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Paper 38
Entered: December 10, 2015

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 IPR2014-00884
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, 7, 10, 21, 23, and 24 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 decided to institute trial ("Dec. Inst.") because Ford demonstrated a reasonable likelihood that the challenged claims are unpatentable under 35 U.S.C. § 103. In due course, Paice filed a Patent Owner Response ("PO Resp."), and Ford followed with a Reply ("Reply"). Having heard oral argument on this matter,[1] and pursuant to our jurisdiction under 35 U.S.C. § 6(c), we determine Ford has proven that claims 1, 7, and 10 are unpatentable by a preponderance of the evidence, but has not carried its burden with respect to claim 24. Also, pursuant to 35 U.S.C. § 315(e)(1), we determine that Ford is estopped from maintaining its challenge against claims 21 and 23.

II. BACKGROUND

A. Related Proceedings

The instant Petition challenges several claims of the '347 patent that have been adjudicated previously in IPR2014-00571 and IPR2014-00579, but on different grounds. Specifically, those prior proceedings led to final written decisions in which claims 1, 7, 21, and 23 at issue here were determined to be unpatentable, among other claims of the '347 patent. *See* IPR2014-00571, Paper 44, 2015 WL 5782084 (PTAB Sept. 28, 2015); IPR2014-00579, Paper 45, 2015 WL 5782085 (PTAB Sep. 28, 2015).[2] We

[1] A transcript ("Tr.") has been entered into the record. Paper 36.
[2] Paice has filed notices of appeal from our final written decisions in the -571 and -579 proceedings.

granted institution of trial in the instant proceeding back in December 2014, well before our final written decisions in the -571 and -579 proceedings.

The ’347 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. 1; *see also* PO Resp. 7–8 (referencing the district courts’ claim construction). We are informed that, in the latter action, a jury trial was recently completed on October 1, 2015, and the parties are currently engaged in post-trial briefing.

B. The ’347 Patent

The ’347 patent describes a hybrid vehicle with an internal combustion engine, at least one electric motor, and a battery bank, all controlled by a microprocessor that controls the direction of torque between the engine, motor, and drive wheels of the vehicle. Ex. 1201, 17:5–45, Fig. 4. The microprocessor monitors the vehicle’s instantaneous torque requirements, or road load, to determine the source of torque necessary to propel the vehicle, be it the engine, the motor, or both. *Id*. at 11:60–62. Aptly, the ’347 patent describes the vehicle’s various modes of operation as an engine-only mode, an all-electric mode, or a hybrid mode. *Id*. at 35:66–36:58, 37:26–38:11.

In summarizing the invention, the ’347 patent states that 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*.

[3] The ’347 patent contrasts the claimed invention to prior control strategies “based solely on speed,” which are “incapable of responding to the

at 17:28–32. More specifically, "the microprocessor can effectively determine the road load by monitoring the response of the vehicle to the operator's command for more power." *Id*. at 37:44–51. "[T]he torque required to propel the vehicle [i.e., road load] varies as indicated by the operator's commands." *Id*. at 38:12–14. For example, the microprocessor "monitors the rate at which the operator depresses pedals [for acceleration and braking] as well as the degree to which [the pedals] are depressed." *Id*. at 27:21–34. These operator input commands are provided to the microprocessor "as an indication that an amount of torque" from the engine "will shortly be required." *Id*. at 27:36–53.

The microprocessor then compares the vehicle's torque requirements against a predefined "setpoint" and uses the results of the comparison to determine the vehicle's mode of operation. *Id*. at 40:20–55. The microprocessor may utilize a control strategy that runs the engine only in a range of high fuel efficiency, such as when the torque required to drive the vehicle, or road load (RL), reaches a setpoint (SP) of approximately 30% of the engine's maximum torque output (MTO). *Id*. at 20:52–60, 37:26–46; *see also id*. at 13:47–61 ("the engine is never operated at less than 30% of MTO, and is thus never operated inefficiently"). The microprocessor may also monitor other operating parameters to control the vehicle's mode of operation, such as the battery's state of charge and the operator's driving history over time. *Id*. at 19:53–60; *see also id*. at 37:23–26 ("according to one aspect of the invention, the microprocessor 48 controls the vehicle's mode of operation at any given time in dependence on 'recent history,' as

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operator's commands, and will ultimately be unsatisfactory." Ex. 1201, 13:35–38.

well as on the instantaneous road load and battery charge state"). According to the '347 patent, this microprocessor control strategy maximizes fuel efficiency and reduces pollutant emissions of the hybrid vehicle. *Id*. at 15:48–50.

