

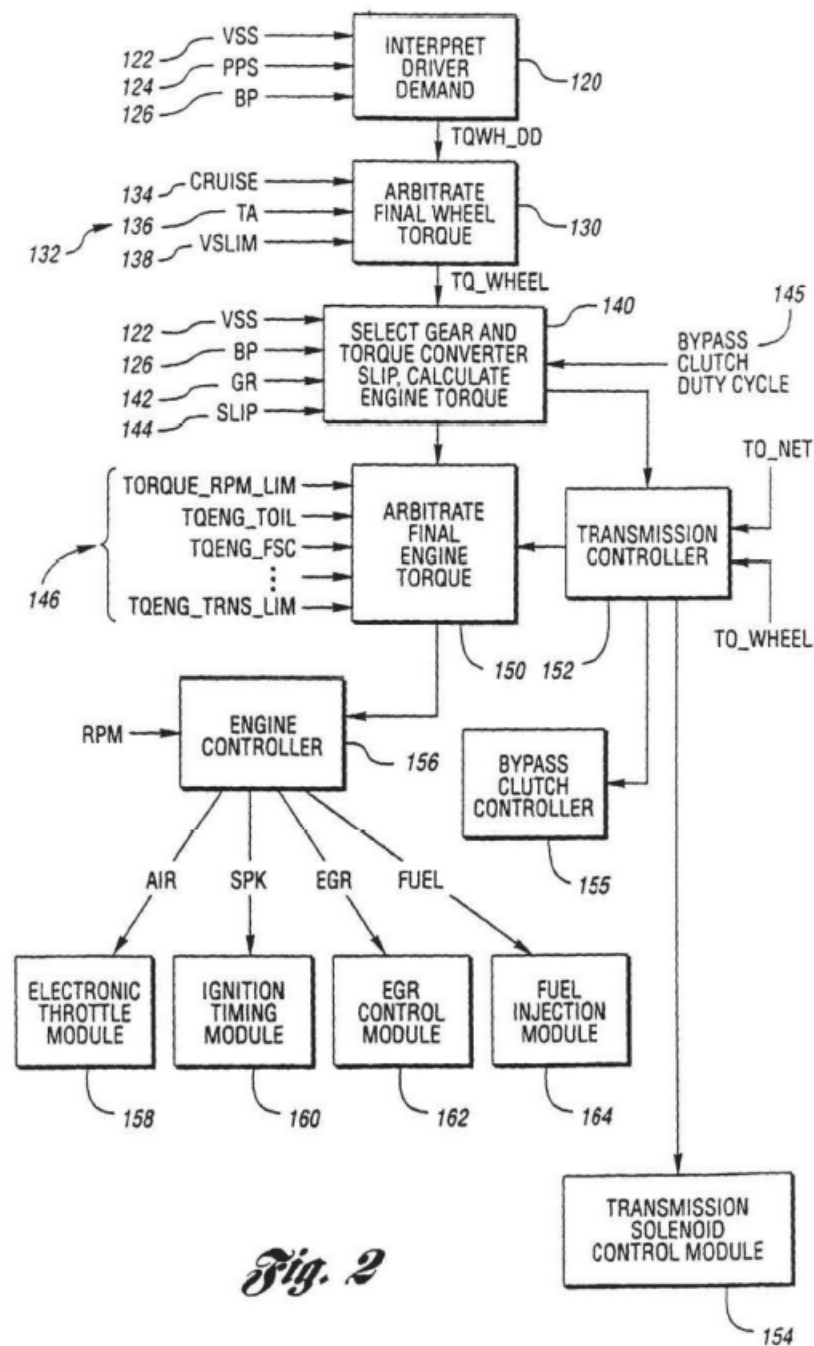
¶¶ 12, 15. Sensors 60 include throttle valve position sensor (TPS) 68, mass airflow sensor (MAF) 74, temperature sensor (TMP) 76, engine speed sensor (RPM) 80, and certain other sensors. *Id.* ¶¶ 15–16. Pedal position sensor 59 indicates the position of accelerator pedal 58. *Id.* ¶ 19.

