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Paper 31
Entered: October 21, 2016

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 IPR2015-00785
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 (Ex. 1351, "the '634 patent"). Paper 1. The Petition challenges the patentability of claims 80, 91, 92, 97, 99, 107, 108, 110, 112, 114, 125, 126, 130, 132, 140, 141, 143, 145, 241, 252–254, 256–263, and 265 of the '634 patent. In an Initial Decision, we instituted *inter partes* review of each of these claims, except for claims 99 and 132. Paper 13 ("Dec. Inst.").

Paice LLC and The Abell Foundation, Inc. ("Patent Owner") filed a Patent Owner Response (Paper 15, "PO Resp."), and Petitioner filed a Reply (Paper 19, "Reply").[1] Oral hearing was held on June 29, 2016. A transcript of the oral hearing is included in the record. Paper 30 ("Tr."). Neither party filed a motion to exclude evidence.

For reasons discussed below, we (1) dismiss Petitioner's challenge of claims 80 and 114, and (2) determine that Petitioner has shown by a preponderance of the evidence that each of claims 91, 92, 97, 107, 108, 110, 112, 125, 126, 130, 140, 141, 143, 145, 241, 252–254, 256–263, and 265 is unpatentable.

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[1] In addition, Patent Owner filed a Motion for Observation on Cross-Examination (Paper 23) and Petitioner filed a Response to Motion for Observation on Cross-Examination (Paper 26), both of which have been considered.

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.). Pet. 2, Paper 5, 2–3. 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, IPR2015-00800, and IPR2015-00801.

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. 1351, 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 and 241 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.

D. Evidence Relied Upon

Prior Art References		Date	Exhibit
Severinsky ’970	U.S. Pat. No. 5,343,970	Sept. 6, 1994	Ex. 1354
Lateur	U.S. Pat. No. 5,823,280	Oct. 20, 1998	Ex. 1356
Frank	U.S. Pat. No. 5,842,534	Dec. 1, 1998	Ex. 1357

Prior Art References		Date	Exhibit
Anderson	Catherine Anderson & Erin Pettit, *The Effects of APU Characteristics on the Design of Hybrid Control Strategies for Hybrid Electric Vehicles*, DESIGN INNOVATIONS IN ELECTRIC AND HYBRID ELECTRIC VEHICLES, (SP-1089), Society of Automotive Engineers, Inc. 1995.	1995	Ex. 1355

Petitioner also relies on the declarations of Jeffrey L. Stein, Ph.D. Ex. 1352 ("first declaration"), Ex. 1384 ("reply declaration").

E. The Asserted Grounds of Unpatentability

References	Basis	Claims Challenged
Severinsky '970 and Anderson	§ 103(a)	241, 252–254, 256, 258, 259, 263, and 265
Severinsky '970, Anderson, and Lateur	§ 103(a)	257 and 260–262
Severinsky '970 and Frank	§ 103(a)	80, 91, 92, 112, 114, 125, 126, and 145
Severinsky '970, Frank, and Anderson	§ 103(a)	110 and 143

References	Basis	Claims Challenged
Severinsky ’970, Frank, and Lateur	§ 103(a)	97, 107, 108, 130, 140, and 141

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, and 241. 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. 1351, 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. 9. Patent Owner does not propose a different construction.

"setpoint (SP)"

The term "setpoint" or "SP" is recited in each of independent claims 80, 114, and 241. Petitioner proposes that "setpoint" or "SP" be construed, in the context of these claims, as "predetermined torque value." Pet. 10. 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. 9–10. Each of claims 80, 114, and 241 recites a condition "when the RL required to do so is less than a setpoint (SP)." Ex. 1351, 65:16–18, 68:40–42, 81:38–40. Each of claims 80, 114, and 241 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, 81:41–44.

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 SP 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 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. 1351, 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. 6–7. 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.

Id. at 7 (citing Ex. 1351, 40:18–26 (emphasis added by Patent Owner)). The argument also is misplaced. As we noted above, each independent claim 80, 114, and 241 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 259 depends from independent claim 241. Claim 259 recites limitations referring to "low-load operation mode I," "high-way cruising operation mode IV," and "acceleration operation mode V." Claim 260 depends from claim 241 and recites a limitation referring to "mode I." The Specification of the '634 patent does set 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. 1351, 35:63–36:1 (emphasis added).

Petitioner proposes a construction for "mode I" that disregards the "all torque" requirement quoted above. Pet. 11. 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. 1351, 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. 11. 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. 1351, 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. 7–9. 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 and 241.

In the above discussion of the construction of setpoint, we already noted that claims 80, 114, and 241 each require a comparison of road load to a setpoint because of the claim recitations "when the RL required to do so is less than a setpoint (SP)" and "when the RL required to do so is between the SP and a maximum torque output (MTO) of the engine." For similar reason, claims 80, 114, and 241 each require a comparison of road load to a maximum torque output (PTO) 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 145 depends from independent claim 114, and claim 265 depends from independent claim 241. Relative to each's base independent claim, each of claims 145 and 265 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. 1351, 71:43–46, 83:51–54. 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. 11. 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. 1364, 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. 9–10. 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. 2301, 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. 2301,

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. 1352 ¶ 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. 10–12. In that regard, Patent Owner refers to claim 241 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 11–12. 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.* at 12. 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 241, 252–254, 256, 258, 259, 263, and 265 as Obvious over Severinsky '970 and Anderson

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 241, 252–254, 256, 258, 259, 263, and 265 would have been obvious over the combined teachings of Severinsky '970 and Anderson 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. 1354, 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 241

In what Petitioner regards as limitation [241.0], claim 241 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. 13. Petitioner also cites to declaration paragraphs 124–128 of the first declaration of Dr. Stein (Ex. 1352). *Id.* We find that this limitation is disclosed by Severinsky '970.