B. The Challenged Claims

Of the challenged claims, claims 1 and 23 are independent. Claim 1 requires *two* electric motors, while claim 23 requires simply *one or more* electric motors. Claim 1 is illustrative and recites:

> 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. 1201, 58:13–37.

C. The Decision to Institute

In the preliminary proceeding, we instituted *inter partes* review on two grounds, determining Ford had demonstrated a "reasonable likelihood" that (1) claims 1, 7, 10, and 21 are unpatentable as obvious over Caraceni,[4] and (2) claims 23 and 24 are unpatentable as obvious over Tabata '201[5] and Tabata '541.[6] Dec. Inst. 14–15. We now determine whether Ford has proven the unpatentability of these claims by a "preponderance of the evidence." 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)."[7]

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[4] A. Caraceni et al., *Hybrid Power Unit Development for Fiat Multipla Vehicle*, SAE TECHNICAL PAPER 981124, pub. 1998 (Ex. 1203, "Caraceni").
[5] U.S. Patent No. 5,841,201, iss. Nov. 24, 1998 (Ex. 1204, "Tabata '201").
[6] U.S. Patent No. 6,158,541, iss. Dec. 12, 2000 (Ex. 1205, "Tabata '541").
[7] Although Ford also proposes a construction for the terms "low-load mode I," "highway cruising mode IV," and "acceleration mode V" (Pet. 17), those terms are expressly defined by claim 7. Ex. 1201, 58:58–59:8. As such, they do not require further construction.

1. "Road load" or "RL"

The term "road load" or "RL" does not appear in independent claim 1, but is found in independent claim 23, as well as dependent claims 7 and 21. Both Ford and Paice agree that "road load" means the instantaneous torque required to propel the vehicle. Pet. 14–15; PO Resp. 7, 17. That proposed construction comports with the specification, which 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." Ex. 1201, 12:38–42.

In further defining road load, the specification notes that "the operator's depressing the accelerator pedal signifies an increase in desired speed, *i.e., an increase in road load*, while reducing the pressure on the accelerator or depressing the brake pedal signifies a desired reduction in vehicle speed, *indicating that the torque being supplied is to be reduced or should be negative*." *Id*. at 12:42–51 (emphases added). As such, the specification states that road load "can be positive or negative." *Id*. at 12:51–54. Thus, consistent with the specification, we construe "road load" or "RL" as "the amount of instantaneous torque required to propel the vehicle, be it positive or negative."

2. "Setpoint" or "SP"

The term "setpoint" or "SP" is found in independent claims 1 and 23, as well as dependent claim 7. Ford proposes that "setpoint" be construed, in the context of the claims, as a "predetermined torque value." Pet. 15, 17. In that regard, Ford correctly notes that the claims compare the setpoint against a *torque* value. *Id*. at 16. For example, claim 1 speaks of the "setpoint" or "SP" as being the lower limit at which the engine can produce torque efficiently, i.e., "*when torque require[d]* to be produced by said engine to

propel the vehicle . . . *is at least equal to a setpoint (SP)* above which said engine torque is efficiently produced."[8] Ex. 1201, 58:29–34. Similarly, claim 23 recites "employing said engine to propel said vehicle when the torque RL required to do so is between said lower level SP and MTO," where MTO stands for maximum *torque* output. *Id*. at 60:39–41. This express language suggests that "setpoint" is not just any value, but a value that—per the surrounding claim language—equates to "torque." *See 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").

Paice, on the other hand, argues that "setpoint" is synonymous with a "transition" point, not a torque value. PO Resp. 9–12. Citing the specification, Paice urges that "setpoint" must be construed to indicate a point "at which a transition between operating modes may occur." *Id*. at 9. Paice's argument is misplaced. While Paice is correct that *sometimes* the specification describes the setpoint in terms of a "transition point" (s*ee id*. at 10), the claim language itself makes clear that setpoint relates simply to a torque value, without requiring that it be a transition point. 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 parameters. For instance,

[8] Paice's declarant, Mr. Neil Hannemann, agreed that, given the "comparison" being made by this claim language, the "most straightforward" construction is that "setpoint is a torque value." Ex. 1246, 79:16–80:25.

