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Paper 30
Entered: October 25, 2016

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,
Petitioner,

v.

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

Case IPR2015-00792
Patent 8,214,097 B2

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

DEFRANCO, *Administrative Patent Judge.*

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

I. INTRODUCTION

Paice LLC & The Abell Foundation, Inc. (collectively, "Paice") are the owners of U.S. Patent No. 8,214,097 B2 ("the '097 patent"). Ford Motor Company ("Ford") filed a Petition for *inter partes* review of the '097 patent, challenging the patentability of claims 1, 3, 4, 7, 9, 11, 13, 14, 17, 19, 21, 23, 24, 27, 28, 30, 32, 33, 37, and 38 under 35 U.S.C. § 103. Paper 2 ("Pet."). In a preliminary proceeding, we instituted an *inter partes* review because Ford made a threshold showing of a "reasonable likelihood" that the challenged claims are unpatentable under 35 U.S.C. § 314. Paper 13 ("Dec.").

Subsequent to institution, Paice filed a Patent Owner Response (Paper 16, "PO Resp."), and Ford followed with a Reply (Paper 18, "Reply").[1] An oral hearing was held on June 28, 2016, and a transcript of the hearing is included in the record. Paper 29 ("Tr."). After reviewing the evidence and arguments of the parties, and pursuant to our jurisdiction under 35 U.S.C. § 6, we conclude, *first*, that Ford is estopped from maintaining its challenge in this proceeding against claims 1, 3, 4, 9, 11, 13, 14, 19, 21, 23, 24, 28, 30, 32, and 33, and, *second*, that Ford has proven, by a preponderance of the evidence, that remaining claims 7, 17, 27, 37, and 38 are unpatentable.

II. BACKGROUND

A. Related Cases

This is not the first time Ford has presented the '097 patent for *inter partes* review. A number of claims of the '097 patent were adjudicated

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[1] In addition, Paice filed a Motion for Observation on Cross-Examination (Paper 22) and Ford filed a Response to Motion for Observation on Cross-Examination (Paper 25), both of which have been considered.

previously in IPR2014-00570 and IPR2014-01415, only on different grounds.[2] Specifically, the -570 proceeding led to final written decision of unpatentability for claims 30, 32, and 33 at issue here (2015 WL 5782083 (PTAB Sep. 28, 2015)), and the -1415 proceeding led to a final written decision of unpatentability for claims 1, 3, 4, 7, 9, 11, 13, 14, 19, 21, 23, 24, 28, and 30 (2016 WL 932941) (PTAB Mar. 10, 2016)). The -570 and -1415 decisions are currently on appeal at the U.S. Court of Appeals for the Federal Circuit.

The ’097 patent is also the subject of co-pending district court actions, including *Paice, LLC v. Ford Motor Co.*, No. 1:14-cv-00492 (D. Md.), filed Feb. 19, 2014, and *Paice LLC v. Hyundai Motor Co.*, No. 1:12-cv-00499 (D. Md.), filed Feb. 16, 2012. Pet. 2.

B. The ’097 Patent

The ’097 patent describes a hybrid vehicle with an internal combustion engine, an electric motor, and a battery bank, all controlled by a microprocessor that controls the direction of torque transfer between the engine, the motor, and the drive wheels of the vehicle. Ex. 1201, 16:61–17:5, Fig. 4. The microprocessor monitors the vehicle’s instantaneous torque requirements, also known as “road load (RL),” to determine whether to operate the engine, the electric motor, or both, to propel the vehicle. *Id*. at 11:50–52. The vehicle’s various modes of operation include an engine-only mode, an all-electric mode, or a hybrid mode. *Id*. at 35:14–36:4, 36:39–37:22.

[2] The earlier -570 and -1415 proceedings each included a number of claims from the ’097 patent not at issue here.

As summarized in the ’097 patent, the microprocessor selects the appropriate mode of operation “in response to evaluation of the road load, that is, the vehicle’s instantaneous torque demands and input commands provided by the operator of the vehicle.”[3] *Id*. at 17:16–22. “[T]he microprocessor can effectively determine the road load by monitoring the response of the vehicle to the operator’s command for more power.” *Id*. at 36:57–64. “[T]he torque required to propel the vehicle [i.e., road load] varies as indicated by the operator’s commands.” *Id*. at 37:23–25. For example, the microprocessor “monitors the rate at which the operator depresses [accelerator and brake] pedals . . . as well as the degree to which [the] pedals . . . are depressed.” *Id*. at 27:1–4. The microprocessor uses this information “as an indication that an amount of torque that can efficiently be provided by the engine . . . will shortly be required.” *Id*. at 27:6–22.

The microprocessor then compares the vehicle’s torque requirements against a predefined “setpoint (SP)” to determine whether to employ the engine. *Id*. at 36:39–37:21, 39:27–59. The microprocessor runs the engine only in a range of high fuel efficiency, such as when the vehicle’s torque requirements, or road load (RL), reaches a setpoint (SP) of approximately 30% of the engine’s maximum torque output (MTO). *Id*. at 20:37–45, 36:39–59; *see also id*. at 13:48–50 (“the engine is never operated at less than 30% of MTO, and is thus never operated inefficiently”). The microprocessor also limits the rate of increase of the engine’s torque output so that combustion of fuel occurs at a near stoichiometric air-fuel ratio. *See*,

[3] The ’097 patent contrasts the claimed invention to prior control strategies “based solely on speed,” which are “incapable of responding to the operator’s commands, and will ultimately be unsatisfactory.” Ex. 1201, 13:24–28.

e.g., *id*. at 27:31–35, 29:63–30:12, 37:2–6, 38:62–39:14. These control strategies have the effect of maximizing fuel efficiency and reducing carbon emissions of the vehicle. *Id*. at 15:38–41.