In what Petitioner regards as limitation [241.1], claim 241 recites: "determining instantaneous road load (RL) required to propel the hybrid vehicle responsive to an operator command." For that recitation, Petitioner cites (Pet. 13) to the following text of Severinsky '970 as well as declaration paragraphs 129–147 of the first declaration of Dr. Stein (Ex. 1352): "[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. 13 (citing Ex. 1354, 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. 1354, 14:15–18, 12:60–13:2; Stein, Ex. 1352, ¶¶ 133–135, *see also* ¶ 142.) 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. 1352, ¶¶ 133–136.) 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. 13–14. Petitioner further explains the different operating modes for a hybrid vehicle as is disclosed by Severinsky ’970. *Id.* at 14. We are persuaded, notwithstanding the arguments of Patent Owner which we address below, that limitation [241.1] 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. 1354, 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. 1352 ¶ 134. 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.* ¶ 136.

Accordingly, we find that limitation [241.1] is disclosed by Severinsky '970.

Claim 241 recites in what Petitioner identifies (Pet. 16) as limitation [241.2] 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. 16) as limitation [241.3] 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 [241.2] and limitation [241.3] 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. 1354, 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. 1352 ¶¶ 154–155, 165–166.

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. 1352 ¶¶ 154–156. Dr. Stein also explains that the 60% MTO referred to in Severinsky '970 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.* ¶ 156. 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*. ¶¶ 185–187. 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.* ¶¶ 183–184.

Accordingly, we find that limitation [241.2] and limitation [241.3] are each disclosed by Severinsky '970.

Claim 241 recites in what Petitioner identifies (Pet. 24) as limitation [241.4] 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. 24), 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. 1354, 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. 1351, 44:65–45:2 (emphasis added). Dr. Stein testifies and explains why Severinsky '970 discloses limitation [241.4]. Ex. 1352 ¶¶ 189–194.

Accordingly, we find that limitation [241.4] is disclosed by Severinsky '970.

Claim 241 recites in what Petitioner identifies (Pet. 25) 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 Anderson (Pet. 25–26).

Petitioner explains that Severinsky '970 sets forth a desire to lower harmful emissions in all three hydrocarbon ("HC"), carbon monoxide ("CO"), and nitrogen oxide ("NOx"). Pet. 25 (citing Ex. 1354, 12:12–22). Petitioner further explains that it was well known[2] 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. Pet. 25–26 (citing Ex. 1352 ¶¶ 78–79). Anderson, cited to by Petitioner (Pet. 25), describes:

> Emissions – Frequently, one of the principle aims of a hybrid vehicle is to reduce vehicle emissions to ULEV (Ultra Low Emission Vehicle) levels. Consequently, APU emissions are very important for system success. In general, emissions are minimized when a stoichiometric air to fuel ratio is maintained by a closed loop feedback system (using an oxygen sensor for feedback). *In some operating regimes, such as engine starts and transients, the stoichiometric ratio is very difficult to maintain resulting in an increase in emissions.*
>
> * * *
>
> *Transients present an emissions problem that is largely related to the speed of the transient.* The closed feedback system that maintains the stoichiometric air fuel ratio is sufficient during quasi-steady state modes, however, it can only react as fast as the

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

> O_2 levels can be sensed. If the transient is too fast, the engine may run rich, increasing CO and HC emissions, or lean, increasing NO_x emissions. *Some of this effect can be reduced using a hybrid strategy that only allows slow transients*, but this places greater strain on the LLD [battery].

Ex. 1355, 11 (emphasis added). Petitioner identifies specifically that Anderson states: "In some operating regimes, such as engine starts and transients, the stoichiometric ratio is very difficult to maintain resulting in an increase in emissions." Pet. 26 (citing Ex. 1355, 11; Ex. 1352 ¶¶ 86, 199). Petitioner also identifies specifically that Anderson states that the effects of emissions "can be 'reduced using a hybrid strategy that only allows slow transients.'" *Id.* Thus, Anderson teaches the desirability of allowing only slow transients to help in maintaining the stoichiometric ratio.

With regard to a motivation to combine Anderson's teachings of limitation [241.5] with the teachings of Severinsky '970, Petitioner notes that Severinsky '970 sets forth a desire to lower emissions, specifically hydrocarbons, carbon monoxide, and nitrogen oxide. Pet. 25 (citing Ex. 1354, 12:12–22). Specifically, Petitioner states: "The rationale for the combination is provided by the objects of Severinsky '970 'to provide an improved parallel hybrid electric vehicle' to produce 'reduced pollutant emissions.' (Severinsky '970, Ex. 1354, 5:24–36.)." Pet. 38. As is explained by Petitioner, Anderson solves the emissions problem caused by fast transients, through "a hybrid strategy that only allows slow transients." Pet. 39. Imposing a slow transient requirement, according to Petitioner, means "limiting the rate of change of engine torque output." *Id.* Petitioner's position is supported by the testimony of Dr. Stein. Ex. 1352 ¶ 317.

We are persuaded that one with ordinary skill in the art would have been motivated to combine the mode selection control of Severinsky '970 with the "transient" engine control strategy of Anderson "to obtain the predictable results expressly taught in Anderson, improved control of the stoichiometric air-fuel ratio which results in reduced emissions." *See* Pet. 39 (citing Ex. 1352 ¶ 323). Further as noted by Petitioner, Severinsky '970 discloses using microprocessor controller 48 to control the rate of air and fuel supplied to the engine which affects the torque produced by the engine. Pet. 25 (citing Ex. 1354, 10:4–14, 12:41–52; Ex. 1352 ¶¶ 195–197). For these reasons, we determine that limitation [241.5] is disclosed by the combined teachings of Severinsky '970 and Anderson.

