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Paper 44
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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 IPR2014-00571
Patent 7,104,347 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

Ford Motor Company ("Ford") filed a Petition ("Pet.") for *inter partes* review of claims 1, 6, 7, 9, 15, 21, 23, and 36 of U.S. Patent No. 7,104,347 B2 ("the '347 patent"), which is owned by Paice LLC & The Abell Foundation, Inc. (collectively, "Paice"). In a preliminary proceeding, we determined a reasonable likelihood existed that the challenged claims are unpatentable under 35 U.S.C. § 103, and instituted trial. In support of patentability, Paice filed a Patent Owner Response ("PO Resp."), and Ford followed with a Reply ("Reply"). After hearing oral argument from both parties,[1] and pursuant to our jurisdiction under 35 U.S.C. § 6(c), we conclude Ford has proven, by a preponderance of the evidence, that all of the challenged claims are unpatentable.

II. BACKGROUND

A. The '347 patent [2]

The '347 patent describes a hybrid vehicle with an internal combustion engine, two electric motors (a starter motor and a traction motor), and a battery bank, all controlled by a microprocessor that directs the transfer of torque from the engine and traction motor to the drive wheels of the vehicle. Ex. 1001, 17:5–45, Fig. 4. The microprocessor features an engine control strategy that runs the engine only under conditions of high efficiency, typically when the vehicle's instantaneous torque requirements (i.e., the amount of torque required to propel the vehicle, or "road load") is

[1] A transcript ("Tr.") has been entered into the record. Paper 49.
[2] The '347 patent is also the subject of several co-pending cases, including *Paice, LLC v. Ford Motor Co.*, No. 1:14-cv-00492 (D. Md.), filed Feb. 19, 2014 (Pet. 1), and *Paice LLC v. Hyundai Motor Co.*, No. 1:12-cv-00499 (D. Md.), filed Feb. 16, 2012 (PO Resp. 6).

at least equal to 30% of the engine's maximum torque output ("MTO") capability. *Id*. at 20:52–60, 35:5–14; *see also id*. at 13:47–61 ("the engine is never operated at less than 30% of MTO, and is thus never operated inefficiently").

Running the engine only when it is efficient to do so leads to improved fuel economy and reduced emissions. *Id*. at 13:47–51. To achieve such efficiency, the hybrid vehicle includes various operating modes that depend on the vehicle's torque requirements, the battery's state of charge, and other operating parameters. *Id*. at 19:53–55. For example, the hybrid vehicle may operate in: (1) an all-electric mode, where only the traction motor provides the torque to propel the vehicle and operation of the engine would be inefficient (i.e., stop-and-go city driving); (2) an engine-only mode, where only the engine provides the torque to propel the vehicle and the engine would run at an efficient level (i.e., highway cruising); (3) a dual-operation mode, where the traction motor provides additional torque to propel the vehicle beyond that already provided by the engine and the torque required to propel the vehicle exceeds the maximum torque output of the engine (i.e., while accelerating, passing, and climbing hills); and (4) a battery recharge mode where the engine operates a generator to recharge the battery while the traction motor drives the vehicle. *Id*. at 35:66–36:58, 37:26–38:55.

B. The challenged claims

Ford challenges the patentability of claims 1, 6, 7, 9, 15, 21, 23, and 36. Pet. 3. Of the challenged claims, claims 1 and 23 are independent. Claim 1 is directed to a "hybrid vehicle" (Ex. 1001, 58:13), while claim 23 is directed to a "method of control" of a hybrid vehicle (*id*. at 60:22). Each of

the independent claims recites that the engine is employed when it can produce torque "efficiently," which claim 1 describes as when the torque required to propel the vehicle is "at least equal to a setpoint (SP) [but] substantially less than the maximum torque output (MTO)" of the engine (*id*. at 58:29–37), and claim 23 describes as when the torque required to propel the vehicle is "between a lower level SP and a maximum torque output MTO" (*id*. at 60:23–42).