C. The Challenged Claims

Of the challenged claims, four are independent—claims 1, 11, 21, and 30. Claims 1, 11, and 21 relate to a method for controlling a hybrid vehicle, while claim 30 relates to the hybrid vehicle itself. Claim 1 is illustrative:

> 1. A method for controlling a hybrid vehicle, said vehicle comprising a battery, a controller, wheels, an internal combustion engine and at least one electric motor, wherein both the internal combustion engine and motor are capable of providing torque to the wheels of said vehicle, and wherein said engine has an inherent maximum rate of increase of output torque, said method comprising the steps of:
>
> operating the internal combustion engine of the hybrid vehicle to provide torque to operate the vehicle;
>
> operating said at least one electric motor to provide additional torque when the amount of torque provided by said engine is less than the amount of torque required to operate the vehicle; and
>
> employing said controller to control the engine *such that a rate of increase of output torque of the engine is limited* to less than said inherent maximum rate of increase of output torque, *and* wherein said step of controlling the engine such that the rate of increase of output torque of the engine is limited is performed *such that combustion of fuel within the engine occurs at a substantially stoichiometric ratio*; and comprising the further steps of:
>
> operating said internal combustion engine to provide torque to the hybrid vehicle *when the torque required to operate the hybrid vehicle is between a setpoint SP and a maximum torque output (MTO) of the engine, wherein the engine is operable to efficiently produce torque above SP*, and wherein SP is substantially less than MTO;

> operating both the at least one electric motor and the engine to provide torque to the hybrid vehicle when the torque required to operate the hybrid vehicle is more than MTO; and
>
> operating the at least one electric motor to provide torque to the hybrid vehicle when the torque required to operate the hybrid vehicle is less than SP.

Ex. 1201, 56:47–57:14 (emphases added).

Independent claims 11 and 21 are similar in scope to claim 1, except claim 21 uses the term "RL" in place of the phrase "the amount of torque required to operate the vehicle" found in claims 1 and 11. Claim 21 also recites the steps of "determining instantaneous road load (RL) required to propel the vehicle" and "operating the engine to charge the battery responsive to the state of charge of the battery." Finally, although claim 30 is directed to the components of a hybrid vehicle, the limitations pertaining to the "controller" are similar in scope to those of claims 1, 11, and 21.

D. The Instituted Grounds

In a preliminary proceeding, we instituted trial because Ford made a threshold showing of a "reasonable likelihood" under 35 U.S.C. § 314(a) that claims 1, 7, 9, 11, 17, 19, 21, 27, 28, 30, 37, and 38 are unpatentable as obvious over Severinsky[4] and Takaoka,[5] and that claims 3, 4, 13, 14, 23, 24, 32, and 33 are unpatentable as obvious over Severinsky, Takaoka, and Yamaguchi.[6] Dec. 14, 16.

We now decide, first, whether Ford is estopped under 35 U.S.C. § 315(e)(1) from maintaining its challenge against claims 1, 3, 4, 9, 11, 13,

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[4] U.S. Patent No. 5,343,970, iss. Sept. 6, 1994 (Ex. 1205, "Severinsky").
[5] T. Takaoka et al., *A High-Expansion Ratio Gasoline Engine for the Toyota Hybrid System*, TOYOTA TECHNICAL REVIEW, vol. 47, no. 2 (Apr. 1998) (Ex. 1206, "Takaoka").
[6] U.S. Patent No. 5,865,263, iss. Feb. 2, 1999 (Ex. 1209, "Yamaguchi").

14, 19, 21, 23, 24, 28, 30, 32, and 33 because they are the subject of prior final written decisions, and second, whether Ford has proven the unpatentability of any remaining claims by a "preponderance of the evidence" under 35 U.S.C. § 316(e).

III. ANALYSIS

A. Petitioner Estoppel

As discussed above, in two previous final written decisions on the '097 patent, we determined that claims 1, 3, 4, 9, 11, 13, 14, 19, 21, 23, 24, 28, 30, 32, and 33 are unpatentable. Given those final written decisions, Paice argues that, pursuant to 35 U.S.C. § 315(e)(1), Ford is estopped from maintaining the instant challenge against any claims previously found unpatentable. PO Resp. 15–16. Ford responds that estoppel should not attach to claims 7, 17, 27, and 37 because they were not challenged previously. Reply 6–7. And, although claim 38 was challenged previously, Ford points out that it was denied institution. *Id*.

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

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

As mentioned above, on September 15, 2015, a final written decision was entered in IPR2015-00570, in which we deemed claims 30, 32, and 33 to be unpatentable. Later, on March 10, 2016, a final written decision was entered in IPR2015-01415, in which we deemed claims 1, 3, 4, 7, 9, 11, 13, 14, 19, 21, 23, 24, 28, and 30 unpatentable. Ford was the petitioner in those proceedings, as it is in this proceeding. Although the grounds raised by Ford in the -570 and -1415 proceedings against claims 1, 3, 4, 9, 11, 13, 14, 19, 21, 23, 24, 28, 30, 32, and 33 were not the same as the grounds raised against those claims in this proceeding, the prior art references asserted in those prior proceedings include the identical references asserted in this proceeding, i.e., Severinsky, Takaoka, and Yamaguchi.

Ford makes no argument as to why it reasonably could not have raised the grounds based on Severinsky, Takaoka, and Yamaguchi, as asserted here, in its earlier challenges against claims 1, 3, 4, 9, 11, 13, 14, 19, 21, 23, 24, 28, 30, 32, and 33. *See* Reply 6–7. Indeed, with respect to claims 4, 14, 24, and 30, Ford did raise the identical ground asserted here in the -1415 proceeding. Thus, at a minimum, we determine that Ford reasonably could have raised the grounds based on Severinsky, Takaoka, and Yamaguchi against any of the claims under challenge in the -1415 proceeding. Accordingly, Petitioner is now estopped under 35 U.S.C. § 315(e)(1) from maintaining its challenge against claims 1, 3, 4, 9, 11, 13, 14, 19, 21, 23, 24, 28, 30, 32, and 33, on which a final written decision has already been rendered. As such, we dismiss the *inter partes* review with respect to those claims.[7]

[7] Although we address the parties' contentions with respect to independent claims 1, 11, 21, and 30, because their respective limitations are necessarily

B. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142–46 (2016). Ford proposes a construction for three claim terms, namely, "road load," "setpoint," and "abnormal and transient conditions." Pet. 13–16. We construed all three terms in our Decision to Institute. Dec. 6–9. Ford does not challenge our original constructions. *See* Reply 2–5. Paice, however, requests that we reconsider our construction of "setpoint" and "ambient and transient conditions." *See* PO Resp. 6–9, 12–13. Paice also requests clarification with respect to the term "maximum torque output," as used in claims 1, 11, and 21. PO Resp. 9–12. We address the three terms disputed by Paice, but first we summarize our construction of "road load" from the institution decision.