Claim 241 recites in what Petitioner identifies (Pet. 27) as limitation [241.6] the conditional 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 disclosure of Severinsky '970 alone, or Anderson alone. Pet. 27–28. Petitioner does not need to rely on Anderson to account for limitation [241.6] because Severinsky '970 alone teaches this limitation. Specifically, Petitioner points (Pet. 27) to the following description of Severinsky '970:

> 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. . . .
>
> Figure 6 illustrates operation of the system in a high-speed acceleration and/or hill climbing mode, wherein both internal

> combustion engine 40 and electric motor 20 provide torque to road wheels 34.

Ex. 1354, 14:15–25. Petitioner's above-stated position with regard to the disclosure of Severinsky '970 is supported by the testimony of Dr. Stein. *See* Ex. 1352 ¶¶ 211–215. Accordingly, we find that limitation [241.6] is disclosed by Severinsky '970.

2. Claims 252–254, 256, 258, 259, 263, and 265

Each of claims 252–254, 256, 258, 259, 263, and 265 depends directly from claim 241. By way of their dependency from claim 241, they incorporate all of the limitations of claim 241, which have been addressed above. As for the additional limitations added to those of claim 241, Petitioner persuasively accounts for claim 252 on page 28 of the Petition, for claim 253 on pages 28–30 of the Petition, for claim 254 on pages 30–31 of the Petition, for claim 256 on pages 31–32 of the Petition, for claim 258 on page 32 of the petition, for claim 259 on pages 32–36 of the Petition, for claim 263 on page 36 of the Petition, and for claim 265 on pages 36–37 of the Petition.

In particular, we address what Petitioner regards as limitation [259.2] ("wherein said operating the at least one electric motor to drive the hybrid vehicle composes a low-load operation mode I") and limitation [259.3] ("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 [259.2], Petitioner cites (Pet. 33) to paragraph 289 of the first declaration of Dr. Stein (Ex. 1352), 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. 1354, Abstr. For limitation [259.3], Petitioner cites (Pet. 34) to paragraph 293 of the first declaration of Dr. Stein (Ex. 1352), 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. 1354, 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. 1352 ¶ 293 (citing Ex. 1354, 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. 1354, Abstr.

Accordingly, we find that Severinsky '970 discloses the limitations added by each of claims 252–254, 256, 258, 259, 263, and 265, relative to claim 241.

E. Claims 257 and 260–262
as Obvious over Severinsky '970, Anderson, 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 claims 257 and 260–262 would have been obvious over the combined teachings of Severinsky '970, Anderson, and Lateur and thus are unpatentable.

Each of claims 257, 260, and 261 depends directly from claim 241, and claim 262 depends from claim 261. By way of their dependency from claim 241, they incorporate all of the limitations of claim 241, which have been addressed above. As for the limitations added to those of claim 241, Petitioner persuasively accounts for claim 257 on pages 40–41 of the Petition, for claim 260 on pages 41–42 of the Petition, for claim 261 on pages 42–44 of the Petition, and for claim 262 on page 44 of the Petition. As explained by Petitioner (Pet. 40–44), which explanation is supported by the cited testimony of Dr. Stein (Ex. 1352), we find that the added limitations of claims 257 and 260–262 are each disclosed by Lateur.

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 44–47 of the Petition, reasoning with rational underpinnings. For instance, Petitioner explains that cruise control is a driver convenience that also improves fuel efficiency, and that because the objectives of Severinsky ’970 includes 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. 44. Also, Petitioner explains that Lateur’s engine starting routine permits the engine to warm-up prior to placing it under increased or full load, to reduce emissions, and thus one with ordinary skill in the art would have recognized that adopting that feature in Severinsky ’970 would further the goal of Severinsky ’970 to reduce emissions. Pet.

45–46. Finally, Petitioner explains 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. 46–47.

F. Claims 80, 91, 92, 112, 114, 125, 126, and 145 as Obvious over Severinsky '970 and Frank

For reasons discussed below, we conclude (1) that Petitioner is estopped from continuing to maintain its challenge against claims 80 and 114, and (2) that Petitioner has shown by a preponderance of the evidence, notwithstanding the arguments of Patent Owner which we discuss below, that claims 91, 92, 112, 125, 126, and 145 are unpatentable as obvious over Severinsky '970 and Frank.

1. Claims 80 and 114

Citing 35 U.S.C. § 315(e)(1), Patent Owner asserts that Ford may not maintain its challenge of claims 80 and 114, after the Board enters a final written decision on those claims in IPR2014-01416. PO Resp. 12–13. We agree.

Specifically, section 315(e)(1) provides:

(e) Estoppel.—

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

A final written decision was entered in IPR2014-01416 on March 10, 2016, in which we determined that both claims 80 and 114 of the '634 patent, among other claims, are unpatentable. Petitioner in this proceeding was also the Petitioner in IPR2014-01416. The ground raised by Petitioner in IPR2014-01416 against claims 80 and 114 was identical to the ground raised by Petitioner against those two claims in this proceeding, i.e., obvious under 35 U.S.C. § 103 over Severinsky '970 and Frank. Thus, Petitioner actually raised the same ground against these two claims in IPR2014-01416.

Petitioner argues that estoppel should not be applied against its assertion of unpatentability against claims 80 and 114 in this proceeding, noting that its Petition challenges claims which depend from claims 80 and 114 and that the dependent claims incorporate the limitations of the claims from which they depend. Reply 6–7. We are unpersuaded by the argument, because regardless of whether the dependent claims include the limitations of the claims on which they depend, Petitioner may challenge only the dependent claims without challenging the independent claims, and also because the dependent claims may be cancelled, if determined as unpatentable, without also cancelling the claims from which they depend. It is unnecessary that we make a formal determination of patentability with regard to claims 80 and 114 to rule on the claims dependent therefrom.

Because a final written decision was issued in IPR2014-01416, on March 10, 2016, against claims 80 and 114 of the '634 patent on the ground of obviousness over Severinsky '970 and Frank, Petitioner is now estopped from maintaining a challenge as to claims 80 and 114 of the '634 on that

same ground of unpatentability. Accordingly, we dismiss the Petition with respect to claims 80 and 114.