Claim 1 is illustrative of the challenged claims:

> 1. A hybrid vehicle, comprising:
>
> an internal combustion engine controllably coupled to road wheels of said vehicle;
>
> a first electric motor connected to said engine [a]nd operable to start the engine responsive to a control signal;
>
> a second electric motor connected to road wheels of said vehicle, and operable as a motor, to apply torque to said wheels to propel said vehicle, and as a generator, for accepting torque from at least said wheels for generating current;
>
> a battery, for providing current to said motors and accepting charging current from at least said second motor; and
>
> a controller for controlling the flow of electrical and mechanical power between said engine, first and second motors, and wheels,
>
> *wherein said controller starts and operates said engine when torque require[d] to be produced by said engine to propel the vehicle* and/or to drive either one or both said electric motor(s) to charge said battery *is at least equal to a setpoint (SP) above which said engine torque is efficiently produced*, and wherein the torque produced by said engine when operated at said setpoint (SP) is substantially less than the maximum torque output (MTO) of said engine.

Ex. 1001, 58:13–37 (emphasis added).

C. The instituted grounds of unpatentability

In the preliminary proceeding, we instituted trial because Ford made a threshold showing of a "reasonable likelihood" that claims 23 and 36 were unpatentable as obvious over Severinsky,[3] and claims 1, 6, 7, 9, 15, 21 were unpatentable as obvious over Severinsky and Ehsani.[4] Dec. to Inst. 10–15. We now decide whether Ford has proven the unpatentability of these claims by a "preponderance of the evidence." *See* 35 U.S.C. § 316(e).

III. ANALYSIS

A. 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). This standard involves determining the ordinary and customary meaning of the claim terms as understood by one of ordinary skill in the art reading the patent's entire written disclosure. *In re Translogic Tech., Inc*., 504 F.3d 1249, 1257 (Fed. Cir. 2007). Here, our review centers on the construction of two claim terms—"road load (RL)" and "setpoint (SP)."[5]

1. "Road load" or "RL"

The term "road load" or "RL" appears throughout the claims of the '347 patent. For example, claim 7, which depends from claim 1, recites that the operating modes are "responsive to the value for the road load (RL) and

[3] U.S. Patent No. 5,343,970, iss. Sept. 6, 1994 (Ex. 1003, "Severinsky").
[4] U.S. Patent No. 5,586,613, iss. Dec. 24, 1996 (Ex. 1004, "Ehsani").
[5] Ford also contends that the terms "low-load mode I," "highway cruising mode IV," and "acceleration mode V" are in need of construction. Pet. 16–17. Those terms are expressly defined by claim 7. Ex. 1001, 58:64–59:8. As such, no further construction is necessary.

said setpoint (SP), both expressed as percentages of the maximum *torque* output of the engine," and claim 23 recites the step of "determining the instantaneous *torque* RL required to propel said vehicle responsive to an operator command."

The specification also describes "road load" as "the vehicle's instantaneous torque demands, i.e., that *amount of torque* required to propel the vehicle at a desired speed." Ex. 1001, 12:40–57 (emphasis added). Elsewhere the specification similarly speaks of road load in terms of a "torque" requirement:

> The vehicle operating mode is determined by a microprocessor responsive to the *"road load," that is, the vehicle's instantaneous torque demands*.
>
> * * *
>
> While operating at low speeds, e.g., when *the vehicle's torque requirements ("road load," or "RL")* are less than 30% of the engine's maximum torque output ("MTO"), engine 40 is run only as needed to charge battery bank 22.

Id. at 11:60–63, 36:8–11, respectively (emphases added). Also, in distinguishing the claimed invention over the prior art, the specification explains that:

> Numerous prior art references . . . indicate the vehicle operating mode should be controlled in response to vehicle speed . . . [but none] recognizes that the desired vehicle operational mode should preferably be controlled *in response to the vehicle's actual torque requirements, i.e., the road load*. Doing so according to the invention provides superior performance, in terms of both vehicle response to operator commands and fuel efficiency . . .

Id. at 13:1–15 (emphasis added).

These passages from the specification comport with a construction of "road load" that is limited to an instantaneous torque value, and more specifically, a torque value which can be expressed in terms of *a percentage* of the engine's "maximum torque output" or "MTO." For instance, the specification states that:

> *road load* is shown . . . as varying from *0 at the origin to 200% of maximum torque output*.
>
> * * *
>
> During highway cruising . . . 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.
>
> * * *
>
> [W]hen 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.

Id. at 37:13–15, 37:45–47, 38:5–10 (emphases added).