1. "Road load (RL)"

The term "road load" or "RL" appears in independent claim 21, and thus, necessarily is included in dependent claim 27. Neither Ford nor Paice challenges our construction of "road load" from the Decision to Institute. As noted therein, the specification of the '097 patent expressly 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

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included in remaining claims 7, 17, 27, 37, and 38, we do not otherwise provide a final written decision on their merits.

the battery bank." Dec. 6 (citing Ex. 1201, 12:30–57). We do not perceive any reason or evidence that might compel us to deviate from that original analysis. Thus, we maintain our construction of "road load" or "RL" as "the amount of instantaneous torque required to propel the vehicle, be it positive or negative."

2. "Setpoint (SP)"

The term "setpoint" or "SP" is found in independent claims 1, 11, and 21, as well as dependent claims 7, 17, 27, and 37. In our Decision to Institute, after taking into consideration the parties' arguments and supporting evidence, we construed "setpoint" or "SP" to mean "a predetermined torque value that may or may not be reset." Dec. 8. Ford agrees with that construction, but Paice does not. Reply 3; PO Resp. 6–9. Paice maintains, as it did in the preliminary proceeding, that "setpoint" or "SP" should "not be limited to a torque value" but rather should be construed as "a definite, but potentially variable value *at which a transition between operating modes may occur*." PO Resp. 6–9 (emphasis added).

As discussed in our Decision to Institute, we looked first to the context in which the term "setpoint" appears in the claims. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005) (en banc) ("[T]he claims themselves provide substantial guidance as to the meaning of particular claim terms. . . . [T]he context in which a term is used in the asserted claim can be highly instructive"). In that regard, we determined that the claims compare the setpoint against a *torque* value. *Id.* For example, each of claims 1 and 11 speaks of "setpoint" or "SP" as being the lower limit of a range at which the engine can produce torque efficiently, i.e., "*when the torque required* to operate the hybrid vehicle is between a setpoint (SP) and a maximum torque output (MTO) of the engine, wherein the engine is operable to efficiently produce torque above SP." Ex. 1201, 57:1–7, 58:11–17 (emphasis added). Claim 21 similarly compares the setpoint "SP" against a torque-based "road load" or "RL" value. *Id*. at 59:7–12. These express recitations suggest that "setpoint" is not just any value, but a value that—per the surrounding claim language—equates to a measure of "torque."[8]

Paice, on the other hand, urges that "setpoint" is synonymous with a "transition" point, not a torque value. PO Resp. 6–7. Paice points to a passage from the specification, exclusive of the claims, as supporting a construction of "setpoint" that "marks a point at which the vehicle may transition between two modes," such as from the motor propelling the vehicle to a mode in which the engine is also used to propel the vehicle. *Id*. at 7 (citing Ex. 1201, 39:52–59). Paice's argument is misplaced. Although the passage of the specification on which Paice relies says that "sometimes" the setpoint may serve as a "transition point" (*see id*.), the claim language itself makes clear that setpoint relates simply to a torque value, without requiring that it be a transition point. In other words, a transition between modes is neither an intrinsic property nor a necessary and required condition of the setpoint as claimed. Indeed, the specification acknowledges that the mode of operation does not always transition, or switch, at a setpoint, but instead depends on a number of parameters. For instance,

> the values of the sensed parameters in response to which the operating mode is selected may vary . . . , so that the operating

[8] Paice's technical expert, Mr. Neil Hannemann, testified similarly that the comparison made in the claims is "most straightforward" if the "setpoint is a torque value." Ex. 1240, 79:16–80:25.

> mode is *not repetitively switched simply because one of the sensed parameters fluctuates around a defined setpoint*.

Ex. 1201, 19:45–51 (emphasis added). That disclosure suggests that a transition does not spring simply from the recitation of "setpoint." Thus, we will not import into the meaning of "setpoint" an extraneous limitation that is supported by neither the claim language nor the specification. As such, we reject Paice's attempt to further limit the meaning of setpoint to a transition between operating modes.

Paice additionally argues that "setpoint" should not be limited to a torque value because the specification describes that the system variable, "the state of charge of the battery BSC," may be compared against a setpoint. PO. Resp. 8–9 (citing Ex. 1201, 39:29–37). This argument also is misplaced. As discussed above, each of claims 1, 11, and 21 requires a comparison of the setpoint to a variable expressed as a torque value, not a variable expressed as a state of electrical charge. Thus, in the context of claims 1, 11, and 21, and those depending therefrom, a setpoint must be a torque value, and not some state of charge of a battery.

We also regard as meaningful that nothing in the specification precludes a setpoint from being reset, after it has been set. The specification states that the value of a setpoint may be "reset . . . in response to a repetitive driving pattern." Ex. 1201, 39:60–63. That a setpoint may be reset under certain circumstances, however, does not foreclose it from being "set," or "fixed," at some point in time.[9] A setpoint for however short a period of time still is a setpoint. Thus, for the foregoing reasons, we construe

[9] The definition of "set" is "determined . . . premeditated . . . fixed . . . prescribed, specified . . . built-in . . . settled." *Merriam-Webster's Collegiate Dictionary* (10th ed. 2000). Ex. 3001.

"setpoint" and "SP" as a "predetermined torque value that may or may not be reset."

3. "Maximum Torque Output (MTO)"

Paice requests that we make clear that each of claims 1, 11, and 21 requires a comparison of road load (RL), i.e., the vehicle's torque requirements, not only to the setpoint (SP) but also to the *maximum torque output (MTO)* of the engine. PO Resp. 9–12. Paice points to the following limitation as calling for such a comparison: "operating both the at least one electric motor and the engine to provide torque to the hybrid vehicle when the torque required to operate the hybrid vehicle is more than MTO." *Id*. at 9. According to Paice, this limitation calls expressly for a comparison with MTO. *Id*. at 10. We agree. Each of claims 1, 11, and 21 has limitations directed to a comparison with setpoint (SP) or maximum torque output (MTO). But that comparison is clear from the claim language itself, thus, no further construction is necessary. Nor does Ford dispute that such a comparison takes place. And, to the extent Paice requests that we read the additional phrase "a comparison . . . [that] results in a determination" into the claims (PO Resp. 10–11), we decline to do so, as it is unclear what is meant by "determination" when only a comparison is required. And, although claims 1, 11, and 21 may require a comparison, at some point, with maximum torque output (MTO) of the engine, that does not mean the claims exclude a comparison with other parameters.