2. Claims 91, 92, and 112

Claims 91, 92, and 112 each depend from claim 80, and thus includes all of the limitations of claim 80. 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 each of claims 91, 92, and 112 would have been obvious over Severinsky '970 and Frank.

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

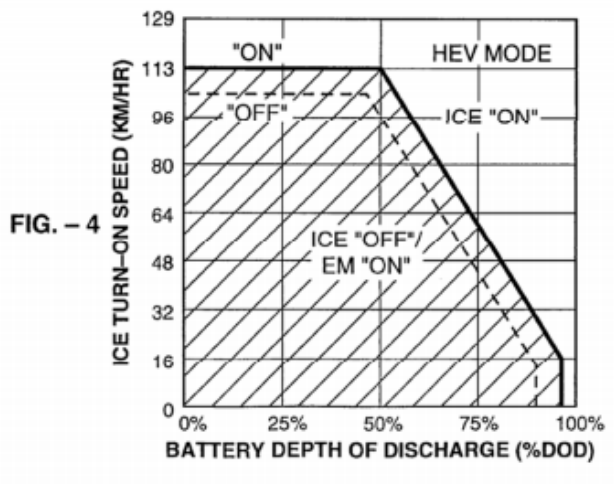
[80.5]—"wherein said operating the internal combustion engine to propel the hybrid vehicle is performed when: the RL>the SP for at least a predetermined time; or the RL>a second setpoint (SP2), wherein the SP2 is a larger percentage of the MTO than the SP."

For limitation [80.2], Petitioner relies on the disclosure of Severinsky '970. Pet. 48. 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. 1354, 17:11–15. Petitioner's position is supported by the testimony of Dr. Stein. Ex. 1352 ¶¶ 418–425. Accordingly, we find that Severinsky '970 discloses limitation [80.2].

For limitation [80.5], Petitioner relies on the disclosure of Frank. Pet. 49–51. 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. 49. 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. (Stein, Ex. 1352, ¶¶ 100–101.) 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. 1357, 7:66–8:11' Stein, Ex. 1352 ¶ 474.)
>
> 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. 1357, 7:66–8:11; Stein, Ex. 1352, ¶ 484.)



Frank, Ex. 1357, Fig. 4

Pet. 49–50. 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 page 51 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. 49 (citing Ex. 1352 ¶¶ 96–101, 473–474). 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. 1352, ¶¶ 476, 485.) 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 ¶ 476.) 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 ¶ 485.)

Pet. 51.

Claim 91 incorporates the limitations of claim 80 and further recites the step of: "turning off the engine when the torque required to propel the vehicle is less than the SP." For that recitation, Petitioner cites to Severinsky '970 and the testimony of Dr. Stein. Pet. 28–30, 54. We have

reviewed the arguments and supporting evidence, and find that Severinsky '970 discloses the step further recited in claim 91, relative to claim 80.

Claim 92 incorporates the limitations of claim 80 and further recites the step of: "turning off the engine when the torque required to propel the vehicle and/or charge the battery is less than the SP." For that recitation, Petitioner cites to Severinsky '970 and the testimony of Dr. Stein. Pet. 28–30, 54. We have reviewed the arguments and supporting evidence, and find that Severinsky '970 discloses the step further recited in claim 91, relative to claim 80.

Claim 112 incorporates the limitations of claim 80 and further recites the step of: "operating the engine at torque output levels less than the SP under abnormal and transient conditions to satisfy drivability and/or safety considerations." For that recitation, Petitioner cites to Severinsky '970 and the testimony of Dr. Stein. Pet. 36–38, 55. We have reviewed the arguments and supporting evidence, and find that Severinsky '970 discloses the step further recited in claim 112, relative to claim 80, notwithstanding Patent Owner's arguments about abnormal and transient condition, which we address below.

We find that Severinsky '970 discloses the limitations further recited in each of claims 91, 92, and 112, relative to claim 80.

3. Claims 125, 126, and 145

Claims 125, 126, and 145 each depend from claim 114, and thus includes all of the limitations of claim 114. 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 each of claims 125, 126, and 145 would have been obvious over Severinsky '970 and Frank.

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 52–53 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.

Claim 125 incorporates the limitations of claim 114 and further recites the step of: "turning off the engine when the torque required to propel the vehicle is less than the SP." For that recitation, Petitioner cites to Severinsky '970 and the testimony of Dr. Stein. Pet. 28–30, 54. We have

reviewed the arguments and supporting evidence, and find that Severinsky '970 discloses the step further recited in claim 125, relative to claim 114.

Claim 126 incorporates the limitations of claim 114 and further recites the step of: "turning off the engine when the torque required to propel the vehicle and/or charge the battery is less than the SP." For that recitation, Petitioner cites to Severinsky '970 and the testimony of Dr. Stein. Pet. 28–30, 54. We have reviewed the arguments and supporting evidence, and find that Severinsky '970 discloses the step further recited in claim 126, relative to claim 114.

Claim 145 incorporates the limitations of claim 114 and further recites the step of: "operating the engine at torque output levels less than the SP under abnormal and transient conditions to satisfy drivability and/or safety considerations." For that recitation, Petitioner cites to Severinsky '970 and the testimony of Dr. Stein. Pet. 36–38, 55. We have reviewed the arguments and supporting evidence, and find that Severinsky '970 discloses the step further recited in claim 145, relative to claim 114, notwithstanding Patent Owner's arguments about abnormal and transient condition, which we address below.

We find that Severinsky '970 discloses the limitations further recited in each of claims 125, 126, and 145, relative to claim 114.

G. Claims 110 and 143 as Obvious over Severinsky '970, Frank, and Anderson

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 claims 110 and 143 would have been obvious over the combined teachings of Severinsky '970, Frank, and Anderson, and thus are unpatentable.