We see no reason to depart from these express definitions of "road load" in terms of an amount of torque. Thus, consistent with the specification's many uses of the term, "road load" is properly construed to be "the amount of instantaneous torque required for propulsion of the vehicle."

Paice urges that our construction of "road load" should additionally account for external forces acting on the vehicle, such as "aerodynamic drag." PO Resp. 31–32; *see also* Ex. 2002 ¶¶ 85–88. Although aerodynamic forces may play a role in the amount of torque required to propel the vehicle, we need not address them in order to construe the term "road load." That is because the claims and specification of the '347 patent

consistently speak of "road load" in a more general sense. In fact, the specification mentions aerodynamic forces only in the context of a "heavy vehicle" having "high torque requirements" and "poor aerodynamic characteristics." Ex. 1001, 49:9–14. That singular example, however, is not enough for us to overlook the countless descriptions found elsewhere in the specification, where "road load" or "RL" is defined simply as "the amount of torque required to propel the vehicle," divorced from other potential forces acting on the vehicle.

2. "Setpoint" or "SP"

Each of independent claims 1 and 23 recites that the engine operates "efficiently" when the torque required to propel the vehicle is between a "setpoint (SP)" and a "maximum torque output (MTO)." Paice seeks to construe the term "setpoint" as "a definite, but potentially variable value at which a transition between operating modes may occur." PO Resp. 6–7. Ford, on the other hand, advocates that "setpoint" means a "predetermined torque value." Pet. 16. Paice protests any construction that limits the meaning of "setpoint" to a "torque value" (PO Resp. 11), arguing that the specification supports a broader definition that also could encompass a "state of charge of the battery" (Prelim. Resp. 13–15) or a "transition between operating modes" (PO Resp. 7–10).

We agree with Paice that the *specification* speaks of "setpoint" in terms of a "torque output," a "state of charge of the battery," or a "transition point." *See* Ex. 1001, 40:20–54. However, the *claim language* is not so broad. Although we recognize that the specification is an important tool in claim construction, it is the claim language—and the context in which the disputed term is used—that is of primary importance. *Phillips v. AWH*

Corp., 415 F.3d 1303, 1314 (Fed. Cir. 2005) (en banc) ("the claims themselves provide substantial guidance as to the meaning of particular claim terms . . . the context in which a term is used in the asserted claim can be highly instructive") (citations omitted). Put another way, "the name of the game is the claim." *In re Hiniker Co.*, 150 F.3d 1362, 1369 (Fed. Cir. 1998) (quoting Giles Sutherland Rich, *Extent of Protection and Interpretation of Claims—American Perspectives*, 21 Int'l Rev. Indus. Prop. & Copyright L. 497, 499 (1990)).

Here, contrary to Paice's assertion, the claim language consistently refers to a "setpoint" in terms of a "torque" requirement. For instance, claim 1 recites that the controller starts and operates the engine

> when *torque require[d]* to be produced by said engine . . . *is at least equal to a setpoint (SP)* above which said engine torque is efficiently produced, and wherein the *torque produced* by said engine when operated *at said setpoint (SP)* is substantially less than the maximum torque output (MTO) of said engine.

Ex. 1001, 58:30–37 (emphases added). And, likewise, claim 23 speaks consistently of "setpoint" or "SP" as being the "lower level," or limit, at which the engine can efficiently produce torque, reciting that: the engine is capable of "efficiently producing *torque at loads between a lower level SP* and a maximum torque output"; the engine is employed to propel the vehicle "when the *torque RL required to do so is between said lower level SP* and MTO"; and "wherein the *torque produced* by said engine when operated *at said setpoint (SP)* is substantially less than the maximum torque output." *Id.* at 60:22–54 (emphases added). These express limitations suggest that "setpoint" is not just any value, but a value that—per the surrounding claim language—equates to the level of the engine's "torque."

Moreover, we note that claim 23 includes a limitation directed to "the state of charge of said battery," but it never correlates that limitation with a "setpoint" or "SP," even though those terms are used elsewhere throughout the claim. Nor does Paice point us to anywhere in the claims that describe the setpoint in the context of the battery's state of charge. Indeed, when speaking of "the state of charge of the battery," dependent claims 9 and 31 refer to it in terms of falling below "a predetermined level," not a "setpoint." Thus, given the claim language's unequivocal use of "setpoint" or "SP" in the context of a "torque" requirement, we construe the terms "setpoint" and "SP" to mean "a torque value." Our assessment does not end there, however.