4. "Abnormal and Transient Conditions"

Each of claims 7, 17, 27, and 37, which depend, respectively, from independent claims 1, 11, 21 and 30, adds that the engine is operated "at torque output levels *less than SP under abnormal and transient conditions*."

See, e.g., Ex. 1201, 57:39–41, 60:54–56. The term "abnormal and transient conditions" is not defined or described with any particularity in the specification of the '097 patent. In our Decision to Institute, we found it unnecessary to construe "abnormal and transient conditions" beyond determining that it encompasses "starting and stopping the engine" when the vehicle is operated in "city traffic and reverse operation." Dec. 9. Ford does not dispute that construction. Reply 4–5. Paice urges, however, that we further construe this limitation to exclude such conditions as "city traffic and reverse operation." PO Resp. 12–13. Paice notes that such a distinction was made during prosecution of the '097 patent. *Id.* at 12.

We have reviewed the prosecution history of the '097 patent and find it does not support Paice's assertion. *See* Ex. 1210. Instead, as Ford points out, the prosecution history makes clear that "starting the engine" is at least one example of 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." *Id*. at 238 (emphasis added). Thus, contrary to what Paice urges now, there was no disavowal, whatsoever, of starting the engine as an abnormal and transient condition, let alone a "clear and unmistakable" disavowal. *Omega Engineering, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1325–26 (Fed. Cir. 2003). As such, we are not persuaded by Paice's attempt to exclude starting and stopping the engine in city traffic or reverse operation as abnormal and transient conditions. Beyond determining that abnormal and transient conditions include starting and stopping of the engine in city traffic or reverse operation, we need not construe this term further.[10]

C. Claims 7, 17, 27, 37, and 38

As discussed above, we dismiss the *inter partes* review with respect to independent claims 1, 11, 21, and 30, as well as dependent claims 3, 4, 9, 13, 14, 19, 23, 24, 28, 32, and 33. Thus, only dependent claims 7, 17, 27, 37, and 38 are before us. Nonetheless, dependent claims 7, 17, and 37 stem from claims 1, 11, 21, respectively, and dependent claims 37 and 38 stem from claim 30, and thus, each of these remaining claims at issue necessarily includes the limitations of its base claim. Accordingly, we first address the limitations incorporated from base claims 1, 11, 21, and 30 into the respective dependent claims at issue.

Ford provides detailed explanations as to how Severinsky and Takaoka together teach the limitations of base claims 1, 11, 21, and 30, and advances a reason why a skilled artisan would have combined their teachings to arrive at the claimed invention. Pet. 16–48; Reply 7–10, 14–21. In doing so, Ford relies upon the declaration of Dr. Jeffrey L. Stein, a technical expert retained by Ford for purposes of this proceeding. Ex. 1202. As discussed below, and notwithstanding Paice's arguments to the contrary, we are persuaded by Ford's showing, which we adopt as our own, that claims 1, 11, 21, and 30 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Severinsky and Takaoka.

[10] We also note that the term "abnormal and transient conditions" is exemplified in a related patent, U.S. Patent No. 7,104,347 B2 ("the '347 patent"), in which claim 22 describes abnormal and transient conditions as "comprising starting and stopping of the engine and provision of torque to satisfy drivability or safety considerations." Ex. 1211, 60:17–21.

1. The Hybrid Components of Base Claims 1, 11, 21, and 30

To begin, each of claims 1, 11, 21, and 30 recites a general configuration of components for a hybrid vehicle, which include "an internal combustion engine," "at least one electric motor," "a battery," and "a controller." Contrasting the claimed invention with Severinsky, we are persuaded that Severinsky discloses the same configuration, at least by way of components, as that called for by claims 1, 11, 21, and 30. *Compare* Ex. 1205, Fig. 3 (Severinsky) *with* Ex. 1201, Fig. 4 (the '097 patent). Ford's expert witness, Dr. Stein, whose testimony we credit, confirms as much. *See, e.g.*, Ex. 1202 ¶¶ 132–138, 272–278, 370–390. Thus, we are persuaded that Severinsky discloses the general configuration of components called for by the claims.

Paice does not dispute that Severinsky discloses the components called for by the claims but, instead, argues that it fails to disclose using torque or road load for determining *when* to operate the engine to propel the vehicle. PO Resp. 16, 20. In that regard, each of claims 1, 11, and 21 (but not claim 30) recites a "setpoint" or "SP" for operating the engine "efficiently." Paice further argues that the combination of Severinsky and Takaoka fails to teach the additional condition of limiting the engine's "rate of increase" of output torque "such that combustion of fuel within the engine occurs at a substantially stoichiometric ratio," as required by claims 1, 11, 21, and 30. We address each argument in turn.

2. The "Setpoint" Limitations of Base Claims 1, 11, and 21

Base claims 1, 11, and 21 include limitations directed to a particular "setpoint" or "SP" for operating the engine such that it produces torque "efficiently." For instance, claims 1 and 11 recite operating the engine "when the torque required to operate the hybrid vehicle is between a setpoint SP and a maximum torque output (MTO) of the engine, wherein the engine is operable to efficiently produce torque above SP." Ex. 1201, 57:1–7, 58:11–17. And, claim 21 similarly recites operating the engine "when RL is between SP and a maximum torque output (MTO) of the engine, wherein the engine is operable to efficiently produce torque above SP." *Id*. at 59:7–12. Although claim 21 recites the term "RL," or "road load," in place of the recitation "torque required to operate the hybrid vehicle" in claims 1 and 11, the meaning is the same given our construction that "road load" or "RL" equates to "torque required to propel the vehicle," as discussed above in section III.B.1.

We are persuaded, notwithstanding the arguments of Paice (which we address below), that Severinsky teaches a comparison of road load (i.e., the vehicle's torque requirements) to a "setpoint" for determining when to operate the engine, as called for by claims 1, 11, and 21, even though Severinsky may not employ the exact same language as the claims. For instance, Severinsky describes that microprocessor 48 "monitors the performance of the electric motor and the internal combustion engine, the state of charge of the battery, and other significant variables [and] . . . *determines whether the internal combustion engine or the electric motor or both should provide torque to the wheels under various monitored operating conditions*." Ex. 1205, 6:19–23 (emphasis added). In determining whether to employ the engine, Severinsky states that microprocessor 48 operates the engine only when it is "efficient" to do so:

> *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); *see also id*. at 9:40–52 ("the internal combustion engine operates only in its most efficient operating range").

