phases in Figure 8 of Vittone have different slopes.

On pages 53–55 of the Patent Owner Response, Patent Owner argues that the engine control strategies of Vittone would not have worked with the engine control strategies of Severinsky. According to Patent Owner, Severinsky '970 uses "speed" to operate the engine and to change operating modes, and Vittone does not use speed to control operating modes but a driver selectable switch. *Id.* at 54. The argument is misplaced.

First, as discussed above, Severinsky '970 does disclose a torque based method for selecting the vehicle's operational mode. Specifically, also as explained above, the method is based on the instantaneous torque required to propel the vehicle, i.e., road load. Second, Petitioner does not rely on Vittone for teaching when to effect a change in the vehicle's operational modes, and has not proposed to incorporate Vittone's driver selectable switch in Severinsky '970. As noted above, one may not attack prior art references individually when the alleged ground of unpatentability is based on the combined teachings of references. In any event, it is

incorrect that Vittone is limited to mode-selection by use of a driver selectable switch. As is explained by Petitioner:

> The electric/hybrid selector switch in Vittone (Fig. 5) merely permits a user to force an all-electric operating mode in which only the motor is used, to accommodate trends in Europe that have "city centers with mobility restricted to ZEV [zero emissions] vehicles." (Pet. at 51, Vittone, Ex. 1858 at 26; Reply Decl., Ex. 1889, ¶ 87.) Otherwise, the vehicle operates in the "hybrid mode" using control strategies that employ the motor alone, the engine alone, or both, depending on "the inputs of the accelerator and brake pedals." (Vittone, Ex. 1858 at 25–26; Reply Decl., Ex. 1889, ¶ 87.)

Reply 22. The explanation is supported by the cited testimony of Dr. Stein.

Patent Owner further argues that Vittone teaches away from preheating the engine before starting the engine. PO Resp. 55. The argument is unpersuasive. In that regard, Patent Owner explains: "Vittone discloses that to reduce emissions, 'warm-up of the main catalyst is performed while the thermal engine works at *minimum* r.p.m.' Ex. 1858 at 29 (emphasis added)." *Id.* As noted by Petitioner, however, Vittone is silent regarding preheating the engine. Reply 23 (citing Ex. 1889 ¶ 111, Ex. 1896, 104:15–19). We are persuaded by the following explanation by Petitioner:

> But, Vittone's disclosure regarding the engine working at a "minimum rpm" refers to a mode during which the engine is <u>already started</u>. (Reply Decl., Ex. 1889, ¶¶ 107–110.) Thus, it is not relevant to the claimed "*before starting the engine*" timeframe, as required by claim 264 [and also claim 267].

Reply 22.

Patent Owner asserts that Petitioner's assertion that Vittone's teachings "bolster" Petitioner's stated reasoning for combining the teachings of Severinsky '970 and Yamaguchi should be given little, if any, weight. PO Resp. 50. We have discussed Petitioner's stated reasoning for combining the teachings of Severinsky '970 and Yamaguchi. It does not require any "bolstering" from Vittone, and we have not made a finding of "bolstering." Thus, Patent Owner's argument is inconsequential.

8.

On pages 55–60, Patent Owner argues that the prior art references of record, as relied on by Petitioner, do not disclose road-load based hysteresis as is required by independent claims 80 and 114. The argument is misplaced, because it is not Petitioner's contention that road-load based hysteresis is "disclosed" by the prior art. Rather, it is Petitioner's position that the combined teachings of Severinsky '970 and Frank would have rendered obvious road-load based hysteresis as is recited in claims 80 and 114. Pet. 52–59. Patent Owner argues that neither Severinsky '970 nor Frank discloses road-load based hysteresis control strategy and thus their combination cannot yield road-load based hysteresis control strategy. PO Resp. 55–59. That is an over-simplification of the issue and again reflects attacking references individually when the ground of unpatentability is based on a combination of references, which is improper. *In re Merck & Co. Inc.*, 800 F.2d at 1097; *In re Keller*, 642 F.2d at 426. Note that if either reference alone discloses road-load based hysteresis, there would be no need to rely on their combined teachings to meet the limitation.

