Trials@uspto.gov
571-272-7822

Paper 44
Entered: September 28, 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 IPR2014-00570
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

Ford Motor Company ("Ford") filed a Petition ("Pet.") for *inter partes* review of claims 30–33, 35, 36, 38, and 39 of U.S. Patent No. 8,214,097 B2 ("the '097 patent"), which is owned by Paice LLC & The Abell Foundation, Inc. (collectively, "Paice"). In a preliminary proceeding, we determined a reasonable likelihood existed that claims 30–33, 35, 36, and 39 are unpatentable under 35 U.S.C. § 103, and instituted trial of those claims, but we denied review of claim 38. As to the triable claims, 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 claims 30–33, 35, 36, and 39 are unpatentable.

II. BACKGROUND

A. The '097 patent[2]

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 directs the transfer of torque from the engine and/or motor to the drive wheels of the vehicle. Ex. 1001, 17:5–45, Fig. 4. The microprocessor features a control strategy that limits the rate of increase of the engine's output torque so that fuel combustion occurs near a stoichiometric air-fuel ratio. *Id*. at 37:2–42. By limiting the rate of

[1] A transcript ("Tr.") has been entered into the record. Paper 43.

[2] The '097 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, and *Paice LLC v. Hyundai Motor Co.*, No. 1:12-cv-00499 (D. Md.), filed Feb. 16, 2012. Pet. 2.

increasing engine torque and maintaining a near stoichiometric air-fuel mixture, the hybrid control strategy improves fuel economy and reduces undesirable emissions during starting and normal operation of the vehicle. *Id*. at 36:60–37:6, 38:62–39:14.

B. The challenged claims

Claim 30 is the only independent claim on review. Pet. 3. Claims 31, 32, 35, 36, and 39 depend directly, and claim 33 depends indirectly, from claim 30. Claim 30 recites:

> 30. A hybrid vehicle, comprising:
>
> one or more wheels;
>
> an internal combustion engine operable to propel the hybrid vehicle by providing torque to the one or more wheels, wherein said engine has an inherent maximum rate of increase of output torque;
>
> at least one electric motor operable to propel the hybrid vehicle by providing torque to the one or more wheels;
>
> a battery coupled to the at least one electric motor, operable to provide electrical power to the at least one electric motor; and
>
> a controller, operable to control the flow of electrical and mechanical power between the engine, the at least one electric motor, and the one or more wheels, responsive to an operator command;
>
> wherein said controller controls said at least one electric motor to provide additional torque when the amount of torque being provided by said engine is less than the amount of torque required to operate the vehicle; and
>
> wherein said controller controls said engine such that a rate of increase of output torque of said engine is limited to less than said inherent maximum rate of increase of output torque, and wherein the controller is operable to limit the rate of change of torque produced by the engine such that combustion of fuel within the engine occurs at a substantially stoichiometric ratio.

Ex. 1001, 60:4–29.

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 30, 31, 35, 36, and 39 were unpatentable as obvious over the combined teachings of Severinsky[3] and Anderson;[4] that claim 32 was unpatentable as obvious over the teachings of Severinsky, Anderson, and Yamaguchi;[5] and that claim 33 was unpatentable as obvious over the teachings of Severinsky, Anderson, Yamaguchi, and Katsuno.[6] Dec. to Inst. 10–12. We now decide whether Ford has proven the unpatentability of these same claims by a "preponderance of the evidence." 35 U.S.C. § 316(e).

III. ANALYSIS

A. Claim construction

Ford asks that we construe the term, "rate of change," as used in claim 30, to mean "rate of increase" because that construction is consistent with an amendment that was requested during prosecution but "mistakenly failed" to get processed, even though the amendment was made for other occurrences of the same term, "rate of change," found elsewhere in the claim. Pet. 22–23. Without that construction, Ford argues, the term "rate of change" in claim 30 is left with "no antecedent basis." *Id*. at 23. Paice does not oppose Ford's proposed construction, and we see merit in such a construction. Thus, we conclude that the term "rate of change" is properly