These disclosures indicate that Severinsky's microprocessor monitors the performance of the vehicle to ensure the engine operates within a certain range of efficiency. Even more specifically, Severinsky discloses that to maximize efficiency, microprocessor 48 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). That alone, Severinsky says, will yield improvement in fuel economy on the order of 200–300%. *Id*. at 20:67–68.

Ford's expert, Dr. Stein, explains that because the engine in Severinsky 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 the MTO, e.g., 75% MTO, the engine alone produces the required torque. Ex. 1202 ¶¶ 176–179. Dr. Stein further explains that the 60% of MTO in Severinsky is a setpoint below which only the electric motor is operated to propel the vehicle. *Id.* As such, Dr. Stein concludes that a skilled artisan would have understood that Severinsky's lower limit of 60% of MTO is "a predetermined torque value or setpoint," thereby satisfying the claims. *Id.* ¶ 178. Dr. Stein further concludes that the setpoint of 60% of MTO, disclosed by Severinsky, is "substantially less than MTO" of the engine, as also required by the claims. *Id*. ¶¶ 194–197.

Paice responds that the claims require a comparison of the vehicle's torque requirement, or road load, to a setpoint for determining when to operate the engine. PO Resp. 16, 20. And, according to Paice, "Severinsky determines when to use the internal combustion engine *based on the speed of the vehicle*, in contrast to the '097 patent, which turns the engine on based on road load (claim 21) or the torque necessary to operate the vehicle (claims 1 and 11)." *Id*. at 17 (emphasis added); *see also id*. at 18–29, 36–37, 44–45 (arguing repeatedly that Severinsky's control strategy is based on speed, not the vehicle's torque requirements or road load). Likewise, Paice argues that Severinsky uses speed in determining when to operate the motor. *Id*. at 19.

Although we agree with Paice that the claims require a comparison of the vehicle's torque requirements, or road load, to a setpoint, we are unpersuaded that Severinsky does not compare road load to a setpoint in determining when to operate the engine and/or motor. As discussed above, Ford and its declarant, Dr. Stein, whose testimony we credit, make a specific accounting of how Severinsky teaches a comparison of the vehicle's torque requirements to a setpoint in the range of 60–90% of MTO.

And, to the extent that Paice points to passages in Severinsky that discuss "speed" as a factor in selecting the operating mode of the engine and/or motor (*see* PO Resp. 19–20, 23–24), we decline to read those passages in isolation, as Paice does, without crediting Severinsky's disclosure as a whole. For instance, Paice argues that such passages indicate that "Severinsky only considers speed" as a factor in determining when to operate the engine. PO Resp. 19. That is, quite simply, not the case. Although it is true that certain passages in Severinsky describe the operating modes in terms of speed, other passages in Severinsky express a framework that clearly extends beyond considerations of speed: "More particularly, according to the invention, the internal combustion engine is operated only under *the most efficient conditions of output power and speed*." Ex. 1205, 7:8–10 (emphasis added). Paice's own expert, Mr. Hannemann, testified that "power is a product of *torque* and speed" and a skilled artisan would have understood as much. Ex. 1240, 31:6–13 (emphasis added). Thus, at the very least, Severinsky contemplates the use of both torque and speed in determining when the engine can be operated efficiently.

Moreover, in another passage, Severinsky makes clear that the microprocessor responds to "load" requirements of the vehicle in determining when the engine can be operated efficiently:

> 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 propulsion requirements, so that the engine 40 can be operated in its most fuel efficient operating range*.

Ex. 1205, 17:11–15 (emphases added). That Severinsky may reflect on speed in determining when to operate the engine does not nullify or undermine these otherwise express disclosures by Severinsky of employing the engine based on the "torque" or "load" requirements of the vehicle. With that in mind, we reject Paice's incorrect assertions that Severinsky considers "only" speed to determine when to operate the engine. *See* PO Resp. 19.

Paice also points to Severinsky's disclosure of "speed-responsive hysteresis" as purported evidence of "a speed-based control strategy to turn the engine on and off." PO Resp. 18–19. According to Paice, "[i]t makes no sense for Severinsky to use 'speed responsive-hysteresis' if it uses road load to control engine starts and stops." *Id*. at 19. But Severinsky discusses "speed-responsive" hysteresis only in the context of preventing the engine from cycling on and off in "low-speed" situations where engine speed may dip temporarily to "20-25 mph" while in a highway-cruising mode. Ex. 1205, 18:23–42. That Severinsky may teach an additional hysteresis feature as a way of controlling unintended engine starts during temporary dips in speed does not preclude Severinsky from also teaching the use of a torque value, or road load, as a way to determine when to employ the engine in the first instance. Indeed, both Severinsky and the '097 patent under challenge describe a speed-responsive hysteresis feature in the context of a torque-responsive control system for determining when to operate the engine. More specifically, similar to Severinsky, the '097 patent discloses that "excessive mode switching otherwise likely to be encountered in suburban traffic can be largely avoided [by] . . . implementing this '*low-speed* hysteresis'." Ex. 1201, 42:65–43:1 (emphasis added).

Paice also argues that Severinsky's use of the modifier "high-speed" and "low-speed" in describing some of the operating modes "can only infer" that Severinsky considers speed in deciding when to use the engine versus the motor. PO Resp. 23. Those disclosures, however, do not foreclose Severinsky from teaching that the engine's torque requirements are also a determinant in employing the engine and/or motor. In other words, torque and speed are not mutually exclusive concepts. Thus, regardless of whether the modifier "high-speed" or "low speed" is used, Severinsky expressly describes the consideration of "torque" or "load" for triggering the mode, as discussed above. Indeed, the '097 patent itself speaks of "speed" when describing the vehicle's various operating modes, stating that "the traction motor provides torque to propel the vehicle in *low-speed situations*" and "[d]uring substantially steady-state operation, e.g., during *highway cruising*, the control system operates the engine." Ex. 1201, 17:24–25, 19:23–24, respectively (emphasis added). Just as "speed" is a factor in the control strategy of the '097 patent, so too is it in Severinsky.