> 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. 1201, 19:58–64 (emphasis added). That disclosure suggests that a transition does not spring simply from the recitation of "setpoint." As such, we will not import into the meaning of "setpoint" an extraneous limitation that is supported by neither the claim language nor the specification.

Moreover, that a "setpoint" does not mean a *per se* transition between operating modes is reinforced by the fact that only the dependent claims, for example, claims 3 and 10, describe the "setpoint" in terms of a "transition" between operating modes. *See id*. at 58:41–47, 59:25–29. 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, we reject Paice's attempt to further limit the meaning of setpoint to a transition between operating modes.

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, 40:55–58. But, just because a setpoint may be reset under certain circumstances 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, we construe "setpoint" as a "predetermined torque value that may or may not be reset."

Finally, Paice argues that any construction limiting the meaning of setpoint to a "torque value" would be "directly at odds with the construction adopted by two district courts" in related litigation.[10] PO Resp. 7–8. Although, generally, we construe claim terms under a different standard than a district court, and thus, are not bound by a district court's prior construction, Paice's emphasis on the district court's construction compels us to address it. *See Power Integrations, Inc. v. Lee*, 797 F.3d 1318, 1327 (Fed. Cir. 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").

In that regard, the district court 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.

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

[10] *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).

Ex. 1211, 13 (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, supra*. Here, the claims instruct us that "setpoint," when read in the context of the surrounding language, is limited to a torque value. As for the district court's statement that the battery's state of the charge is compared to a setpoint, we note that *the claims* actually speak of comparing the "state of charge of the battery" to "a predetermined level," not the "setpoint" or "SP" recited elsewhere in the claims. *See, e.g.*, Ex. 1201, 59:13–16, 61:33–36 (dependent claims 9 and 31, respectively). Thus, in the context of the claims, we decline to read "setpoint" as also encompassing a state of charge of the battery, as the district court did. Instead, we construe "setpoint" as representing a torque-based value.

3. "Monitor Patterns of Vehicle Operation Over Time"

Claim 24 recites that the controller is operable to "monitor patterns of vehicle operation over time." Ford does not explicitly propose a construction for this phrase, other than to argue it should be construed "according to its plain and ordinary meaning." Reply 3. Paice, on the other hand, argues that this phrase should be construed to mean that the controller "tracks and records the driver's repeated driving operations over time." PO Resp. 13.

According to Paice, the specification of the '347 patent supports a construction that monitoring the patterns of vehicle operation over time refers to how the operator actually drives the vehicle over some period of time, as opposed to monitoring an internal data point of the vehicle. PO

Resp. 13–16. Specifically, Paice points to the following descriptions in the specification:

> Examples of this practice—amounting in many circumstances to modifying certain specific values depending on other data items not discussed in detail, *or by monitoring the vehicle's actual usage patterns over time*—are given below.

Ex. 1201, 35:47–58 (emphasis added).

> It is also within the scope of the invention for the microprocessor to monitor the vehicle's operation over a period of days or weeks and reset this important setpoint *in response to a repetitive driving pattern*. For example, suppose the operator drives the same route from a congested suburban development to a workplace about the same time every morning; typically the road load might remain under 20% of MTO for the first few minutes of each day, then vary between 0 and 50% of MTO for another few minutes as the operator passes through a few traffic lights, and then suddenly increase to 150% of MTO as the operator accelerates onto a highway. *It is within the skill [in] the art to program a microprocessor to record and analyze such daily patterns, and to adapt the control strategy accordingly*. For example, *in response to recognition of a regular pattern as above, the transition point might be adjusted to 60% of MTO*; this would prevent repetitive engine starts as the road load exceeded 30% of MTO for a few hundred yards at a time, as might often occur in suburban traffic. Similarly, the engine starting routine might be initiated after the same total distance had been covered each day.

Id. at 40:56–41:9 (emphasis added).

Although Ford does not provide an explicit construction for the phrase "monitor patterns of vehicle operation over time," Ford implicitly construes the phrase to encompass monitoring the battery state of charge and adjusting the control strategy based on that state of charge. Pet. 55–56 (citing Ex. 1215 ¶¶ 468–471). As shown above, however, the specification makes clear

that the "patterns" recited by claim 24 are the repetitive and regular driving patterns *of the vehicle's operator*, not some internal data point of the vehicle itself (such as battery state of charge). Ex. 1201, 40:56–41:9. Indeed, the specification draws a clear distinction between changing the control strategy in response to monitored battery state of charge ("BSC") and changing it in in response to monitored driving patterns. *See*, *e.g.*, Ex. 1201, 44:23–39 ("it may be desirable to vary the operation of the system insofar as responsive to BSC in accordance with monitored variables indicative of battery temperature, ambient temperature, and the like"). Notably, the specification makes no mention of monitoring "patterns" of a battery state of charge.