Powertrain 12 also includes actuators 64 linked to controller 18 “to provide control signals or to effect movement of various devices in powertrain 12.” *Id.* ¶¶ 15, 20. Robichaux explains that

[a]ctuators 64 may include actuators for timing and metering fuel (FUEL) 90, controlling ignition angle or timing (SPK) 92, controlling intake/exhaust valve actuators 93 (VCT) to implement variable cam timing, setting the amount of exhaust gas recirculation (EGR) 94, and adjusting the intake air using throttle valve 70 with an appropriate servomotor or actuator (TVA) 96.

Id. ¶ 20.

Robichaux discusses a control architecture in connection with Figure 2, which is reproduced below.



“Figure 2 is a block diagram illustrating an output torque based powertrain control strategy including determination of a desired engine torque.” *Id.* ¶ 10.

At block 120, “a driver demand is interpreted . . . based on vehicle speed 122 accelerator pedal position 124 and barometric pressure 126.” *Id.* ¶ 23. The driver demand is received by input block 130 as a wheel torque (TQWH_DD). *Id.* A final wheel torque is arbitrated by block 130 from the wheel torque TQWH_DD and various other torque requesters, including “a cruise control torque 134, a traction assist torque 136, and/or a vehicle speed limiting torque 138.” *Id.*

Block 140 receives the resulting final wheel torque (TQ_WHEEL) from block 130. *Id.* Based on the final wheel torque and certain other factors, block 140 determines a desired engine brake torque. *Id.*

At block 150, the requested engine torque is arbitrated with certain engine torque limiting functions 146. *Id.* ¶ 24. Block 150 transmits a final desired engine brake torque to engine controller 156, which “modifies the desired engine brake torque based on current engine operating conditions to determine a requested engine brake torque prior to determination of control parameters such as air flow, spark, EGR, and fuel as represented by blocks 158, 160, 162, and 164, respectively.” *Id.* ¶ 25.

Robichaux illustrates engine controller 156 in Figure 3, which is reproduced below.

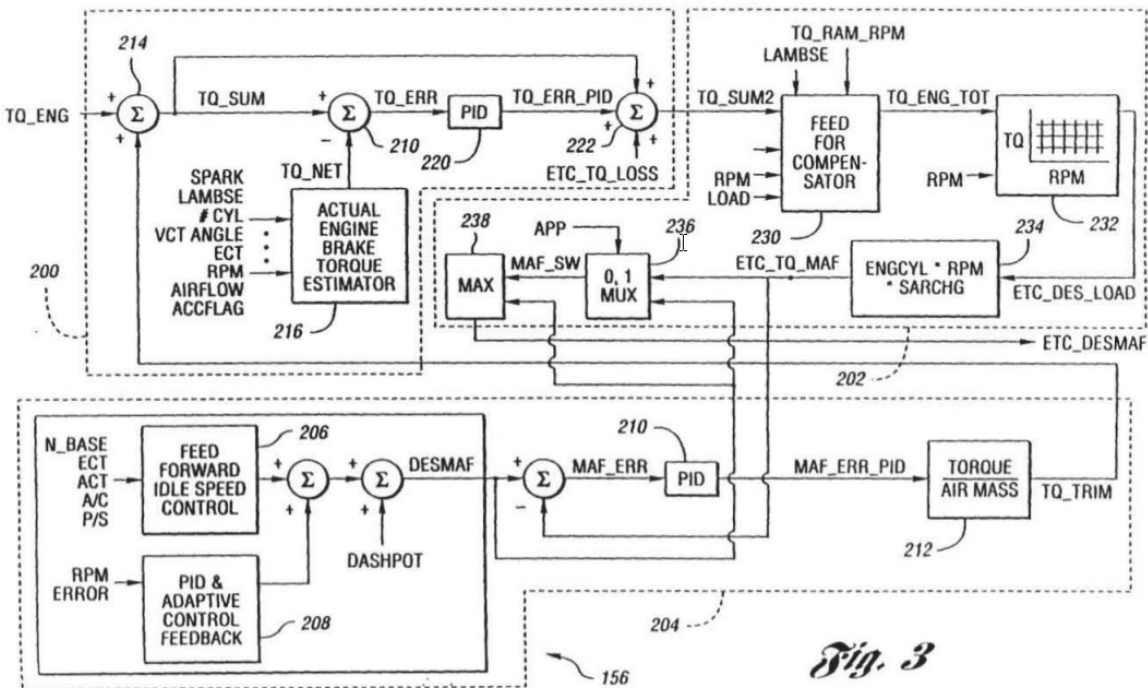


Figure 3 is a block diagram illustrating engine controller 156 with its three functional sections “represented generally by reference numerals 200, 202, and 204.” *Id.* ¶ 27.