According to Patent Owner, Petitioner "offers no explanation as to how combining two speed-based hysteresis references would result in a road load-based hysteresis teaching." PO Resp. 59. That is incorrect. Petitioner explained that although Severinsky '970 discloses a torque based setpoint for determining when to use or not use the engine, it would have been obvious to one with ordinary skill in the art to apply Frank's speed-based hysteresis approach to turning the engine on and off to the torque-based setpoint of Severinsky '970. Pet. 54–59. The reasoning is rational and persuasive, because the point for applying hysteresis strategy in the vicinity of a setpoint or threshold that determines an "on" or "off" condition is to avoid excessive cycling, i.e., cycles of turning on and off. Ex. 1852 ¶¶ 776–777. That remains true no matter how the setpoint is determined, e.g., whether it is speed based or torque based.

Specifically, Petitioner explained:

> It would have been obvious to combine Frank's hysteresis strategies with Severinsky '970's HEV mode selection strategies to obtain the well-known benefit of hysteresis – avoiding excessive on/off switching of the engine – that Severinsky '970 and Frank expressly disclose. (Severinsky '970, Ex. 1854, 18:34–42; Frank, Ex. 1859, 7:66–8:11; Stein, Ex. 1852, ¶¶ 776–780.)

Pet. 55–56. Petitioner further explained:

> A POSA would have also been motivated to combine Severinsky '970 and Frank because it was well known in the art at the time of the invention to use hysteresis controls between switching modes in an HEV, in order to prevent excessive cycling of the engine; because such excessive cycling increases emissions and decreases fuel economy. (Stein, Ex. 1852,

> ¶¶ 100–101, 779.) Reducing emissions and increasing fuel economy are stated goals in both Severinsky '970 and Frank (Severinsky '970, Ex. 1854, 5:24–36; Frank, Ex. 1859, 3:62–67), a POSA would certainly look to utilize hysteresis controls to reduce excessive engine cycling. (Stein, Ex. 1852, ¶¶ 779–781.)

Id. at 56. We are persuaded by both reasoning as quoted above.

Patent Owner argues that Petitioner has not explained why one with ordinary skill in the art "would choose road load-based hysteresis over "speed-responsive hysteresis." PO Resp. 59–60. The argument is misplaced. The issue is not why one would choose one over the other. Employing hysteresis is beneficial to both a speed-based control strategy and a road-load based control strategy for switching operational mode of the vehicle. That which would have been obvious need not be the one and only solution desirable to the exclusion of all others.

Patent Owner argues that Petitioner's conclusion that it would have been a simple design choice to modify the controls to use "RL" as the controlled variable and to apply Frank's hysteresis strategies to the torque based setpoint of Severinsky '970 is insufficient motivation to combine as a matter of law. PO Resp. 60. The argument is ineffective, because that is not the only articulation provided by Petitioner regarding a reasoning to combine teachings. Indeed, other reasoning to combine teachings to arrive at road-load based hysteresis, as presented by Petitioner, have been reproduced and discussed above. The conclusion about design choice, supported by the cited testimony of Dr. Stein, is effective to indicate that one with ordinary skill in the art would have been able to implement, from a

technological perspective, road-load based hysteresis, when he or she already possesses a reason to do so. Patent Owner, however, has not argued that one with ordinary skill in the art would not have known how to implement road load based hysteresis on a vehicle that already employs road-load based determination of vehicle operational mode.

III. CONCLUSION[3]

Petitioner has shown, by a preponderance of the evidence, that claims 267, 278–280, 282, 284, 285, 289, and 290 are unpatentable as obvious over Severinsky ’970 and Yamaguchi.

Petitioner has shown, by a preponderance of the evidence, that claims 283, 286, 287, and 288 are unpatentable as obvious over Severinsky ’970, Yamaguchi, and Lateur.

Petitioner has shown, by a preponderance of the evidence, that claim 291 is unpatentable as obvious over Severinsky ’970, Yamaguchi, and Suga.

Petitioner has shown, by a preponderance of the evidence, that claim 241 is unpatentable as obvious over Severinsky ’970 and Vittone.

Petitioner has shown, by a preponderance of the evidence, that claim 264 is unpatentable as obvious over Severinsky ’970, Vittone, and Yamaguchi.

Petitioner has shown, by a preponderance of the evidence, that claim 266 is unpatentable as obvious over Severinsky ’970, Vittone, and Suga.

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[3] In making these 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.

Petitioner has shown, by a preponderance of the evidence, that claims 111 and 144 are unpatentable as obvious over Severinsky ’970, Frank, and Yamaguchi.

IV. ORDER

It is

ORDERED that claims 111, 144, 241, 264, 266, 267, 278–280, and 282–291 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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