---

[3] U.S. Patent No. 5,343,970, iss. Sept. 6, 1994 (Ex. 1009, "Severinsky").
[4] C. Anderson & E. Pettit, *The Effects of APU Characteristics on the Design of Hybrid Control Strategies for Hybrid Electric Vehicles*, SAE TECHNICAL PAPER 950493 (1995) (Ex. 1006, "Anderson").
[5] U.S. Patent No. 5,865,263, iss. Feb. 2, 1999 (Ex. 1007, "Yamaguchi").
[6] U.S. Patent No. 4,707,984, iss. Nov. 24, 1987 (Ex. 1008, "Katsuno").

construed to mean "rate of increase." No other claim terms require an express construction for us to analyze the challenged claims relative to the asserted prior art.

B. Claims 30, 31, 35, 36, and 39—Obviousness over Severinsky and Anderson

Ford relies on Severinsky and Anderson as together teaching the limitations of claims 30, 31, 35, 36, and 39. Pet. 46–54. Ford also advances a reason why a skilled artisan would have combined their teachings to arrive at the claimed invention. *Id*. at 50–51. Specifically, like the claimed invention, 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 operation of the engine and motor. *Compare* Ex. 1009, Fig. 3 (Severinsky) *with* Ex. 1001, Fig. 4 (the '097 patent). Also, Severinsky teaches that "stoichiometric combustion" is important to "lower the toxic hydrocarbon and carbon monoxide emission" of the engine. Ex. 1009, 12:13–17.[7]

Acknowledging that Severinsky does not disclose achieving stoichiometric combustion by limiting the "rate of increase," or "rate of change," of the engine's output torque, as required by claim 30, Ford relies on Anderson as teaching this limitation. Pet. 49–50 (citing Ex. 1006, 7). Notably, Anderson discloses a hybrid control strategy that "maintains the stoichiometric air fuel ratio" of the engine by limiting "engine starts and transients," and more specifically, by performing "slow transients" so the

[7] Ford's declarant, Dr. Stein, whose testimony we credit, confirms the teachings of Severinsky with respect to the basic elements and functions recited by claim 30, i.e., the engine, motor, battery, and controller. Ex. 1002 ¶¶ 324–346.

"speed of the transient" is not "too fast."[8] Ex. 1006, 7. The benefit of this strategy, according to Anderson, is that "[hydrocarbon and carbon monoxide] emissions are minimized." *Id*. In combining Severinsky and Anderson, Ford submits that supplementing Severinsky's engine control strategy with Anderson's "slow transients" strategy would have been obvious to a skilled artisan because both references correlate "stoichiometric" combustion with minimizing carbon emissions. Pet. 51 (citing Ex. 1002 ¶ 397).

Paice, in turn, argues primarily two points in response to Ford's reliance on the combination of Severinsky and Anderson: *first*, the references fail to teach or suggest the "controller" and associated functions recited in the "wherein" clauses of claim 30; and, *second*, the references cannot be combined because Severinsky's "parallel" hybrid control strategy "teaches away" from Anderson's "series" hybrid control strategy. PO Resp. 2, 8–9. We are not persuaded by either of Paice's arguments.

1. The "controller" element of claim 30

Paice argues that "Ford has failed to prove that the combination of Severinsky and Anderson disclose[s] or suggest[s] a controller, responsive to an operator command, that controls both the electric motor and engine," as required by claim 30. PO Resp. 23. This argument lacks merit for the simple reason that Severinsky discloses a controller in much the same way as claim 30 requires.

---

[8] The term "transients" is used to describe relatively short-term events between steady-state conditions. The engine "transients" disclosed in Anderson refer to the relatively rapid changes in the output torque of the engine due to a change in the amount of torque requested. The speed of the transient refers to its rate of change. Ex. 1002 ¶ 348.