A desired engine brake torque (TQ_ENG) is input to block 200. *Id.* Block 200 generates a requested engine brake torque (TQ_SUM2) by adjusting the desired engine brake torque. *Id.*

Block 202 receives requested engine brake torque TQ_SUM2 from block 200. *Id.* Based on requested engine brake torque TQ_SUM2, block 200 controls one or more engine operating parameters to produce the desired engine brake torque. *Id.*

Block 204 has “an airflow-based idle speed controller.” *Id.* This “generates an idle speed torque determined at least in part based on a desired engine speed, preferably stored in a lookup table.” *Id.*

In block 200, “the desired engine brake torque (TQ_ENG) is adjusted or modified first by combining the desired engine brake torque with an idle speed torque (TQ_TRIM) to generate a first intermediate torque (TQ_SUM) according to: $TQ_SUM = TQ_ENG + TQ_TRIM$.” *Id.* ¶ 29. Block 216 generates an actual engine brake torque (TQ_NET). *Id.* ¶ 30. This may be a measured or estimated value. *Id.* ¶ 31. Block 218 compares first intermediate torque TQ_SUM to actual engine brake torque (TQ_NET) “to generate a torque error (second intermediate torque) according to: $TQ_ERROR = TQ_SUM - TQ_NET$.” *Id.* ¶ 30.³

Based on second intermediate torque TQ_ERROR, PID controller 220 produces a feedback correction torque (TQ_PID). *Id.* ¶¶ 31, 34. Feedback correction torque TQ_PID “is provided to a summing block 222 where it is combined with the first intermediate torque and a third intermediate torque (ETC_TQ_LOSS) to determine the final requested engine brake torque according to: $TQ_ENG_DES = TQ_SUM + TQ_PID + ETC_TQ_LOSS$.” *Id.* ¶ 34. “Preferably, controller 220 includes proportional, integral, and derivative terms but is not active during certain transient torque limiting control modes, which may include idle speed control, dashpot, engine speed limiting, traction assist, transmission gear shifting, and fail safe cooling, among others.” *Id.* ¶ 32.

³ In paragraph 30, “block 218” appears to refer to the item identified with reference number 210 inside block 200 of Figure 3. The instance of reference number 210 inside block 200 of Figure 3 seems to be a typographical error, given that another instance of reference number 210 appears in block 204 of Figure 3. Based on the text of Robichaux, it appears that the item labeled with reference number 210 within block 200 was intended to be labeled with reference number 218.

“The output of block 222 is then the requested final engine brake torque which is provided to section 202 to control the engine output.” *Id.*

¶ 35. Airflow constitutes the principal control parameter, and fuel flow may also be adjusted to control torque output. *Id.*

Robichaux discusses control logic of one embodiment in connection with Figure 4, which is reproduced below.