The specification states that "the value of a setpoint (for example) may vary somewhat in response to recent [driving] history, or in response to monitored variables" or may be "reset . . . in response to a repetitive driving pattern." Ex. 1001, 40:37–59. But, just because a setpoint *may* vary under certain circumstances, that potential variation does not foreclose it from being "set," or "fixed," at some point in time.[6] A setpoint for however short a period of time still is a setpoint. Any other construction would defeat its purpose of being *set* for comparison against another value. For example, the specification states that "the microprocessor tests sensed and calculated values for system variables [such as road load (RL)] . . . *against setpoints, and uses the results of the comparisons* to control the mode of vehicle operation." Ex. 1001, 40:22–31 (emphasis added). That description makes

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

clear that the comparative setpoint is a pre-defined value. Indeed, the specification refers to setpoint in terms of a "defined setpoint." *Id*. at 19:64. As such, we construe the term "setpoint" to mean at least "a predefined torque value that may or may not be reset."[7]

Finally, we cannot disregard Paice's argument that our construction is "at odds" with the construction adopted by two district courts in related actions.[8] PO Resp. 6. According to Paice, each of the district courts construed "setpoint," as used in the '347 patent, to mean "a definite, but potentially variable value at which a transition between operating modes may occur." *Id*. Although, generally, we construe claim terms under a different standard than that of a district court, and thus, are not bound by a district court's prior claim construction, we nonetheless feel compelled, by the circumstances of this case, to evaluate the district courts' construction in light of our construction. *See Power Integrations, Inc. v. Lee*, 2015 WL 4757642, at *6 (Fed. Cir. Aug. 12, 2015) ("Given that [patent owner's] principal argument to the board . . . was expressly tied to the district court's claim construction, we think that the board had an obligation, in these circumstances, to evaluate that construction") .

Here, the first half of the district courts' construction—"a definite, but potentially variable value"— coincides squarely with our construction of "setpoint" as a "predefined" value "that may or may not be reset." The

[7] Even Paice's declarant agreed that, given the "comparison" being made in claims 1 and 23, the "most straightforward" construction is that "setpoint is a torque value." Ex. 1039, 79:1–80:25.
[8] *Paice LLC v. Toyota Motor Corp.*, No. 2:07-cv-00180, Dkt. 63 (E.D. Tex. Dec. 5, 2008); *Paice LLC v. Hyundai Motor Co.*, No. 1:12-cv-00499, 2014 WL 3725652 (D. Md. July 24, 2014).

difference, however, lies in our construction of "setpoint" as a "torque" value. On that point, at least one of the district courts held:

> there is nothing in the claims or specification that indicate a given setpoint value is actually represented in terms of torque. In fact, the specification clearly indicates that the state of charge of the battery bank, 'expressed as a percentage of its full charge' is compared against setpoints, the result of the comparison being used to control the mode of the vehicle.

Ex. 1011, 10 (citing the '347 patent, 40:28–31). But, as discussed above, although claims are read in light of the specification, it is the use of the term "setpoint" within the context of the claims themselves that provides a firm basis for our construction. *See Phillips*, 415 F.3d at 1314 ("the context in which a term is used in the asserted claim can be highly instructive"). Here, the claims instruct us that "setpoint," when read in the context of the surrounding language, is limited to a torque value. We decline to read the term as also encompassing a state of charge of the battery, as the district court did. Thus, we stand by our determination that claims 1 and 23 consistently refer to "setpoint" as a "torque" requirement.

With regard to the second half of the district courts' construction of "setpoint" as "a transition between operating modes," we believe it imports an extraneous limitation into the meaning of "setpoint" that is neither supported by the claim language nor the specification. In particular, claims 1 and 23 expressly describe "setpoint (SP)" as being the lower limit at which the engine can "efficiently" produce torque. Those claims make no mention of this lower limit as being a "transition" point for the "operating modes," although it potentially may be. Indeed, the specification acknowledges that the mode of operation does not always transition, or

switch, at the setpoint, but instead depends on a number of operating parameters:

> 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. 1001, 19:53–64 (emphasis added).