Claim 110 depends from claim 80, and claim 143 depends from claim 114. Thus, claim 110 incorporates all the limitations of claim 80, and claim 145 incorporates all the limitations of claim 114. 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 each of claims 110 and 143 would have been obvious over Severinsky '970, Frank, and Anderson.

The limitations of claims 80 and 114 have been discussed above. They are met by the combined teachings of Severinsky '970 and Frank. Claims 110 and 143 each further recite, relative to their respective base independent claims 80 and 114:

> controlling the 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.

The first one of the two above-quoted limitations is the same as limitation [241.5] and the second one of the two above-quoted limitations is the same as limitation [241.6]. Both have been discussed above in the context of claim 241. For the same reasons as discussed above, we find that Anderson

discloses limitation [241.5] and that Severinsky '970 discloses limitation [241.6]. Also, for the same reasons as discussed above in the context of claim 241, we find that Petitioner has articulated reasoning with rational underpinnings to support combining Anderson's teaching regarding limitation [241.5] with the control method of Severinsky '970, such that the feature of limitation [241.5] is incorporated in the control method of Severinsky '970.

H. Claims 97, 107, 108, 130, 140, and 141 as Obvious over Severinsky '970, Frank, 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 claims 97, 107, 108, 130, 140, and 141 would have been obvious over the combined teachings of Severinsky '970, Frank, and Lateur.

Claims 97 and 107 each depend from claim 80, and claim 108 depends from claim 107. Claims 130 and 140 each depend from claim 114, and claim 141 depends from claim 140. Thus, each of claims 97 and 107 incorporates all of the limitations of claim 80, and claim 108 incorporates all of the limitations of claim 107. Similarly, each of claims 130 and 140 incorporates all of the limitations of claim 114, and claim 141 incorporates all of the limitations of claim 140. The limitations of claims 80 and 114 have been discussed above. They are met by the combined teachings of Severinsky '970 and Frank.

Claims 97 and 130 add the following limitations to each's respective base claim, claim 80 or claim 114:

> receiving operator input specifying a desired cruising speed;
>
> 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.

The first one of the two above-quoted limitations is the same as limitation [257.1] and the second one of the two above-quoted limitations is the same as limitation [257.2]. Both have been discussed above in the context of claim 257. For the same reasons as discussed above, we find that Lateur discloses limitation [257.1] and limitation [257.2]. Also, for the same reasons as discussed above in the context of claim 257, Petitioner has articulated reasoning with rational underpinnings to support combining Lateur's teachings regarding limitation [257.1] and limitation [257.2] with the control method of Severinsky '970.

Claims 107 and 140 add the following limitation to each's respective base claim, claim 80 or claim 114:

> wherein the hybrid vehicle comprises a variable-ratio transmission disposed between the engine and the wheels of the hybrid vehicle.

The above-quoted limitation is the same limitation expressly added in claim 261 relative to claim 241 and has been discussed above in the context of claim 261. For the same reasons as discussed above, we find that Lateur discloses the above-quoted limitation added by claims 107 and 140 relative to each's respective base claim. Also, for the same reasons as discussed

above in the context of claim 261, Petitioner has articulated reasoning with rational underpinnings to support combining Lateur's teachings regarding this limitation with the control method of Severinsky '970.

Claims 108 and 141, relative to respective base claims 107 and 140, add the following limitation:

> wherein said variable-ratio transmission comprises a planetary gear mechanism.

The above-quoted limitation is the same limitation expressly added in claim 262 relative to claim 261 and has been discussed above in the context of claim 262. For the same reasons as discussed above, we find that Lateur discloses the above-quoted limitation added by claim 262 relative to claim 261. Also, for the same reasons as discussed above in the context of claim 262, Petitioner has articulated reasoning with rational underpinnings to support combining Lateur's teachings regarding this limitation with the control method of Severinsky '970.

I. Patent Owner's Contentions

Patent Owner organizes its arguments into six 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. PO Resp. 13. 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. 1354, 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. 13–16. Patent Owner argues that "the overwhelming number of [such] passages" indicate "that Severinsky only considers speed." *Id.* at 15.

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. 1354, 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) that Severinsky '970 only describes using speed to determine when to operate the engine.[3]

Patent Owner argues (PO Resp. 18–19) 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

[3] Patent Owner's argument specifically pertaining to claims 91, 92, 125, 126, 252, 253, and 256 (PO Resp. 16 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. 1354, 17:7–15 (emphasis added 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 limitation 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 limitations 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. 20. 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. 1354, 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. 20–21. 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. 1354, 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. 1354, 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. 20) 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. 20. 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 RL is evaluated or used to effect mode switching." PO Resp. 22. 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 34 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. 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. 23 (citing Pet. 22–23). On pages 22–23 of the Petition, Petitioner points to 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. 23 (Ex. 1354, 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. 23–24. 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. 24–25. 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. 25 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. 16–19.

2.

On pages 26–33 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 can be disregarded 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 [241.2] and [241.3] [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 [241.2] and [241.3][a].

Pet. 16–17.

On pages 34–35 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. 34. 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. 13, 16. 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. 16–19. 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 36–38 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 38–43 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 are 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. 15 (citing Ex. 1351, 35:5–9 (emphasis 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. 38–39) 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. 15 (citing Ex. 1351, 44:65–45:2 (emphases added by Petitioner)). Petitioner again cites to the same text, on pages 24–25 of the Petition, but with different emphasis. 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. 39) 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. 20 (citing Ex. 1351, 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. 39–40. 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 259, 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. 40. 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. 16 (citing Ex. 1354, 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. 34 (citing Ex. 1351, 35:63–36:1).

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. 2301 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. 41. We have reviewed the cited pages of Exhibit 2301 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. 43. 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 43–53 of the Patent Owner Response, Patent Owner argues that the prior art fails to disclose limiting a rate of change of torque output of the engine to achieve stoichiometry.