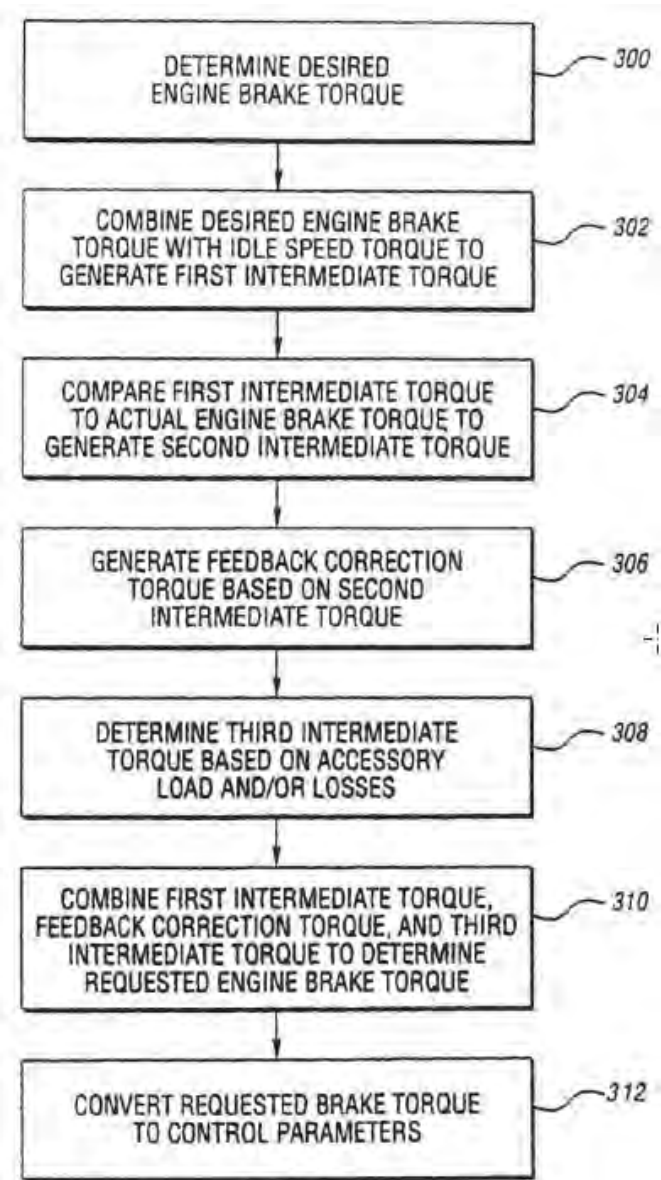


Fig. 4

Figure 4 is a flowchart illustrating “one ‘loop’” of control logic of a method or system. *Id.* ¶ 43.

In block 300, desired engine brake torque is determined. *Id.* ¶ 44. To do so, various approaches may be used. *Id.* Preferably, accelerator pedal position, vehicle speed, and barometric pressure factor into the determination of desired engine brake torque. *Id.*

In blocks 302–308, the desired engine brake torque is adjusted based on current operating conditions to produce a requested engine brake torque. *Id.* The desired engine brake torque is combined with an idle speed torque at block 302 to produce a first intermediate torque. *Id.* ¶ 45. Block 304 compares the first intermediate torque to the actual engine brake torque, thereby producing a second intermediate torque. *Id.* In block 306, a feedback correction torque is produced based on the second intermediate torque. *Id.* ¶ 46. “Preferably, a proportional-integral-derivative (PID) controller is used to generate the feedback correction torque.” *Id.* In block 308, engine frictional losses and/or accessory loads are used to ascertain a third intermediate torque. *Id.* ¶ 47.

“Blocks 310-312 represent controlling at least one of the operating parameters of the engine based on the requested engine brake torque to deliver the desired engine brake torque.” *Id.* ¶ 44. In block 310, the requested engine brake torque is determined by combining “[t]he first intermediate torque, feedback correction torque, and third intermediate torque.” *Id.* ¶ 48. In block 312, the compensated requested engine brake torque “is converted to appropriate control parameters to control the engine.” *Id.* “The control parameters may include airflow, fuel, ignition angle

regulating branch includes input-side air flow rate calculating unit 2 and adjoining PID air flow rate regulator 3. *Id.* at 3:67–4:2. The ignition point adjusting branch includes high pass filter 4 with characteristic time constant diagram unit 5. *Id.* at 4:20–35. The ignition point adjusting branch also includes input-side dead zone unit 6, unit 7, adder 8, ignition point calculating unit 9, unit 10, unit 11, adder 12, and conventional knock regulating stage 13. *Id.* at 4:53–5:5.

Air flow rate calculating unit 2 of the airflow regulating branch receives demanded desired engine torque M_{des} and the momentary rotational engine speed (n). *Id.* at 4:2–5. Based on these inputs and a stored characteristics diagram, air flow rate calculating unit 2 calculates a desired air flow rate value (m_s). *Id.* at 4:2–7. The actual air flow rate value (m_I) is also detected by air flow rate calculating unit 2 via an associated sensor system. *Id.* at 4:8–10.