Moreover, that a "setpoint" is not a *per se* transition between operating modes is reinforced by the fact that only the dependent claims, for example claims 7 and 28, mention "setpoint" in terms of "operating modes." *See id*. at 58:58–60, 61:11–13. Where the meaning of a claim term is clear from the context of its use in an independent claim, we will not further limit the meaning of the term by its use in a dependent claim, absent justification for doing so. *See Phillips*, 415 F.3d at 1315 ("the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim"). Thus, although the district courts may have had justification for a narrower construction of "setpoint," we believe it is unnecessary here and may lead to confusion given our standard of applying the "broadest reasonable construction" to the terms of a claim. *See* 37 C.F.R. § 42.100(b). As such, we maintain our construction of "setpoint," as discussed above, which arguably may differ from the construction arrived at in the related district court actions.

B. The asserted grounds

1. Claims 23 and 36—obviousness over Severinsky

Ford relies primarily on Severinsky as teaching the limitations of the contested claims, including claim 23 on which Paice focuses the majority of

its response in defending the '347 patent.[9] *See* PO Resp. 12–52. Like claim 23, Severinsky discloses the essential components of a hybrid electric vehicle, including an internal combustion engine, an electric motor, a battery, and a microprocessor for controlling the vehicle's mode of operation, i.e., an all-electric mode, an engine-only mode, or a hybrid mode. *Compare* Ex. 1003, Fig. 3 (Severinsky) *with* Ex. 1001, Fig. 4 (the '347 patent).

In determining whether to employ the engine or the motor or both, Severinsky's microprocessor bases its decision on "various monitored operating conditions" (*id*. at 6:19–26) that include "the operator's inputs and the vehicle's performance" (*id*. at 14:15–18). Furthermore, Severinsky teaches that the microprocessor activates 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[*[10]*] 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.

Ex. 1003, 7:8–16 (emphasis added); *see also id*. at 9:40–52 ("the internal combustion engine operates only in its most efficient operating range"). Even more importantly, Severinsky teaches that the engine's efficient range

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[9] Paice does not dispute that Severinsky is prior art against the '347 patent.
[10] Paice's declarant testified that a skilled artisan would have understood that "power is a product of *torque* and speed." Ex. 1039, 32:6–13, 82:10–11 (emphasis added); *see also* Ex. 2002 ("For every engine speed, *there is an associated torque value*. Another way of defining an engine's operating range would be by its output power, which is the engine's speed multiplied by the output *torque*") (emphases added).

is based on the "torque" level required to propel the vehicle, stating that the microprocessor runs 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 20:63–66 (emphasis added).

Central to our analysis is the recitation in claim 23 that the engine can operate "efficiently" and be employed to propel the vehicle "when the torque RL [road load] required to do so is between a lower level SP [setpoint] and a maximum torque output MTO." Ex. 1001, 60:22–25, 39–41. Paice does not dispute that Severinsky teaches operating the engine when it is efficient to do so. Rather, Paice faults Severinsky, repeatedly so, for failing to teach that efficient operation of the engine is based on "road load," or "RL," as required by claim 23. PO Resp. 12; *see also id*. at 26 ("Severinsky '970 does not consider road load at all"), *id*. at 46 ("the vehicle taught by Severinsky does not calculate road load or have any concept of road load").

In Paice's view, "Severinsky determines *when* to turn the engine on based on the speed of the vehicle in contrast to the '347 patent, which turns the engine on based on road load." *Id*. at 17. More specifically, Paice argues, "nowhere does Severinsky disclose that road load or any other torque demand is considered when determining when to employ the engine or if the road load is above the setpoint when the engine is operated." *Id*. at 37; *see also id*. at 19, 26, 34–36 (arguing same). Instead, according to Paice, Severinsky "uses speed as *the one factor* in determining whether to employ the engine." *Id*. at 56 (emphasis added). In support of that proposition, Paice cites various passages in Severinsky that discuss "speed." *See, e.g., id*. at 18–19, 27, 29–30.