Moreover, the plain words of claim 24 require monitoring patterns over time. It is not enough to monitor a single variable of a vehicle component, such as battery state of charge. Rather, the plain meaning of the words require monitoring *patterns*, particularly where the specification speaks of patterns in terms of regular and repetitive usage *by the operator* of the vehicle, not a component of the vehicle. Thus, we agree with Paice that the phrase "monitoring patterns of vehicle operation over time" means monitoring a driver's repeated driving operations over time.

B. The Instituted Grounds

1. Estoppel—Claims 21 and 23

Ford is estopped from maintaining its challenge against claims 21 and 23 in the instant proceeding because the asserted grounds are based on prior art that Ford was aware of, and could have raised, in prior proceedings challenging the same claims. Specifically, claims 21 and 23 were the subject of the related -571 and -579 proceedings discussed above (*see* section II.A.), in which final written decisions were entered. In those prior

proceedings, claims 21 and 23 were adjudged to be unpatentable on grounds that differ from the Caraceni-based and Tabata-based grounds asserted against claims 21 and 23, respectively, in the instant proceeding.

Under 35 U.S.C. § 315(e)(1), once a petitioner has obtained a final written decision on a patent claim in an *inter partes* review, that petitioner 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.

The prerequisites for applying estoppel are satisfied here because: (1) Ford is the petitioner in the instant proceeding and in the prior -571 and -579 proceedings; and (2) the -571 and -579 proceedings resulted in final written decisions. With those prerequisites in place, our determination of whether to apply estoppel turns on whether Ford could have raised the prior art asserted here—Caraceni against claim 21, and Tabata '201 and Tabata '541 against claim 23—in the -571 and/or -579 proceedings.

What a petitioner "reasonably could have raised" includes prior art that a skilled advocate would have been expected to discover and proffer in the course of conducting due diligence on the patent at issue. Here, we need not speculate about what reasonably could have been discovered and proffered, because the record demonstrates that Ford must have known of Caraceni, Tabata '201, and Tabata '541 at the time of the -571 and -579

Petitions, and if not, such knowledge should be imputed to it. More specifically, with respect to the Tabata references, they were cited during prosecution that led to the '347 patent and are listed on the face of the patent. Ex. 1201, 3, 4. As such, Ford was on notice of the existence of the Tabata references as potential prior art to the '347 patent before it filed the -571 and -579 Petitions.

In addition, Ford could have raised the Caraceni reference against claim 21 in the -571 and -579 proceedings because it was asserted in a related petition, IPR2014-00570, that Ford filed on the very same day as the -571 and -579 Petitions. Thus, Ford must have known, or should have known, of Caraceni's potential application to claim 21 before it filed the -571 and -579 Petitions. Under these circumstances, we determine that the Caraceni and Tabata references constitute grounds that Ford reasonably could have asserted against claims 21 and 23 in the original -571 and -579 Petitions. Accordingly, Ford is estopped under 35 U.S.C. § 315(e)(1) from now maintaining those grounds against claims 21 and 23 in the instant proceeding.

2. Claims 1, 7, and 10—Obviousness over Caraceni

Ford challenges independent claim 1, and dependent claims 7 and 10, on the ground that the claimed invention would have been obvious over the teachings of Caraceni.[11] Pet. 18–42. In support of this ground, Ford

[11] This is the first instance in which Ford challenges dependent claim 10. Thus, unlike claim 21, which Ford is estopped from pursuing (as discussed above), claim 10 was not the subject of the prior -571 and -579 proceedings that resulted in final written decisions. And, although claims 1 and 7 were the subject of final written decisions in the -571 and -579 Petitions, we exercise our discretion to maintain the instant proceeding against claims 1

provides a detailed analysis of how Caraceni meets each limitation of the challenged claims and why a skilled artisan would have found the claimed invention obvious over Caraceni and the general state of the art. *Id*. at 21–42.