First, Patent Owner asserts that Anderson discloses limiting transient capabilities only by the inherent mechanical characteristics of the engine itself, by its design, rather than by a control strategy that can modify these characteristics, relying on the testimony of Dr. Hannemann (Ex. 2308 ¶¶ 128–130). PO Resp. 44–45. However, we credit the testimony of Dr. Stein more than that of Dr. Hannemann. Dr. Stein testifies:

> Anderson correlates slowing engine transients with maintaining a “stoichiometric air to fuel ratio” such that “emissions are minimized.” (Anderson, Ex. 1355 at 11.) In addition to disclosing that the engine has inherent limited transient capabilities, Anderson further discloses actively limiting “a rate of change of torque output of the engine” by only allowing slow engine transients and slowing the engine transient response time to improve emissions:
>
> > Transients present an emissions problem that is largely related to the speed of the transient. The

> closed loop feedback system that maintains the stoichiometric air fuel ratio is sufficient during quasi-steady state modes, however, it can only react as fast as the O2 levels can be sensed. If the transient is too fast, the engine may run rich, increasing CO and HC emissions, or lean, increasing NOx emissions. Some of this effect can be reduced using a hybrid strategy that only allows slow transients, but this places greater strain on the LLD [battery].

(Anderson, Ex. 1355 at 11, emphasis added.)

> For example, a generic strategy may begin with a focus on fuel economy. A basic strategy would drive the APU at a constant peak efficiency power level (based on the first APU efficiency estimates), similar to the thermostat APU scheme discussed previously. Bringing in aspects of battery life would push the turn down ratio up (using an approximation of the engine sweet spot) until a suitable balance point between life and fuel efficiency appears, incorporating their relative importance. Emissions characteristics may then be included by **slowing** down the engine transient response time.

(Anderson, Ex. 1355 at 12, emphasis added.)

Ex. 1352 ¶ 203. Note also the testimony of Dr. Stein in his reply declaration. Ex. 1384 ¶¶ 29–36. In particular, Dr. Stein states:

> A person of ordinary skill in the art would have understood that Anderson's "hybrid strategy that only allows slow transients" is a strategy that is an algorithm that is implemented as software and employed by a controller for actively controlling the engine (slowing its transients performance) and the motor during transient conditions; and clearly not referring to choosing an engine whose inherent mechanical inertia provides a slow

> enough transient response. (*See* also Stein, Ex. 1352, ¶¶ 203–205.)

Id. ¶ 36.

In light of the testimony of Dr. Stein, Patent Owner's argument is unpersuasive. We find that one with ordinary skill in the art would have read and understood Anderson's disclosure of "slowing down the engine transient response time" as conveying actively controlling the rate of change of engine output torque to something less than its inherent transient capabilities.

Second, Patent Owner argues that "neither reference [referring to Severinsky '970 and Anderson] teaches or renders obvious limiting the rate of change of engine output torque in a hybrid vehicle to achieve stoichiometry by using the motor to supplement the engine's output torque." PO Resp. 43. The argument hinges on attacking references individually when the ground of unpatentability is based on the combined teachings of references, which is improper. In any event, the claims do not require the restriction put forth in the last portion of Patent Owner's argument, i.e., "by using the motor to supplement the engine's output torque."

According to Patent Owner, limitations [241.5] and [241.6] must be performed together. *Id.* at 46–47. We are unpersuaded. Petitioner correctly notes that limitations [241.5] and [241.6] are separated by a semicolon and are not a part of the same recitation. Reply 15–16. Also, the conjunctive "and" separates limitations [241.5] and [241.6] which are complete in themselves, respectively, and do not require more to express a feature. We do not find, as urged by Patent Owner, that limitations [241.5] and [241.6]

must be performed together or simultaneously, such that limiting the rate of change of engine output torque to achieve stoichiometry is accompanied by or executed together with using the motor to supplement the engine's output torque, under the applicable rule of broadest reasonable interpretation for construing claims.

In any event, even if limitations [241.5] and [241.6] are required to be performed together, we are persuaded at least that Anderson would have suggested that requirement. In that regard, Petitioner notes that Anderson discloses that "[t]ransients present an emissions problem that is largely related to the speed of the transient" and that "[s]ome of this effect can be reduced [by] using a hybrid strategy that only allows slow transients, but this places greater strain on the LLD [battery]." Reply 16 (citing Ex. 1355, 11). Petitioner further explains:

> A POSA would have understood Anderson's disclosure linking "slow transients" with "greater strain on the LLD" [battery] means the motor provides additional torque by discharging or straining the battery while the HEV is limiting engine torque (*i.e.*, only allowing "slow transients.") (Reply Decl., Ex. 1384, ¶ 26; Stein, Ex. 1352, ¶¶ 216–217, *see also* ¶¶ 767–768; 794–795.)

Reply 16. Thus, we are persuaded that in any event Anderson would have suggested to one with ordinary skill in the art the "together" requirement urged by Patent Owner, which we determine is not required by the claims.

On pages 48–49 of the Patent Owner Response, Patent Owner first describes the disclosure in Anderson about difficulty in maintaining the stoichiometric ratio during engine starts and transients and about reducing

that difficulty by adopting a strategy that only allows slow transients, and then concludes: "Anderson, thus, teaches away from 'using a hybrid strategy that only allows slow transients' in a parallel hybrid system. *Id*. at 49, ¶ 152." We are unpersuaded. The disclosure cited to by Patent Owner does not teach away from allowing only slow transients, but proposes allowing only slow transients to minimize difficulties in maintaining stoichiometric ratio. The fact that the proposal recognizes a tradeoff in imposing greater strain on the battery does not alter the fact that it is a proposal described by Anderson. A proposed strategy need not be without tradeoffs.