We are not persuaded by Paice's focus on isolated passages of Severinsky, while downplaying its teaching as a whole. It is the totality of Severinsky that must be assessed, not its individual parts. Paice would have us believe that "speed" is the *sole* factor used by Severinsky's microprocessor in determining when to employ the engine. That is simply not the case. Although Severinsky describes the use of "speed" as a factor considered by the microprocessor, Severinsky makes clear that the microprocessor also uses the vehicle's "torque" requirements in determining when to run the engine. Importantly, Severinsky discloses that

> *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. 1003, 17:11–15 (emphases added). And, while Severinsky may not use the term "road load" expressly, its description of the engine's operation being "responsive to the load imposed by the vehicle's propulsion requirements" is the same as the engine being employed in response to "road load," which we have construed to mean "the torque required for propulsion of the vehicle." As such, we find that Severinsky teaches an engine control strategy that depends on road load, or "RL," as required by claim 23.[11]

[11] We are not persuaded by the testimony of Paice's declarant, who testifies that this passage in Severinsky relates to "providing torque *to the motor*" and "is not related to determining when to employ the engine." Ex. 2002 ¶ 90. Plainly, this passage relates to operation of *the engine*—it states that the microprocessor determines the load "to be provided *to the engine*" and responds to that load "so that *the engine 40 can be operated* in its most fuel efficient operating range." Ex. 1003, 17:7–15 (emphases added).

Moreover, Severinsky teaches elsewhere that efficient operation of the engine is based on torque, not speed. In particular, Severinsky specifies that the microprocessor runs 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). Severinsky's "operational point" for the engine is no different than the "setpoint," or "SP," called for by claim 23. Indeed, just as Severinsky's "operational point" is expressed in terms of a *percentage of maximum torque*—"60–90% of its maximum torque"—so too is the claimed "setpoint." For instance, claim 29, which depends from claim 23, recites that "said setpoint SP is at least approximately 30% of MTO." Ex. 1001, 61:27–28; *see also id*. at 58:55–57. That Severinsky describes the operational point for the engine in terms similar to, if not the same as, the claimed invention runs counter to Paice's argument that Severinsky employs the engine based on speed alone.

Also, we are not persuaded by Paice's argument that Severinsky does not teach a "lower level SP," or setpoint, as required by claim 23. PO Resp. 34–35, 50–52. Rather, we find credible the testimony of Ford's declarant, Dr. Davis, that a skilled artisan would have understood the lower limit of Severinsky's range—60%—to be a "lower level" setpoint. *See* Pet. 21 (citing Ex. 1005 ¶¶ 201–204, 279); *see also id*. at 311, 398–402. Thus, we find that Severinsky fulfills the claim requirement of employing the engine to propel the vehicle when the torque demand, or road load, is between a lower level setpoint (SP) and the engine's maximum torque output (MTO).

Paice cites various passages in Severinsky that purportedly show Severinsky's engine control strategy is "based on vehicle speed, and not the

road load or any other torque demand." PO Resp. 17–19, 27, 29–30. For example, Paice points to Severinsky's disclosure that the engine is turned off in "low speed circumstances" and turned on during "highway cruising" at moderate speeds. *Id*. at 17–18. That disclosure, however, does not foreclose Severinsky from teaching the engine's torque requirements as a determinative factor of when to employ the engine. In other words, torque and speed are not mutually exclusive concepts. Indeed, the '347 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. 1001, 17:34–37, 19:35–36, respectively (emphasis added). Thus, just as "speed" plays some role in the modes of operation in the '347 patent, so too does it in Severinsky.

Paice also points to Severinsky's disclosure of "speed-responsive hysteresis" to argue that Severinsky's control strategy is based on speed, not road load. PO Resp. 27–28. According to Paice, "it simply makes no sense for Severinsky to use 'speed responsive-hysteresis' if Severinsky uses road load to control engine starts and stops." *Id*. at 27. But Severinsky only discusses the implementation of speed-responsive hysteresis for purposes of eliminating "nuisance engine starts." Ex. 1003, 18:40–42. That Severinsky may additionally teach a speed-responsive hysteresis feature as a way to check and control unintended engine starts does not preclude it from also teaching the use of road load as a way to determine when to employ the engine in the first instance, i.e., turn the engine on. We find persuasive the testimony of Ford's declarant, Dr. Stein, confirming that "[e]ven if

Severinsky '970 was considering speed in this particular situation [of nuisance engine starts], it is generally, if not always, using torque/road load in its mode decisions." Ex. 1038 ¶ 19. Indeed, like Severinsky, the '347 patent describes hysteresis in terms of speed, explaining that "the excessive mode switching otherwise likely to be encountered in suburban traffic can be largely avoided [by] implementing this 'low-speed hysteresis'." Ex. 1001, 43:67–44:3.