a. Claim 1

At the outset, we find that Caraceni teaches the essential components of a hybrid vehicle, which like claim 1, include: (1) an internal combustion engine that provides propulsive torque to the wheels of the vehicle, (2) an electric motor that is also capable of providing propulsive torque to the wheels, (3) a battery that provides electrical current to the motor, and (4) a controller, or "Vehicle Management Unit" (VMU), that controls operation of the engine and motor in a "hybrid mode" and a "recharge mode." *Compare* Figs. 2, 10 of Ex. 1003 (Caraceni) *with* Fig. 4 of Ex. 1201 (the '347 patent); *see also* Ex. 1215 ¶ 201 (depicting Caraceni's Figs. 2, 10 as annotated by Ford's declarant, Dr. Davis). Also, with respect to a separate starter motor for the engine (i.e., the "first electric motor" of claim 1), Caraceni teaches an "engine starter." Ex. 1203, Fig. 10. Although Caraceni does not disclose that the engine starter is an electric motor *per se*, we are persuaded that a

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and 7 because they are incorporated within the body of claim 10 as a matter of dependency. *See* 35 U.S.C. § 315(e)(1) (neither the plain terms of this provision, nor chapter 31 more generally, prohibits the Board from entering final decisions where it sees fit); *see also* 35 U.S.C. § 325(d) (conferring authority on the Board to decide how to deal with multiple proceedings). In any event, whatever renders obvious a dependent claim necessarily renders obvious the claims from which it depends.

skilled artisan would have understood Caraceni's "engine starter" to be an electric motor.[12] *See* Ex. 1215 ¶¶ 210–215.

In an attempt to distinguish the claimed invention from the hybrid configuration taught by Caraceni, Paice raises a number of arguments directed to certain functional aspects of the controller of claim 1. PO Resp. 18–43.

"Engine . . . to Propel the Vehicle"

First, Paice contends that Caraceni fails to teach or suggest starting and operating the engine to propel the vehicle in response to a "setpoint," as required by claim 1. PO Resp. 19–32. In particular, Paice argues that, instead of a setpoint, Caraceni "relies on the driver to decide when to turn the engine on." *Id*. at 19. According to Paice, Caraceni discloses that the driver manually selects when to operate the engine, whereas, in the claimed invention, the controller automatically determines when to operate the engine. *Id*. at 20 (citing Ex. 1203, 5–6); *see also id.* at 23 ("the user in Caraceni" selects when to operate the engine, "not the control system").

We are not persuaded that Caraceni controls operation of the engine on *manual* basis. Our review of Caraceni supports a contrary finding. Although Paice is correct that Caraceni permits the driver to manually select whether the vehicle will be operated as an all-electric vehicle, an engine-only vehicle, or a hybrid vehicle, it is only the vehicle's operation in a hybrid mode that Ford relies on to satisfy the "controller" and "setpoint" limitations of claim 1. In that regard, Caraceni states that "a proper combination of thermal engine operation for cruising, and electric motor for

[12] Paice does not dispute that Caraceni meets the "first electric motor" limitation of claim 1.

acceleration can be used to minimize fuel consumption and emissions." Ex. 1203, 6. In other words, Caraceni splits the power between the engine (one drive train) and the electric motor (another drive train) in order to maximize fuel efficiency.

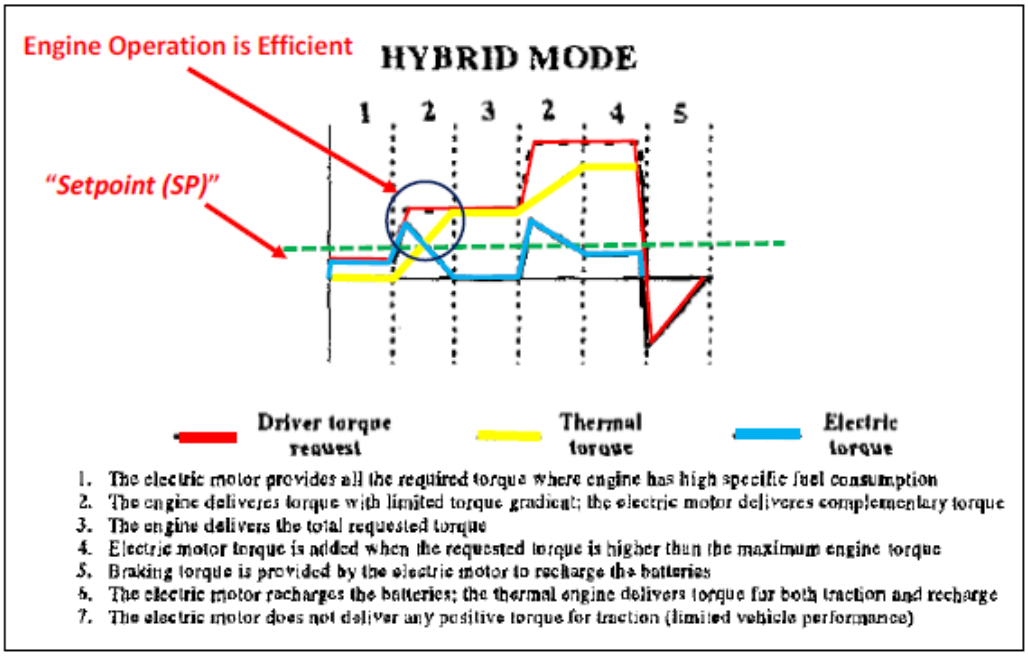
Caraceni then makes clear that, while operating in the "hybrid mode," activation of the engine is controlled *automatically* by a Vehicle Management Unit (VMU), not manually by the driver.