In sum, Paice cannot hold Severinsky to a different standard than it holds the claimed invention. That Severinsky may discuss "speed" as one of the parameters used by the microprocessor does not negate its overall, and express, teaching of employing the engine "responsive to the load imposed by the vehicle's propulsion requirements," or road load, "so that the engine . . . can be operated in its most fuel efficient operating range." Ex. 1205, 17:11–15. We reject Paice's arguments that criticize Severinsky's references to "speed," when the '097 patent itself recognizes that "speed" plays a role in a road load-responsive hybrid control strategy.

Paice also faults Severinsky because its microprocessor "monitors the accelerator pedal position" and uses that information as an input for determining whether to employ the engine and/or motor. PO Resp. 25 (citing Ex. 1205, 13:16–19). According to Paice, "the accelerator position alone is not determinative of road load or torque requirements." *Id*. But, once again, Paice fails to recognize that, first, the controller in the '097 patent at issue utilizes the same input, and, second, the claims do not preclude the controller from receiving such inputs as part of the control strategy. A simple comparison of Severinsky to the '097 patent bears out that both utilize accelerator pedal position as an input and that such an input would have been understood to be an indicator of the torque required to propel the vehicle, i.e., road load. For instance, Severinsky explains:

> 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.

Ex. 1205, 6:19–26 (emphasis added). The "control inputs from the driver," according to Severinsky, include "acceleration, reverse, and deceleration or braking commands." *Id*. at 10:14–16.

Like Severinsky, the '097 patent recognizes that "[t]he microprocessor monitors the rate at which the operator depresses [accelerator and brake] pedals 69 and 70 as well as the degree to which pedals 69 and 70 are depressed [and] uses this information, and other signals provided . . . to properly control operation of the vehicle." Ex. 1201, 27:1–12 (footnote added). Moreover, the '097 patent acknowledges that "the operator's depressing the accelerator pedal signifies an increase in desired speed, i.e., an increase in *road load*" (*id*. at 12:28–37 (emphasis added)), and, thus, expressly requires, in claim 30, for the "controller" to be "responsive to an operator command" (*id*. at 60:14–17). Given that the '097 patent itself utilizes input from the operator's pedal position, and, indeed, equates that input with "road load," we are not persuaded by Paice's attack on Severinsky's microprocessor for likewise utilizing accelerator pedal position as an input. If anything, Severinsky's discussion of pedal position, which the '097 patent admits is indicative of road load, lends further support to our finding that Severinsky uses road load in determining when to employ the engine.

Similarly, Paice argues that Severinsky's use of "potential output torques of the engine" as a control metric is "*unrelated* to the input torque demand control strategy taught by the '097 patent, for example, using the instantaneous torque required to propel the vehicle (i.e., road load)." PO Resp. 38 (emphasis added). Although not entirely clear, Paice appears to take issue with Severinsky's discussion of the engine's operating point as a percentage of "its maximum torque." *Id*. This argument fails for the simple reason that Severinsky expresses the engine's operating range in terms no different than the '097 patent. Notably, the '097 patent explains that "road load is expressed as a function of the engine's maximum torque *output*," which, in turn, is compared to a setpoint that is likewise expressed in terms of maximum torque output: "[t]he engine's output torque is constrained to the range of efficient operation . . . , this range is controlled to be between 30% and 100% of the engine's maximum torque *output* ("MTO")." Ex. 1201, 37:57–58, 37:67–38:4 (emphases added); *see also id*. at 38:36–37 ("the engine's efficient operating range, e.g., 30% MTO>RL>100% of MTO."). Thus, Paice's attempt to fault Severinsky for expressing its setpoint as a percentage of torque output (i.e., "60–90% of its maximum torque"), when the '097 patent itself does the same, is without merit.

Paice further argues that Severinsky's disclosure of an operating range that is at 60% to 90% of the engine's maximum torque output is only "aspirational," and that Severinsky actually relies on a setpoint based on vehicle speed, not road load. PO Resp. 30–37. According to Paice, Severinsky's range is aspirational in the sense that it is a "goal" to be reached, rather than an actual teaching about a torque-based control strategy. *Id*. at 34, 36. This argument is unpersuasive for the simple reason that Paice does not point to any language in Severinsky that conveys uncertainty, or expresses a lack of expectation of success, with respect to its operational ranges being based on a torque value, i.e., road load. Nor does Paice allege that a skilled artisan would not have known how to implement the operational range of torque values expressed in Severinsky. We see no reason to discount or ignore the teachings in Severinsky of determining the engine's operational range on the basis of the torque required to propel the vehicle. Simply put, a prior art reference must be considered for all it teaches. In the absence of an enablement issue with Severinsky's teachings, we will not disregard those teachings simply because they utilize different words than the claimed invention.

In the end, we are not persuaded by Paice's argument that Severinsky does not teach the "setpoint" required by the claims. *See* PO Resp. 21–27, 37–38. Rather, we credit the testimony of Ford's expert, Dr. Stein, that a skilled artisan would have understood the lower limit of Severinsky's range—60% of the engine's maximum torque output—as a predetermined torque value that functions as a setpoint for operation of the engine. *See, e.g.*, Ex. 1202 ¶¶ 165–171, 176–179, 191–197; *see also* Pet. 22–25, 40–42. And, while Paice argues that Severinsky's "60% of MTO" cannot be a setpoint because there is no evidence "that a 'transition between operating modes may occur' at this value" (PO Resp. 30), that argument is premised on a construction of setpoint that we have already rejected. *See* Section III.A.2 above. Thus, we find that Severinsky fulfills the claim requirement of operating the engine when the torque required to propel the vehicle is equal to a setpoint (SP) that is substantially less than the engine's maximum torque output (MTO).