First, and foremost, Severinsky discloses that "microprocessor 48 controls the flow of torque between the motor 20, the engine 40, and the wheels 34 responsive to the mode of operation of the vehicle." Ex. 1009, 10:27–30. Severinsky further discloses that the microprocessor (i.e., controller) "responds to operator commands." *Id*. at 12:60–64, Fig. 3 (inputting "Operator Commands" to "µP Controller"). Those disclosures are virtually identical to the language of claim 30, which requires "a controller, operable to control the flow of electrical and mechanical power between the engine, the at least one electric motor, and the one or more wheels, responsive to an operator command." *See* Ex. 1002 ¶¶ 340–343. Thus, we find that Severinsky teaches the "controller" element of claim 30.

2. The first "wherein" clause of claim 30

Paice next argues that, with respect to the combination of Severinsky and Anderson, "[t]here is no disclosure that the motor provides additional torque when the amount of torque being provided by the engine is less than the capabilities of the engine," as required by claim 30. PO Resp. 22. We disagree. Severinsky discloses this limitation, which requires that the controller activate the electric motor "to provide additional torque" when the torque required to propel the vehicle exceeds the torque output of the engine. Put simply, the electric motor helps the engine drive the vehicle when the engine cannot do it alone.

As Severinsky expressly teaches, the "*[m]icroprocessor 48* monitors the operator's inputs and the vehicle's performance, and *activates electric motor 20 when torque in excess of the capabilities of engine 40 is required*." Ex. 1009, 14:15–18 (emphases added). For example, "[i]f the vehicle then starts to climb a hill, *the motor 20 is used to supplement the output torque of* *engine 40*." *Id*. at 10:36–38 (emphasis added). Likewise, Severinsky specifies "a highspeed acceleration and/or hill climbing mode, *wherein both internal combustion engine 40 and electric motor 20 provide torque to road wheels 34*." *Id*. at 14:22–25 (emphasis added). Those express disclosures by Severinsky are no different than what claim 30 requires—that the controller activate the motor to provide supplemental torque when the torque provided by the engine is insufficient to drive the vehicle. *See* Ex. 1002 ¶¶ 344–346. We find that Severinsky's disclosure of supplementing the torque of the engine with that of the motor meets squarely the language in the first "wherein" clause of claim 30.

3. The second and third "wherein" clauses of claim 30

Ford relies on the combined disclosures of Severinsky and Anderson for teaching the second and third "wherein" clauses of claim 30. Pet. 49–51. These clauses require that the controller limit the "rate of increase" of the engine's output torque "to less than [its] inherent maximum rate of increase of output torque" and "such that combustion of fuel within the engine occurs at a substantially stoichiometric ratio." Ex. 1001, 60:23–29.

To begin, Severinsky teaches that the "microprocessor controller 48 controls the rate of supply of fuel to the engine." Ex. 1009, 10:4–6. According to Ford's declarant, Dr. Stein, that teaching by Severinsky "is one way the microprocessor 48 limits the rate of increase of output torque of the engine 40." Ex. 1002 ¶¶ 351–352; Ex. 1044 ¶¶ 49–53. With that foundation in mind, Ford proffers Anderson as teaching an additional way of limiting the rate of increase of the engine's output torque. Pet. 49. Specifically, Ford submits that Anderson teaches a hybrid strategy that limits the rate of increase of the engine's output torque to less than the engine's inherent maximum rate "by only allowing *slow engine transients*." *Id*. at 49 (emphasis added). We agree.

Anderson is clearly focused on a hybrid control strategy that slows engine transients in an effort to reduce the carbon emissions associated with engine combustion. For instance, in describing an optimum control strategy for the engine (or "APU"), Anderson explains that "slower transients are desirable for reducing emissions." Ex. 1006, 7. This is because:

> [t]ransients present an emissions problem that is largely related to the speed of the transient. . . . If the transient is too fast, the engine may run rich, increasing CO and HC emissions, or lean, increasing NO_x emissions. Some of this effect can be reduced using *a hybrid strategy that only allows slow transients*, but this places greater strain on the LLD [battery].[9]