> The hybrid system is managed by a Vehicle Management Unit (VMU) which implements the working strategies of the vehicle and *activates the two drive trains* through the inverter for the electric motor and the engine electronic control unit respectively.

Ex. 1203, 6 (emphasis added). Ford's declarant, Dr. Davis, explains that the VMU is a controller that receives and transmits commands to an "electromagnetic clutch switch" connected to the engine's transmission for controlling activation and operation of the engine. Ex. 1215 ¶¶ 205–209, 251–252 (citing Ex. 1203, Fig. 10). Dr. Davis further explains that, in the hybrid mode, the VMU controls operation of the electric motor through an "inverter interface" to act as either a traction motor or a generator. *Id*. ¶¶ 218–220, 230–237, 269. Based on Dr. Davis's testimony of a skilled artisan's understanding of Caraceni, we find that Caraceni teaches a controller that automatically starts and operates the engine in a hybrid mode, as required by claim 1.

With respect to the controller's use of a "setpoint" as a basis for starting and operating the engine, we credit Dr. Davis' testimony that Figure 9 of Caraceni illustrates that the engine is not started until the torque

demand exceeds a predetermined torque value. Ex. 1215 ¶¶ 259–287. Figure 9, as annotated by Dr. Davis, is reproduced below.



Ex. 1203, Caraceni, Fig. 9 (annotated)

Figure 9 depicts the torque provided by the thermal engine (yellow line) and the electric motor (blue line) in the hybrid mode in response to various phases of torque demand (red line). In region 1, Dr. Davis explains, the engine is off (horizontal black line) and the motor alone is activated to propel the vehicle because the engine operates inefficiently at low torque demands. Ex. 1215 ¶¶ 275–279, Ex. 1248 ¶¶ 8–12, 16–17. However, as driver torque demand increases in the transition from region 1 to region 2, the engine is started and operated to propel the vehicle because the engine can operate more efficiently at higher torque levels. *Id*. According to Dr. Davis, a skilled artisan would have understood that the point at which the engine takes over for the motor occurs at a predetermined torque level, or

"setpoint," which Dr. Davis indicates with a green line in annotated Figure 9. *Id*.

We credit Dr. Davis's testimony that the VMU, or controller, in Caraceni does not activate the engine until the torque demand reaches a predetermined torque level. Even Paice's declarant, Mr. Hannemann, acknowledges that the point at which the engine is started in Caraceni's Figure 9 "is something that the engineer developing and calibrating the vehicle has to program in to the vehicle . . . [i]t's something that's just built in to the calibration of the vehicle." Ex. 1243, 116:16–117:19. Dr. Davis confirmed this as well. Ex. 1248 ¶¶ 16–17. That the operational point for the efficient production of torque by the engine would have been programmed into the vehicle as part of the calibration process suggests that is predetermined. As such, we conclude that a skilled artisan would have understood Caraceni's Figure 9 as depicting a "hybrid mode" that starts and operates the engine based on a "setpoint," as required by claim 1.