3. The "Stoichiometric" Limitation of Base Claims 1, 11, 21, and 30

Base claims 1, 11, and 30 recite that the controller limits "a rate of increase of output torque of the engine . . . such that combustion of fuel within the engine occurs at a substantially stoichiometric ratio." Base claim 21 recites essentially the same limitation, except it replaces the term "rate of increase" with "rate of change."[11]

Ford relies on the combination of Severinsky and Takaoka as teaching a control strategy that limits the engine's "rate of increase" of output torque so as to maintain "stoichiometric" combustion. To start, Severinsky teaches that "microprocessor controller 48 controls the rate of supply of fuel to engine 40." Ex. 1205, 10:4–6. Ford's expert, Dr. Stein, explains that controlling the rate of fuel to the engine is "one way the microprocessor 48 limits the rate of increase of output torque of the engine 40." Ex. 1202 ¶¶ 149–150; Ex. 1129 ¶¶ 41–42. Severinsky also teaches lowering carbon emissions by operating the engine "slightly in excess of the amount required for stoichiometric combustion." Ex. 1205, 12:13–17. These disclosures indicate Severinsky's relation of stoichiometric combustion to the rate at which the engine increases output torque.

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[11] Ford points out that the term "rate of change" in claims 21 and 30 was the subject of an amendment during prosecution that "mistakenly failed" to get entered, although it was entered with respect to other occurrences. Pet. 34 n.3 (citing Ex. 1210, 227–229, 234). We see merit in reconciling this oversight with the applicant's clear intention that the term "rate of change" be "rate of increase." Thus, we construe the terms synonymously.

Acknowledging that Severinsky may not disclose achieving stoichiometric combustion by limiting the "rate of increase" of the engine's output torque, as required by claims 1, 11, 21, and 30, Ford argues that this limitation does nothing more than apply "a known technique from the prior art," as taught by Takaoka. Pet. 52 (citing Ex. 1206, 2, 6; Ex. 1202 ¶ 446). More specifically, like Severinsky, Takaoka discloses controlling operation of the motor and engine to lower emissions levels: "Emissions levels much lower than the current standard values were attained by *optimum control of the motor and engine*." Ex. 1206, 8 (emphasis added). "In order to achieve a major reduction in emissions," Takaoka teaches that the engine should "operate with $\lambda = 1$ over its entire range" (*id*. at 2) and "reduc[ing] quick transients in engine load so that the air-fuel ratio can be stabilized easily" (*id*. at 5–6). Ford's declarant, Dr. Stein, explains that "[a] lambda (λ) value of 1 corresponds to the stoichiometric air/fuel ratio," and thus, a skilled artisan would have understood Takaoka as achieving stoichiometric combustion by limiting the rate of increase of the engine's output torque.[12] Ex. 1202 ¶¶ 231–237 (claim 21), 314–319 (claim 1), 368 (claim 11), 416–420 (claim 30). This basic technique, according to Dr. Stein, would have been desired by a skilled artisan working on improving stoichiometry in a hybrid control strategy, such as that of Severinsky. *Id*. ¶¶ 449–451. Dr. Stein, thus, concludes that the combination of Severinsky and Takaoka satisfies all of the limitations of claims 1, 11, 21, and 30. *Id*. ¶¶ 264, 364, 368, 423.

[12] The '097 patent speaks of a "lambda sensor" as an indicator of stoichiometric combustion. *See* Ex. 1201, 39:10–12.

Paice, in turn, argues that the focus of Takaoka "is on the design of an engine, *not a hybrid control strategy*." PO Resp. 49 (emphasis added). We disagree. As just explained above, Takaoka provides expressly for an "optimum control" for lowering emission levels. Ex. 1206, 8. That control strategy, according to Takaoka, includes operating the engine "with $\lambda = 1$ over its entire range" (*id*. at 2) and reducing "engine load fluctuation" and "quick transients in engine load." (*id*. at 5–6). We credit the testimony of Ford's expert, Dr. Stein, that a skilled artisan would have understood Takaoka's disclosures as referring to a control strategy for the motor and engine, not the mechanical design of the engine itself. Ex. 1237 ¶¶ 27–32. The same skilled artisan, Dr. Stein observes, would have known "a mechanical component alone (e.g., an engine) is not capable of such control." *Id*. ¶ 32. As such, we do not find merit in Paice's contention that Takaoka is not concerned with a control strategy.

Paice also argues that "to [the] extent Takaoka discloses limiting any characteristic of the engine, it's the engine's *power*, not torque." PO Resp. 51. But, again, Takaoka speaks expressly in terms of reducing "engine *load* fluctuation" and "quick transients in engine *load*." Ex. 1206, 6 (emphases added). And Ford's expert, Dr. Stein, explains that the term "engine load" in this context would have been understood to mean "torque." Ex. 1202 ¶¶ 204–219; Ex. 1237 ¶¶ 36–38. We have considered the testimony of Paice's expert, Mr. Hannemann, that the term "load" is too "general" and "can be used to mean power, torque, fuel consumption, and various other metrics." Ex. 2206 ¶ 147. But Mr. Hannemann fails to read Takaoka in view of what a skilled artisan would have understood about torque. On the one hand, in describing various technical concepts, Mr. Hannemann testifies that torque is "created by the combustion process" and is a function of "fuel ratio" within the engine (Ex. 2206 ¶ 46), but upon reading Takaoka's description of reducing "quick transients in engine load so that the *air-fuel ratio* can be easily stabilized" (Ex. 1206, 6 (emphasis added)), Mr. Hannemann appears to lose sight of his prior relation of torque to the engine's fuel ratio. As such, we give more weight to Dr. Stein's testimony that a skilled artisan would have understood Takaoka's reference to "engine load" to mean torque.

4. The Reason to Combine Severinsky and Takaoka

Finally, Paice argues that a skilled artisan would not have combined Severinsky with Takaoka's engine that operates stoichiometrically. PO Resp. 53–54. According to Paice, Severinsky "teaches away" from operating the engine stoichiometrically by disclosing that the engine is operated at a "lean" fuel mixture. PO Resp. 54 (citing Ex. 1205, 12:13–17). Although we agree that Severinsky discloses operating the engine "lean," it is not a teaching away from operating the engine at or near a stoichiometric ratio, as alleged by Paice. Note that the claims require: "combustion of fuel within the engine occurs at a *substantially* stoichiometric ratio." *See, e.g.*, Ex. 1202, 56:66–67 (claim 1) (emphasis added). Paice does not cite any disclosure in Severinsky to the effect that operating the engine *at or near* the stoichiometric ratio is undesirable and should be avoided at all times. To the contrary, Severinsky discloses that:

> 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.