[9] We also do not find persuasive Paice's argument that Anderson's recognition of certain tradeoffs (such as strain on the battery) would have discouraged a skilled artisan from using her "slow transients" strategy. *See* PO Resp. 37–38. Recognizing that her "slow transients" strategy comes with certain tradeoffs, Anderson emphasizes that "[t]he development of a system's powertrain components and the design of an optimum control strategy for that system *should be concurrent to allow tradeoffs to be made while the designs are still fluid*. An efficient optimization process must involve all aspects of the system . . . from the beginning." Ex. 1006, 1. And, she later emphasizes that "[t]he APU control strategy must be robust, such that no combination of driver actions will result in damage" to any component, despite "[t]radeoffs . . . made between engine complexity, cost, fuel efficiency, and battery lifetime." *Id*. at 7. Thus, by identifying certain tradeoffs, Anderson is merely describing an optimum design process that accounts for those tradeoffs, not one that dictates avoiding "slow transients" altogether. Ex. 1043 ¶¶ 84–85.

Id. (emphasis added). That disclosure of slowing engine transients suggests limiting the rate of increase of the engine's output torque. Ex. 1002 ¶¶ 347–350.

Importantly, Ford's declarant, Dr. Stein, testifies that "a skilled artisan would understand that slowing engine transients means slowing the rate of increase of engine output torque to something less than the engine's maximum rate of increase." Ex. 1002 ¶ 353. We find that testimony persuasive. Based on that testimony, as well as the express teachings of Severinksy and Anderson, we conclude that supplementing Severinsky's microprocessor strategy, which limits the rate of increase of the engine's output torque by controlling the rate of fuel supply to the engine, with an additional "slow transients" strategy for controlling the same rate of increase, as taught by Anderson, would have suggested to a skilled artisan a hybrid control strategy that limits the "rate of increase" of the engine's output torque "to less than [its] inherent maximum rate of increase of output torque," as required by the second "wherein" clause of claim 30.

With respect to the third "wherein" clause of claim 30—limiting the "rate of change" (i.e., rate of increase) of the engine's output torque to achieve combustion at "a substantially stoichiometric ratio," Anderson explains that engine transients make it "difficult" to maintain a "stoichiometric air fuel ratio"—the ratio at which complete combustion occurs. Ex. 1006, 7. On that point, Anderson elaborates as follows:

> Frequently, one of the principle aims of a hybrid vehicle is to reduce vehicle emissions to ULEV (Ultra Low Emission Vehicle) levels. Consequently, APU [engine] emissions are very important for system success. In general, *emissions are minimized when a stoichiometric air to fuel ratio is maintained* by a closed loop feedback system (using an oxygen sensor for

> feedback). *In some operating regimes, such as engine starts and transients, the stoichiometric ratio is very difficult to maintain resulting in an increase in emissions*.

Id. (emphases added).

As a result, to resolve this difficulty, Anderson's control strategy "maintains the stoichiometric air fuel ratio" by slowing "the speed of the transient" so it is not "too fast." *Id*. Ford's declarant, Dr. Stein, confirms as much, testifying that Anderson's disclosure of "slowing transients (i.e., limiting 'the rate of change of engine torque produced by the engine') helps the vehicle's closed loop feedback system maintain operation near the stoichiometric air/fuel ratio, thereby reducing emissions." Ex. 1002 ¶ 357. Dr. Stein further testifies that "the slower transients provide more time for the closed loop feedback system to react to sensed oxygen levels and adjust the fuel feed so that stoichiometric combustion can occur." *Id.*

Based on the express disclosures of Severinsky and Anderson, as well as the testimony of Dr. Stein, we are persuaded the combined teachings of Severinsky and Anderson would have suggested to a skilled artisan a hybrid control strategy that limits the rate of increase of the engine's output torque so that fuel combustion occurs "at a substantially stoichiometric ratio," as required by the third "wherein" clause of claim 30. This is nothing more than applying a known technique from the prior art (slowing the rate of increase of the engine's output torque) for the same purpose (maintaining stoichiometric combustion) to achieving the same benefit (improving fuel economy and reducing carbon emissions). *See* Ex. 1043 ¶¶ 40–46.