Paice responds by arguing that Ford and Dr. Davis are relying on "inherency" to prove Caraceni's disclosure of a "setpoint." PO Resp. 24–30. Paice's argument is misplaced. Ford never relies on the doctrine of inherency in making its obviousness case. Pet. 29–32. Rather, Ford utilizes the testimony of Dr. Davis to explain what a skilled artisan would have understood from Caraceni's Figure 9, that is, the point at which the engine takes over for the motor in Figure 9's "hybrid mode" is a predetermined torque value, or setpoint, for the engine (as discussed above). *See* Ex. 1215 ¶¶ 262–279, Ex. 1248 ¶¶ 6–8. As such, we reject Paice's attempt to inject the heightened standard for inherency into the obviousness analysis.

"Engine . . . to Charge Said Battery"

Second, Paice argues that Caraceni's controller, or VMU, does not "start and operate" the engine to drive the electric motor to charge the battery, as required by claim 1. PO Resp. 38–40. Importantly, it should be noted that this limitation of starting and operating the engine to charge the battery is recited as an alternative to the limitation of starting and operating the engine to propel the vehicle, the latter which we discuss above. *See* Ex. 1201, 58:29–32 (claim 1 using the disjunctive "and/or"). As such, Caraceni need only satisfy one of these limitations. Nonetheless, we determine that Caraceni teaches this second, alternative use of the engine for powering the motor to recharge the battery.

According to Paice, "the driver, not the controller, starts and operates the engine to charge the battery" during Caraceni's "recharge mode." *Id*. at 38–39. But Caraceni expressly illustrates the "recharge mode" within the purview of Figure 9, which depicts the "torque management" strategy *of the controller, or VMU*. Ex. 1203, 6 ("Figure 9 shows a typical torque management"). And Figure 9 states that, when the electric motor recharges the battery, "the thermal engine delivers torque for both traction *and recharge*." Ex. 1203, Fig. 9 (passage 6). And as Dr. Davis testifies, when the VMU determines that recharging is needed, the engine operates above a setpoint to power the motor to charge the battery, as required by claim 1. Ex. 1215 ¶¶ 283–286; *see also* Ex. 1248 ¶¶ 24–27 (regarding Caraceni's disclosure of the VMU "automatically switching" to recharge mode if the battery falls "below a certain threshold"). Given that Figure 9 speaks of the "recharge mode" in connection with the VMU, as well as Dr. Davis's testimony as to the "setpoint" in Figure 9, we find that Caraceni teaches that

the controller, not the driver, starts and operates the engine for purposes of recharging the battery. As such, we find that Caraceni teaches both of the functional limitations of the controller of claim 1.

"Battery, for Providing Current to Said Motors"

Claim 1 requires "a battery" that provides current "to said motors," with the motors being the "first electric motor" that starts the engine and the "second electric motor" that propels the vehicle. Paice argues that Caraceni's "engine starter" is incapable of accepting current from a "hybrid battery." PO Resp. 41. According to Paice, the "first electric motor" of claim 1 is "more powerful," as compared to Caraceni's "engine starter," because the claimed motor can "spin the engine at higher speed" and accept "at least about 30% of the engine's maximum torque output." *Id.* at 40–41. We are not persuaded by Paice's attempt to read limitations into the claim that are not there.

At the outset, we note the claim does not require a "hybrid" battery, but simply "a battery." In any event, with respect to the "first electric motor," Paice relies on aspects not found in the language of claim 1, but rather in embodiments described by the specification. In other words, Paice improperly imports limitations into the "first electric motor" that are not part of the claim. *See Phillips v. AWH Corp.*, 415 F. 3d 1303, 1323 (Fed. Cir. 2005). Under a proper lens, Caraceni's starter motor satisfies the "first electric motor" limitation of claim 1.

We also reject Paice's assumption that Caraceni's engine starter depends on a standard "12V or 24V" battery, separate from the hybrid "traction battery" taught by Caraceni. PO Resp. 41–44. Nowhere does Caraceni disclose that the "engine starter" is connected to a standard battery.