Ex. 1205, 12:13–17 (emphasis added). That Severinsky discloses operating the engine "slightly in excess" of the amount necessary for stoichiometric combustion qualifies, in our view, as operating the engine at a *substantially* stoichiometric ratio.

Moreover, we credit the testimony of Dr. Stein to the effect that Severinsky does not discourage operating the engine at the stoichiometric ratio, but merely "provides a balanced view of the tradeoffs associated with a lean burn strategy." Ex. 1237 ¶¶ 40–41. Such testimony supports finding that the disclosure in Severinsky of operating the engine lean, yet still close to stoichiometric combustion, does not teach away from a combination with Takaoka, as Paice argues. We are persuaded that a skilled artisan would have been led to combine the known technique of reducing quick engine transients to achieve a stoichiometric air-fuel mixture, as taught by Takaoka, with Severinsky's control strategy of operating the engine near a stoichiometric mixture, because both references share the same fundamental goal of reducing carbon emissions by operating the engine stoichiometrically. *See* Ex. 1202 ¶¶ 444–456; Ex. 1237 ¶¶ 39–49.

We have considered Paice's other arguments with respect to Severinsky and Takaoka, but do not find them sufficiently persuasive to rebut Ford's rationale for combining Severinsky and Takaoka. Accordingly, we conclude that Ford has demonstrated, by a preponderance of the evidence, that the limitations of base claims 1, 11, 21, and 30 would have been obvious over Severinsky and Takaoka.

5. The Dependent Limitations

As discussed above, dependent claims 7, 17, 27, 37, and 38 are the only claims remaining in this proceeding that are not subject to estoppel.

Having decided that the limitations of base claims 1, 11, 21, and 30 would have been obvious over the combined teachings of Severinsky and Takaoka, we now address, first, the "abnormal and transient conditions" recited by claims 7, 17, 27, and 37, and second, the battery voltage recited by claim 38.

a. Claims 7, 17, 27, and 37—"Abnormal and Transient Conditions"

Each of dependent claims 7, 17, 27, and 37 recites operating the engine "at torque output levels *less than SP under abnormal and transient conditions*." As discussed above, we construe "*abnormal and transient conditions*" to include "starting and stopping of the engine."

Severinsky discloses that "[i]t is within the scope of the invention to operate the engine 40 outside its most fuel efficient operating range, on occasion," for example, when "the combined load of low-speed vehicle operation in traffic together with battery charging may be less then [*sic*] the minimum power produced by the engine in its most efficient operating range." Ex. 1205, 18:23-30. Severinsky rationalizes its decision to operate the engine outside its most fuel efficient range (*i.e.*, "*at torque output levels less than the SP*") on occasion, as a tradeoff between engine efficiency and vehicle drivability and safety considerations: "it is preferable to use the engine somewhat inefficiently rather than to discharge the batteries excessively, which would substantially reduce the battery lifetime." Ex. 1205, 18:23–33; Ex. 1202 ¶¶ 427–436. A skilled artisan would have understood that the lifetime of the battery in a hybrid vehicle is both a drivability consideration and a safety consideration. Ex. 1202 ¶ 434. Thus, in our view, Severinsky discloses "operat[ing] the engine at torque output levels less than SP under abnormal and transient conditions." *Id*. ¶ 435.

Paice argues that Severinsky fails to disclose operating the engine under "abnormal and transient conditions" because such conditions exclude operation of the engine in city traffic, including starting the engine. PO Resp. 40–42. That argument turns on Paice's proposed construction of "abnormal and transient conditions" as excluding starting the engine. As discussed above, however, we reject Paice's proposed construction. *See* Section III.B.4. Properly construed, "abnormal and transient conditions" includes starting and stopping the engine, whether or not in city traffic. Consequently, Paice's arguments regarding "abnormal and transient conditions" are without merit. *See id.* Thus, we conclude that Ford has demonstrated, by a preponderance of the evidence, that dependent claims 7, 17, 27, and 37, which necessarily include the limitations of their base claims, would have been obvious over Severinsky and Takaoka.

b. Claim 38—Battery Voltage

Claim 38 recites that "energy is supplied from the battery to the motor at a peak of at least 500 volts under peak load conditions." Ford argues that Severinsky satisfies this limitation and relies on the testimony of Dr. Stein. Pet. 50–52 (citing Ex. 1202 ¶¶ 92–95, 440–443). Paice does not offer any rebuttal to Dr. Stein's analysis of claim 38, aside from arguing the limitations of claim 30 from which it depends, which we have already concluded are met by the combined teachings of Severinsky and Takaoka, as discussed above.

After reviewing Dr. Stein's analysis, we find that it provides ample support for concluding that the voltage limitation of claims 38 is met by Severinsky. Specifically, Dr. Stein explains that "Severinsky discloses that the DC voltage will be between 1,000 and 1,400 volts when operating a . . .

motor at its maximum current (i.e., 'peak current') of 50 amperes" to power the vehicle. Ex. 1202 ¶ 440 (citing Ex. 1205, 19:39–49). Dr. Stein further explains that a skilled artisan would have known that a motor is operating "*under peak load conditions*" when it is operating at its maximum current. Ex. 1202 ¶ 441. Thus, according to Dr. Stein, because Severinsky's maximum voltage of 1,400 volts would have been understood to be the peak voltage, Severinsky teaches supplying energy to the motor from the battery "at a voltage of at least 500 volts [i.e., 1,400 volts] under peak load conditions [at a maximum current of 50 amperes]." *Id*. ¶ 442.

We find Dr. Stein's analysis of Severinsky to be credible. Paice's expert does not provide any rebuttal. Thus, the preponderance of the evidence weighs in favor of Ford and demonstrates that claim 38 would have been obvious over Severinsky and Takaoka.

IV. CONCLUSION

Ford has demonstrated, by a preponderance of the evidence, that claims 7, 17, 27, 37, and 38 of the '097 patent are unpatentable under 35 U.S.C. § 103 as obvious over Severinsky and Takaoka.

V. ORDER

Accordingly, it is hereby:

ORDERED that *inter partes* review of claims 1, 3, 4, 9, 11, 13, 14, 19, 21, 23, 24, 28, 30, 32, and 33 is *dismissed*;

ORDERED that claims 7, 17, 27, 37, and 38 of the '097 patent are held *unpatentable*; and

FURTHER ORDERED that any party seeking judicial review of this Final Written Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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