We have considered Paice's arguments and evidence in protest of Anderson, but do not find them persuasive. For example, Paice argues that Anderson's disclosure of "slow transients" is linked to "speed," not torque output. PO Resp. 29. But Paice fails to account for Anderson's description of the engine's "transient capabilities" in terms of "power output" and "combinations of speed *and torque*" for greater optimization of the hybrid control strategy. Ex. 1006, 7 (emphasis added); *see also* Ex. 1002 ¶¶ 348–350; Ex. 1043 ¶¶ 30–31. When viewed properly in the context of the skilled artisan, Anderson teaches a hybrid strategy that limits the rate of increase of the engine by controlling engine transients and their effect on stoichiometric combustion. *See* Ex. 1043 ¶¶ 47–54. We are not persuaded by Paice's attempt to focus on isolated passages in Anderson, to the exclusion of its import as a whole. Doing so glosses over the overall teaching of the reference.

4. The reason to combine

As discussed above, Ford argues that a skilled artisan would have been led to combine the basic hybrid control strategy of Severinsky with the known technique of slowing the engine transient, as taught by Anderson, because both references share the same fundamental goals of reducing carbon emissions by maintaining a stoichiometric air-to-fuel ratio. Pet. 50–51; *see also* Ex. 1002 ¶ 397; Ex. 1043 ¶¶ 37–46. Paice argues, however, that Severinsky and Anderson cannot be combined because they "are directed to very different hybrid architectures and control strategies." PO Resp. 32. At the heart of Paice's argument is that "the *serie*s hybrid engine control strategies of Anderson would not work with the *parallel* hybrid architecture and control strategies of Severinsky." *Id*. (emphases added); *see also id*. at 35, 42 (same).

In making this distinction, Paice contends that Anderson's control strategy of using "slow transients" is limited to a series hybrid system, whereas Severinsky's control strategy requires "fast transients" because it is a parallel system. PO Resp. 32–33. As support, Paice points to a single reference in Anderson to "fast transients," and argues, repeatedly so, that Anderson itself proves that "the engine in a parallel hybrid system *must perform fast transients*." *Id*. at 33 (citing Ex. 1006, 5); *see also id*. at 35, 36, 47 (same). And, according to Paice, "[n]owhere does Anderson suggest that the [slow transients] hybrid control strategies articulated for a series hybrid can be applied to a parallel hybrid." *Id*. at 14.

A close review of Anderson, however, does not support Paice's position. Specifically, Anderson speaks of "fast power transients" only when discussing "two distinct extremes," not the optimum strategy for a hybrid vehicle. Ex. 1006, 5. Indeed, later in the same passage, Anderson points out that "neither of these [extreme] strategies would be the optimum strategy" for the hybrid vehicles "under consideration." *Id*. And, when speaking of the "optimum" strategy being considered (later described to be "slow transients"), Anderson makes clear that it applies equally to both series-type and parallel-type hybrid vehicles.

More specifically, in beginning her discussion of "the design of an optimum control strategy," Anderson describes both types of hybrid vehicles—"Series System" and "Parallel System." Ex. 1006, 3–5. Immediately following that description of series-type and parallel-type vehicles, Anderson makes the following important observation: "[t]he thought processes presented in this paper are sufficiently general that *they can be applied to any type of vehicle*." *Id*. at 5. Paice's argument to the contrary would require us to ignore Anderson's clear indication to the reader that her ensuing discussion of the optimum control strategy applies equally to both parallel and series-type vehicles.

Although Anderson describes her strategy of "slow transients" in terms of a series-type vehicle, she does so because it permits versatility in the design process, explaining that: "[t]o fully explore the flexibility allowed by the hybrid system, we focus on the design of a strategy for the most versatile layout: the power assist [series-type] hybrid." Ex. 1006, 4–5. As for what a skilled artisan would understand from Anderson's utilization of a series-type vehicle over a parallel-type vehicle in describing her control strategy, Ford's declarant, Dr. Stein, testifies:

> [in] thinking about optimizing the design of the vehicle, hybrid electric vehicle, it's important to understand the tradeoffs between the different components. *And she [Anderson] feels that she can illustrate this trade-off by—perhaps more dramatically, in the short amount of space she has here—by focusing on the series system. But she makes it clear that looking at these trade-offs are the same things you do in both the series and parallel configurations.*
>
> * * *
>
> by virtue of what the statement says and my own technical expertise that she's providing a design methodology that she [Anderson] primarily illustrates on a series system, *but is quite clear in showing that it is applicable to a parallel system, as well.*

Ex. 2004, 179:22–182:14.