Ex. 1203, Figure 10. Instead, Caraceni consistently refers only to the "traction battery." *Id*. Even so, as a matter of common sense, a skilled artisan would have readily understood that the "engine starter" needed to be connected, directly or indirectly, to one of the battery packs that make up the "traction battery" in order to be recharged. Ex. 1215 ¶¶ 210–215, 246, 248. As such, we find that a skilled artisan would have understood that Caraceni's traction battery provides current to the engine starter, i.e., first electric motor, as required by claim 1.

b. Claim 7—"Road Load"

Paice also argues that Caraceni does not operate the vehicle in response to "road load," as required by claim 7. PO Resp. 32–37. According to Paice, Caraceni's reliance on "accelerator pedal position" to indicate the "required traction torque" is not determinative of "road load." *Id*. at 34–36 (citing Ex. 2215 ¶¶ 88–95). But Paice fails to explain how Caraceni's disclosure of using "required traction torque," as set by the accelerator pedal position, differs from our construction of "road load" as the "instantaneous torque required to propel the vehicle." *See id*. at 32–37. In our view, Caraceni's use of the "required traction torque" to select operation of the engine and/or motor in the hybrid mode, as shown by each of the regions in figure 9 of Caraceni, is no different than the use of "road load" as recited by claim 7. *See* Ex. 1215 ¶¶ 297–317. Moreover, Paice's argument that pedal position does not indicate road load is belied by the '347 patent itself, which states that depressing the accelerator pedal "signifies . . . an increase in road load." Ex. 1201, 12:42–51. As such, we are not persuaded by Paice's attempt to draw a distinction from Caraceni on the basis of our construction of "road load."

c. Claim 10

Paice does not raise arguments for dependent claim 10 that are separate and distinct from those for claims 1 and 7. Absent any rebuttal to Ford's evidence and arguments in that regard, we are not obligated to roam the record in an attempt to locate evidence supporting patentability of claim 10. Perfunctory or undeveloped arguments are waived. Here, we have considered the evidence and arguments presented by Ford in challenging the patentability of claim 10. Pet. 41–42. Left unrebutted, Ford's evidence and arguments persuade us that claim 10 would have been obvious over the teachings of Caraceni. *Cf. Texas Dept. of Community Affairs v. Burdine*, 450 U.S. 248, 254 (1981) (holding that "[i]f the trier of fact believes the plaintiff's evidence, and if the [defendant] is silent in the face of the presumption, the court must enter judgment for the plaintiff because no issue of fact remains in the case").

2. Claim 24—Obviousness Over Tabata '201 and Tabata '541

Claim 24, which depends from claim 23, recites the additional step of "employing said controller to monitor patterns of vehicle operation over time and vary said setpoint SP accordingly."[13] Ford acknowledges that Tabata '201 does not disclose the step of claim 24, but argues that Tabata '541 does. Pet. 55–56; Ex. 1215 ¶ 464. According to Ford, Tabata '541

[13] Unlike claim 23, which Ford is estopped from pursuing (as discussed above), claim 24 was not the subject of the prior -571 and -579 proceedings that resulted in final written decisions. The instant Petition is the first in which Ford challenges claim 24 and the first in which the Board instituted *inter partes* review of claim 24. Although another Petition, IPR2015-00794, followed this one and also challenged claim 24, our denial of institution in that proceeding has no estoppel effect under 35 U.S.C. § 315(e)(1) because a denial of institution is not a final written decision of the Board.

discloses varying a setpoint in response to "monitored and stored battery parameters" that include "battery charging efficiency, battery voltage, and battery temperature." Pet. 55–56 (citing Ex. 1205, 36:40–59, Ex. 1215 ¶¶ 468–471).

As discussed above in our claim construction, we construe "monitoring patterns of vehicle operation over time" to require monitoring *a driver's* repeated driving operations over time. Also, as discussed above, we reject any construction that encompasses monitoring the vehicle's internal variables, such as battery state of charge. Given that clear construction, we are not persuaded that Tabata '541's disclosure of monitoring the vehicle's battery state of charge (or "SOC") equates to claim 24's requirement of monitoring a driver's driving patterns over time. Accordingly, we determine that Ford has not demonstrated a prima facie case of obviousness with respect to claim 24.

IV. CONCLUSION

In sum, after considering the arguments and evidence presented by the parties' submissions, we conclude that Ford has demonstrated, by a preponderance of the evidence, that claims 1, 7, and 10 would have been obvious over the teachings of Caraceni. Also, we deny the challenge against claim 24 because Ford failed to carry its burden. Finally, we dismiss the challenge against claims 21 and 23 under the estoppel provision of 35 U.S.C. § 315(e)(1).

V. ORDER

Accordingly, it is hereby:

ORDERED that the challenge against claims 21 and 23 of the '347 patent is *dismissed*;

FURTHER ORDERED that claims 1, 7, and 10 of the '347 patent are held unpatentable and should be *cancelled*;

FURTHER ORDERED that the challenge against claim 24 of the '347 patent is *denied*; 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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