Once again, Paice seeks to hold Severinsky to a different standard than it holds the claimed invention. That Severinsky may have an additional speed-responsive hysteresis feature 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. 1003, 17:11–15. Thus, we reject Paice's arguments questioning Severinsky's references to "speed," when the '347 patent itself recognizes that "speed" plays a role in a road load-responsive hybrid control strategy.[12]

Paice also calls Severinsky defective because its "microprocessor receives inputs from the driver." PO Resp. 29 n.9; *see also id*. at 33 ("Severinsky only discloses measuring the position of the accelerator pedal."). But Paice fails to recognize that claim 23 does not preclude inputs from the driver as part of the control strategy. Indeed, claim 23 expressly calls for "determining the instantaneous torque RL required to propel said vehicle *responsive to an operator command*." Ex. 1001, 60:33–34. And the

[12] Even claim 5 of the '347 patent acknowledges that "said setpoint SP may be varied by said controller as [a] function of engine speed." Ex. 1001, 58:53–54.

specification of the '347 patent likewise explains that the microprocessor is "responsive to . . . evaluation of the road load, that is, the vehicle's instantaneous torque demands *and input commands provided by the operator of the vehicle*." *Id*. at 17:27–32; *see also id*. at 38:12–14 ("the torque required to propel the vehicle varies as indicated by the operator's commands"). The specification goes on to explain that the "operator input commands" monitored by the microprocessor include "the motion of accelerator and brake pedals 69 and 70," specifically, "the rate at which the operator depresses pedals 69 and 70 as well as the degree to which pedals 69 and 70 are depressed." *Id*. at 27:20–34. Given that the claims and specification of the '347 patent call for the controller to be responsive not only to road load but also to driver input commands (such as pedal position), we are not moved by Paice's attack on Severinsky for teaching this same feature.

As another purported difference, Paice argues that Severinsky's disclosure of a range of "*output* torques of the engine" is "unrelated to input torque demands taught by the '347 patent, for example, the instantaneous torque required to propel the vehicle (i.e., road load)." PO Resp. 14; *see also id*. at 22–23 ("the operating ranges identified by Severinsky are representative of the output torque of the engine and *not the [input] torque demand*"). In other words, according to Paice, "road load" (or "RL"), as used in the claims, refers to input torque, not output torque. This argument fails for the simple reason that the claims themselves express "road load" as a torque *output*, not an input. For example, claim 23 recites that the engine is employed "when the torque RL . . . is between said lower level SP [setpoint] and MTO [maximum torque output]." And claim 29, which

depends from claim 23, recites that "said setpoint SP is at least approximately 30% of MTO." Moreover, claim 7 states explicitly that "the value for road load (RL) and said setpoint (SP) [are] both expressed as percentages of the maximum torque *output*." Thus, we find disingenuous Paice's attempt to characterize "road load" as a torque "input" when the claims expressly state otherwise.

Paice also argues that Severinsky does not utilize the engine to charge the battery in the manner required by claim 23. PO Resp. 45–50. According to Paice, Severinsky "teaches a much less sophisticated approach" (*id*. at 47) that looks to "the state of charge of the battery and not road load" (*id*. at 46) in determining when to charge the battery. But the problem with that argument is that the claimed invention recites the same approach as Severinsky—using the "state of charge of the battery" to indicate when charging is necessary. For example, claim 23 recites that the engine is employed "to charge said battery when the *state of charge of the battery indicates* the desirability of doing so." Ex. 1001, 60:45–51. And like claim 23, Severinsky teaches a "battery charging mode" that is "*responsive to monitoring the state of charge of battery 22*." Ex. 1003, 15:1–10 (emphasis added). Severinsky further explains that

> microprocessor 48 monitors the state of charge of batteries 22 . . . and recharges the batteries whenever the charge is depleted by more than about 10-20%. . . . Under conditions of maximum battery usage, e.g., in heavy traffic . . . internal combustion engine 40 charges the battery perhaps once per hour for a period of approximately twelve minutes.