Based on Dr. Stein's testimony of how a skilled artisan would have understood Anderson's disclosure as a whole, including Anderson's recognition of applying her control strategy equally to series-type and parallel-type hybrid vehicles, we are persuaded a skilled artisan would have understood from reading Anderson as a whole that "slow engine transients" are the optimum strategy for both series-type and parallel-type hybrid vehicles. *See* Ex. 1043 ¶¶ 41, 79.

In sum, we conclude that a skilled artisan would have been led to combine Anderson's known strategy of slowing engine transients with Severinsky's base, parallel-type control system in order to better maintain stoichiometric combustion and, thereby, reduce carbon emissions. Ex. 1043 ¶¶ 44–49, 88. We have considered Paice's evidence and arguments to the contrary, but we find more persuasive Ford's rationale for combining Severinsky and Anderson.

5. Conclusion

We conclude that Ford has demonstrated, by a preponderance of the evidence, that independent claim 30 would have been obvious over the combined teachings of Severinsky and Anderson. Paice does not argue dependent claims 31, 35, 36, and 39 separately, but instead relies on the same arguments it made for claim 30. PO Resp. 9. Based on our review of the arguments and evidence presented, we determine that Ford also has demonstrated, by a preponderance of the evidence, that dependent claims 31, 35, 36, and 39 would have been obvious over Severinsky and Anderson. *See* Pet. 51–57

B. Claim 32—Obviousness over Severinsky, Anderson, and Yamaguchi

Claim 32 depends from claim 30 and recites that, "the engine is heated, prior to supply of fuel for starting the engine," by rotating the engine at "at least 300 rpm." Ford relies on Yamaguchi, in combination with Severinsky and Anderson, as teaching this limitation. Pet. 55–56 (citing Ex. 1002 ¶¶ 398–407). Yamaguchi discloses rotating an engine to 600 rpm before starting it, and then starting the engine once it reaches a predetermined temperature. Ex. 1007, 8:62–9:5, 11:27–33, Figs. 3, 8, 11. Ford's declarant, Dr. Stein, testifies that this process amounts to heating the engine before igniting it. Ex. 1002 ¶¶ 402–406.

Paice argues, in turn, that because Severinsky discloses operating the engine at a "lower temperature," it "teaches away" from heating the engine as taught by Yamaguchi. PO Resp. 48–49 (citing Ex. 1009, 12:18–21). We are not persuaded for two reasons. First, Severinsky refers to a "lower temperature" in terms of *operating the engine*, not "starting the engine," as claim 32 requires. Ex. 1009, 12:13–21 ("the engine will be operated in lean burn mode . . . at a lower temperature . . . than is a conventional engine"). Ford's declarant, Dr. Stein, confirms as much, explaining that Severinsky's "lower temperature" relates to "engine coolant temperature [around 200 degrees F] *during operating conditions*," and not "the temperature of a cold engine" in need of heating. Ex. 1043 ¶ 94 (emphasis added).

Second, Ford's challenge of claim 32 is predicated on Severinsky, *as modified by Anderson's stoichiometric control strategy*. As Paice's declarant, Mr. Hannemann, testifies, "if you employ a stoichiometric strategy, then you don't really need to worry about a lower temperature." Ex. 1044, 68:8–23. Because the combination of Severinsky and Anderson incorporates Anderson's control strategy (of operating the engine at a stoichiometric air-fuel ratio) into Severinsky's control strategy, Ford's declarant, Dr. Stein, testifies that a skilled artisan would have understood Severinsky's modified control strategy does not apply to low temperature engine starts, and thus, would not teach away from claim 32. Ex. 1043 ¶ 93.