Patent Owner argues that "[n]owhere does Anderson state that a hybrid strategy that only allows slow transients results in the combustion of fuel within the engine occurring at a substantially stoichiometric ratio." PO Resp. 49. The argument is misplaced, because, as discussed above, a prior art reference need not use literally the same words as those in the involved patent to meet a claim limitation. As noted above, Dr. Stein testifies:

> Anderson correlates slowing engine transients with maintaining a "stoichiometric air to fuel ratio" such that "emissions are minimized." (Anderson, Ex. 1355 at 11.) In addition to disclosing that the engine has inherent limited transient capabilities, Anderson further discloses actively limiting "a rate of change of torque output of the engine" by only allowing slow engine transients and slowing the engine transient response time to improve emissions . . . .

Ex. 1352 ¶ 203.

On page 49 of the Patent Owner Response, Patent Owner argues that the "hybrid strategy" described in Anderson merely is expressed in general

terms and is not a specific control strategy. The argument is unpersuasive. For reasons discussed above, the described strategy in Anderson is sufficiently specific to meet the limitation at issue.

On pages 47 of the Patent Owner Response, Patent Owner argues that Anderson's disclosed hybrid strategy "is in the context of a series hybrid system," not a parallel hybrid system like that disclosed in Severinsky '970. We are unpersuaded that all of the disclosures of Anderson are limited in their application to series hybrid vehicles. Those which require the structure and characteristics of series hybrid vehicles are, and those which do not require the structure and characteristics of series hybrid vehicles are not.

Anderson first discusses the general structure and operation of series hybrid systems, followed by the general structure and operation of parallel hybrid systems, and then states: "The thought processes presented in this paper are sufficiently general that they can be applied to any type of vehicle." Ex. 1355, 8–9. The context provided by a series hybrid system for discussion is used only as an example. Immediately after its statement that the thoughts expressed in the paper are applicable to any type of vehicle, Anderson states: "To fully explore the flexibility allowed by the hybrid system, we focus on the design of a strategy for the most versatile layout: the power assist hybrid."[4] Thus, the context of a series hybrid system is provided for illustration purposes only and is not a prerequisite for all of Anderson's control strategies. We credit the testimony of Dr. Stein:

[4] The power assist hybrid is a series hybrid system. *Id.* at 8.

> A person of ordinary skill in the art would have understood that Anderson's teaching of allowing only slow engine transients (*see* e.g., Anderson, Ex. 1355 at 11) becomes more and more important for a parallel hybrid as you approach the follower mode [of parallel hybrid design], illustrated above on the right, because in this mode the engine transients are frequent and unpredictable. If these transients were to be slowed then and the electric motor was used to make up the shortfall in torque, then the motor and thus the battery would be cycling more frequently *i.e.*, providing a greater strain on the LLD (battery).

Ex. 1384 ¶ 62.

Along the same line of argument, Patent Owner asserts:

> A POSITA would understand that Anderson's teachings of an emissions control strategy that is based on decoupling the engine from the wheels and allowing the utilization of an engine that is capable of only slow transients would not have worked with the parallel hybrid system of Severinsky. Ex. 2308 at ¶ 167.

PO Resp. 52. Petitioner, however, has not proposed to apply the teaching of decoupling the engine to the control scheme of Severinsky '970.

The record does not show that controlling the engine output torque to allow only slow transients would not have worked with the parallel hybrid vehicle of Severinsky '970. Petitioner explained that "Severinsky '970 discloses using the microprocessor controller 48 to control the rate of air and fuel supplied to the engine," that "[t]he amount of fuel and air supplied to an engine affects engine torque production," and that "[c]ontrolling the rate of supply is one way to control the output torque of the engine." Pet. 25 (citing Ex. 1352 ¶¶ 195–196). Petitioner also explained that to limit the rate of increase of engine torque in Severinsky '970 to limit transients as is taught by Anderson "requires only modifying certain powertrain control

algorithms in Severinsky '970." Pet. 39–40. Petitioner further explained that "[s]uch algorithm modifications would have been well within the skill of a POSA at the time of the invention." Pet. 40 (citing Ex. 1352 ¶¶ 324–325).

On pages 50–51 of the Patent Owner Response, Patent Owner argues that Anderson teaches away from slowing engine transients in a parallel hybrid system like that of Severinsky '970. Patent Owner asserts:

> Severinsky is clearly directed to a parallel hybrid. Yet, Anderson expressly teaches away from using an engine control strategy employing slow transients in a parallel hybrid system. Ex. 1355 at 11; *see also* Ex. 2308 at ¶ 165. Anderson teaches that a parallel hybrid system *always uses the "following" mode*, which requires the engine to follow the actual wheel power (similar to a conventional automobile). Ex. 1355 at 9. Anderson further states that using this mode, the *engine must operate over its entire range of power levels and perform fast power transients*, both of which can adversely affect efficiency and emissions characteristics. *Id.*

PO Resp. 50–51. The language at issue is a sentence in Anderson that refers to a mode in which the engine "follows" the actual wheel power: "It should be noted that this is the [following] mode a parallel hybrid vehicle *always uses*." Ex. 1355, 9 (emphasis added). Patent Owner is unclear in indicating whether the "always uses" language reflects a technical restriction and impossibility based on the structure of a parallel hybrid design, or merely an observed pattern in previous vehicles of parallel hybrid design. The record does not support that slowing down engine transients in a parallel hybrid vehicle cannot be done.

In any event, the sentence in Anderson is not a teaching away from slowing down engine transients in a parallel hybrid vehicle, because it is followed immediately by: "For most of the APUs and LLDs under consideration, neither of these strategies [one of which is the following mode] would be the optimum strategy." *Id.* Anderson then proceeds to describe its proposed hybrid strategy. *Id.* at 9–13. Thus, Anderson does not convey that one should not deviate from the following mode. In that regard, we credit the following testimony from Dr. Stein:

> Thus, Anderson describes the follower mode as a mode in which the engine "follow(s) the actual wheel power whenever possible" – *i.e.* the engine will not follow wheel power when not possible. Further, Anderson also describes its follower mode as including fast transients and focuses on reducing, *i.e.*, limiting the rate of increase during those fast transients. (Anderson, Ex. 1355, at 9.) Thus a person of ordinary skill in the art would not have been discouraged from combining Severinsky '970's parallel architecture and HEV mode selection strategy with Anderson's strategy of allowing only slow transients, as Anderson clearly describes the benefits that would be afforded the parallel design.