Id. at 18:9–22. Given these plain teachings, we find that a skilled artisan would have understood Severinsky to disclose the battery charging

limitation of claim 23, which, like Severinsky, is responsive to "the state of charge" of the battery.

In sum, we conclude Ford has demonstrated, by a preponderance of the evidence, that claim 23 would have been obvious over Severinsky. Also, we have considered Ford's evidence and argument against the patentability of dependent claim 36 (Pet. 33–34), which Paice does not argue separately, and likewise determine that it would have been obvious over Severinsky.

2. Claims 1, 6, 7, 9, 15, and 21—Obviousness over Severinsky and Ehsani

Ford challenges independent claim 1, as well as dependent claims 6, 7, 9, 15, and 21, on the ground that the claimed invention would have been obvious over the combined teachings of Severinsky and Ehsani. Pet. 34–51. Claim 1 recites a hybrid vehicle having *two* electric motors, one acting as a starter motor for the engine and another acting as a generator for the battery. Ex. 1001, 58:16–22. Acknowledging that Severinsky discloses a *single* electric motor having the dual functionality of both a starter motor and a generator, Ford points to the long history of starter motors in the automotive industry (dating back to 1912) as evidence that equipping Severinsky with a separate starter motor would have been nothing more than an obvious design choice in the eyes of skilled artisans at the time of the claimed invention. Pet. 36 (citing Ex. 1005 ¶¶ 329–333). Indeed, Severinsky recognizes as much, explaining that the decision to eliminate a separate starter motor was a function of "convenience" in terms of "cost, weight, and manufacturing." Ex. 1003, 21:39–55; *see also id*. at 6:36–39.

Nonetheless, Ford relies on Ehsani as teaching expressly the use of two electric motors in a hybrid vehicle. Pet. 37 (citing Ex. 1004, Fig. 5,

3:24–25, 8:32–34). And, we find credible the testimony of Ford's declarant, Dr. Davis, that a skilled artisan would have known (and been able) to modify the "one motor" hybrid vehicle of Severinsky to add a separate starter motor, as taught by Ehsani, so that "noise vibration and harshness (NVH) issues would be greatly minimized." Ex. 1005 ¶¶ 366–68.

Paice does not dispute that a skilled artisan would have had reason to combine the teachings of Severinsky and Ehsani. *See* PO Resp. 52–54. Instead, Paice argues that, even if properly combined, Ehsani does not remedy the deficiencies of Severinsky. *Id*. at 52. In so arguing, Paice raises the same arguments for patentability of claims 1, 7 and 9 as it made for claim 23, that is, "Severinsky does not consider torque demands when determining whether to employ the engine. It considers speed." *Id*. at 53; *see also id*. at 56, 57, 58 ("Severinsky does not consider road load . . . it uses speed as the one factor in determining when to employ the engine"). As discussed *supra* with respect to claim 23, Paice's assertions on this point are not persuasive. Because we already found that Severinsky considers torque in determining when to employ the engine, we reject Paice's arguments with respect to claims 1, 7, and 9 for the same reasons we rejected them with respect to claim 23. Paice does not argue claims 6, 15, and 21 separately. After considering the totality of Ford's evidence and arguments (Pet. 33–34, Reply 24–25), we determine that a preponderance of the evidence weighs against patentability of claims 1, 6, 7, 9, 15, and 21, on the basis that they would have been rendered obvious by Severinsky and Ehsani.[13]

[13] For claim 9, Paice also argues that Ehsani "teaches away" because it states that the generator motor "can be" smaller than the traction motor. PO Resp. 59. This disclosure by Ehsani does not teach away because it "does not

IV. CONCLUSION

In sum, we conclude Ford has demonstrated, by a preponderance of the evidence, that claims 23 and 36 would have been obvious over Severinsky, and that claims 1, 6, 7, 9, 15, and 21 would have been obvious over Severinsky and Ehsani.

V. ORDER

Accordingly, it is hereby:

ORDERED that claims 1, 6, 7, 9, 15, 21, 23 and 36 of the '347 patent are held unpatentable;

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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criticize, discredit, or otherwise discourage" the use of the engine to drive the generator motor for charging the battery. *See In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004).

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