Based on the testimony of both parties' declarants, we are persuaded that Severinsky's modified control strategy would not have been viewed by a skilled artisan as "teaching away" from being combined with Yamaguchi's teaching of heating the engine prior to starting it. Rather, we conclude that Ford has presented *prima facie* evidence of a rationale to combine the teachings of Yamaguchi with Severinsky and Anderson. Thus, after considering the evidence and arguments, we conclude that Ford has demonstrated, by a preponderance of the evidence, that dependent claim 32 is unpatentable as obvious over the combined teachings of Severinsky, Anderson, and Yamaguchi.

C. Claim 33—Obviousness over Severinsky, Anderson, Yamaguchi, and Katsuno

Claim 33, which depends from claim 32, recites that fuel and air are supplied to the engine "at a fuel:air ratio of no more than 1.2 of the stoichiometric ratio for starting the engine." Ford relies primarily on Katsuno for teaching this limitation, in combination with Severinsky, Anderson, and Yamaguchi. Pet. 56–57. Katsuno teaches the importance of maintaining an air-fuel ratio between 0.8 and 1.2 of the stoichiometric ratio during normal operation of the engine and at 1.0 of the stoichiometric ratio (and thus no more than 1.2 of the stoichiometric ratio) during starting conditions. Ex. 1008, 7:1–5; *see also* Ex. 2004, 261:20–263:8 (explaining the intent of Katsuno's ratio), and Ex. 1002 ¶¶ 410–414 (same).

Paice disputes Ford's application of Katsuno. The sum of Paice's argument is that Katsuno teaches only an air-fuel *correction amount*, not an *actual* air-fuel ratio for starting the engine. PO Resp. 51–54 (citing Ex. 2002 ¶¶ 125–134). But the claim only speaks of "a fuel:air ratio," without specifying whether it is an actual ratio or a correction ratio. In any event, Ford's declarant, Dr. Stein, explains that Katsuno's algorithm for determining the air-fuel ratio considers a lot of "conditions; for example, the sensors degrading, running when the engine is hot, the engine is cold, [and] starting the engine," but if these conditions are "out of the picture," then Katsuno's correction amount [or "FAF1"] "has the effect of appearing as . . . acting like a factor which will create a 1.2 stoichiometric ratio in the — the combustion process." Ex. 2004, 261:20–263:8. In other words, Dr. Stein testifies that Katsuno's correction amount correlates to a 1.2 fuel:air ratio. Given that correlation, we are persuaded that Katsuno's disclosed "maximum value of 1.2" corresponds to the claimed "no more than 1.2 of the stoichiometric ratio" required by claim 32.

Also, we have considered but are not persuaded by Paice's argument that Katsuno cannot be combined with the hybrid systems of Severinsky, Anderson, and Yamaguchi. Instead, we find persuasive the rationale for the combination as explained by Ford's declarant, Dr. Stein. *See* Ex. 1043 ¶¶ 112–116. Thus, after considering the evidence and arguments, we conclude that Ford has demonstrated, by a preponderance of the evidence, that dependent claim 33 is unpatentable as obvious over the teachings of Severinsky, Anderson, and Yamaguchi when combined with Katsuno.

IV. CONCLUSION

Ford has demonstrated, by a preponderance of the evidence, that claims 30–33, 35, 36, and 39 of the '097 patent are unpatentable for obviousness.

V. ORDER

Accordingly, it is hereby:

ORDERED that claims 30–33, 35, 36, and 39 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.

FOR PETITIONER:

Frank A. Angileri
John E. Nemazi
John P. Rondini
Erin K. Bowles
BROOKS KUSHMAN P.C.
FPGP010IPR2@brookskushman.com
jrondini@brookskushman.com

Lissi Mojica
Kevin Greenleaf
DENTONS US LLP
lissi.mojica@dentons.com
kevin.greenleaf@dentons.com
iptdocketchi@dentons.com

FOR PATENT OWNER:

Timothy W. Riffe
Kevin E. Greene
Ruffin B. Cordell
Linda L. Kordziel
Brian J. Livedalen
W. Peter Guarnieri
FISH & RICHARDSON P.C.
riffe@fr.com
greene@fr.com
IPR36351-0011IP1@fr.com