Ex. 1384 ¶ 64. Patent Owner's focusing on the literal text of one sentence is taking the statement out of context.

On pages 52–53 of the Patent Owner Response, Patent Owner argues that Severinsky '970 does not teach operating the engine at a stoichiometric ratio but, rather, teaches away from operating the engine at a stoichiometric ratio by disclosing operating the engine at a "lean burn." Severinsky '970 does disclose operating the engine at a lean burn, as alleged by Patent Owner, but that is not a teaching away from operating the engine at a

stoichiometric ratio as alleged by Patent Owner. Patent Owner has not cited to any disclosure in Severinsky '970 to the effect that operating the engine at or near the stoichiometric ratio is undesirable and should be avoided at all times no matter what. The pertinent text in Severinsky '970 is this:

> To lower the toxic hydrocarbon and carbon monoxide emissions from combustion, the engine 40 will be operated in lean burn mode (that is, air will be supplied slightly in excess of the amount required for *stoichiometric combustion*) to achieve complete combustion. To lower nitrogen oxide emissions, the engine will be operated at a lower temperature and thus at slightly reduced thermodynamic efficiency (e.g., 2–3% lower) than is a conventional engine.

Ex. 1354, 12:13–21 (emphasis added). We credit the testimony of Dr. Stein to the effect that it was well known to one with ordinary skill in the art, as of 1988, that operating the engine very close to the stoichiometric air/fuel ratio is most effective for reducing harmful emissions of all three HC, CO, and NO_x as a group, and that operating the engine lean results in very poor NO_x control. Ex. 1352 ¶ 79. Thus, the above-quoted text in Severinsky '970 conveys to one with ordinary skill in the art only a trade-off situation, i.e., one can run the engine lean to lower more harmful emissions in HC and CO, but that would result in very poor NO_x emissions. We further credit the testimony of Dr. Stein, that explains the tradeoff:

> A person of ordinary skill in the art in 1988, would have understood Severinsky '970 disclosure at 12:13–33 as teaching that stoichiometric combustion is important to lower the toxic hydrocarbon and carbon monoxide emissions of the engine and that implementing a lean burn strategy would require trade – offs, such as additional control strategies to lower the temperature of the engine, which in turn sacrifice the thermodynamic efficiency

> of the engine. (Severinsky '970, Ex. 1354, 12:13–33, 21:9–22; Stein, Ex. 1352, ¶ 322.) Thus, Severinsky '970 does not discourage operating the engine at the stoichiometric ratio, rather Severinsky '970 provides a balanced view of the tradeoffs associated with a lean burn strategy. (Stein, Ex. 1352, ¶ 322)

Ex. 1384 ¶ 81. Furthermore, Dr. Stein testified that as NO_x tailpipe emissions regulations were becoming more stringent, one with ordinary skill in the art would have been motivated to replace lean-burning strategies with stoichiometric strategies to pass tightening emissions requirements. Ex. 1384 ¶ 50. Patent Owner's expert testified that "So at the point when nox [NOx emissions regulations] became important, then the lean burn strategies diminished, and pretty much everything went to stoichiometric strategy." Ex. 1391, 54:19–21. Such testimony supports the view that the disclosure in Severinsky '970 of running the engine lean reflects only a tradeoff and not a requirement, and is not a teaching away from running the engine at a stoichiometric ratio.

For the foregoing reasons, we are unpersuaded that either Severinsky '970 or Anderson teaches away from operating at substantially the stoichiometric ratio or slowing transients in the parallel hybrid vehicle of Severinsky '970.

5.

On pages 53–54 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 Anderson. 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. 40–41.

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 54–60, Patent Owner argues that the prior art 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. 49–53, 55–57. 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. 54–58. 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. *Merck*, 800 F.2d at 1097; *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. 58. 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. 51, 53, 55–57. The reasoning is rational, 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. 1352 ¶¶ 734–735. 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. 1354, 18:34–42; Frank, Ex. 1357, 7:66–8:11; Stein, Ex. 1352, ¶¶ 734–738.)

Pet. 55. 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. 1352, ¶¶ 100–101, 485, 623, 737–739.) Reducing emissions and increasing fuel economy are stated goals in both Severinsky '970 and Frank (Severinsky '970, Ex. 1354, 5:24–36; Frank, Ex. 1357, 3:62–67), a POSA would certainly look to utilize hysteresis controls to reduce excessive engine cycling. (Stein, Ex. 1352, ¶¶ 734–739.)

Id. at 55–56. 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. 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 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. 59. 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[5]

Petitioner has shown, by a preponderance of the evidence, that claims 241, 252–254, 256, 258, 259, 263, and 265 are unpatentable as obvious over Severinsky ’970 and Anderson.

Petitioner has shown, by a preponderance of the evidence, that claims 257 and 260–262 are unpatentable as obvious over Severinsky, Anderson, and Lateur.

Petitioner has shown, by a preponderance of the evidence, that claims 91, 92, 112, 125, 126, and 145 are unpatentable as obvious over Severinsky ’970 and Frank.

Petitioner has shown, by a preponderance of the evidence, that claims 110 and 143 are unpatentable as obvious over Severinsky ’970, Frank, and Anderson.

Petitioner has shown, by a preponderance of the evidence, that claims 97, 107, 108, 130, 140, and 141 are unpatentable as obvious over Severinsky ’970, Frank, and Lateur.

IV. ORDER

It is

ORDERED that this *inter partes* review, with respect to claims 80 and 114, is *dismissed*;

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[5] 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.

ORDERED that claims 91, 92, 97, 107, 108, 110, 112, 125, 126, 130, 140, 141, 143, 145, 241, 252–254, 256–263, and 265 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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