PID air flow regulator 3 receives both the desired air flow rate value m_s and the actual air flow rate value m_I . *Id.* at 4:8–12. Based on these values, PID air flow regulator 3 identifies “a suitable control signal (α) for an air-flow regulating throttle valve.” *Id.* at 4:8–13. Scherer explains that

As is well known, because of the finite throttle valve adjusting speed and mainly because of the suction pipe filling characteristics, engine torque cannot be adjusted in this manner to follow a highly dynamic desired engine torque change without a noticeable sluggishness. That is, it can adjust only a quasi-static desired engine torque part.
Id. at 4:13–19.

Given this, Scherer relies on the ignition point adjusting branch “to adjust the dynamic desired torque component which exceeds this quasi-static part.” *Id.* at 4:20–22. Scherer uses the ignition point adjusting branch

only to adjust specifically that dynamic desired torque component which cannot be regulated by the air-flow-regulating branch. The high pass filter stage, which precisely determines this dynamic desired torque component (M_d), consists of a high pass filter 4 with an adjustable decay time constant (τ), and a characteristic time constant diagram unit 5.

Id. at 4:28–35.

High pass filter 4 transmits the dynamic desired torque component M_d to input-side dead zone unit 6, and the ignition point adjusting branch uses the dynamic desired torque component M_d and various other factors to generate an adjusting signal (Z_s) for the ignition point adjustment, which is output from adder 12. *Id.* at 4:53–5:6. Scherer explains that “[t]he ignition point adjusting branch is able to react very rapidly to sudden changes of the engine torque.” *Id.* at 4:23–25.

Scherer discusses other variations of its system in connection with Figures 2–4. For example, in connection with Figure 2, Scherer discusses a system similar to that of Figure 1 but adapted for a diesel engine. *Id.* at 5:16–18. In this embodiment, “instead of an air flow regulating device, a device for adjusting the fuel injection duration is provided.” *Id.* at 5:23–24. Additionally, “[i]nstead of the ignition point adjusting branch of the device of Fig. 1, the device of Fig. 2 contains an injection start adjusting branch.” *Id.* at 5:35–37.

3. Discussion

Petitioner asserts that Robichaux and Scherer, in combination, teach all of the limitations of claims 1 and 7. Pet. 36–57. Petitioner cites Robichaux as teaching most of the limitations of claims 1 and 7. *Id.* For example, Petitioner asserts that Robichaux teaches “a device for controlling

a torque output of an engine”⁵ having a “torque demand controller for generating a torque demand signal,” as recited in claim 1. *Id.* at 36–40. Additionally, Petitioner asserts that Robichaux teaches “a torque producer which receives the torque demand signal,” as recited in claim 1. *Id.* at 40–42. Petitioner also asserts that the torque producer taught by Robichaux includes “an estimator” and “a comparator,” as recited in claim 1. *Id.* at 43–46. Petitioner cites Robichaux’s block 216 as corresponding to the claimed “estimator.” *Id.* at 43–45. Regarding claim 1’s “comparator which receives as inputs the estimated torque signal and a desired torque signal and outputs a difference signal,” the Petition explains that

Robichaux discloses the recited comparator. EX1003, ¶105. Robichaux’s summing junction 214 adjusts the desired engine brake torque TQ_ENG from block 150 (Figure 2) by adding an idle speed torque TQ_TRIM to generate a first intermediate torque TQ_SUM. EX1020, ¶0029, FIG. 3; EX1003, ¶105. Block 218 receives the TQ_SUM torque signal, compares this signal to the actual engine brake torque TQ_NET signal (“estimated torque signal”) estimated by block 216, and produces a torque error TQ_ERROR. EX1020, ¶0030, FIG. 3; EX1003, ¶105. The generated torque error TQ_ERROR is a “difference signal,” representing the difference between the estimated actual engine brake torque TQ_NET and the desired engine brake torque TQ_ENG. EX1003, ¶105.

Id. at 45.

Petitioner asserts that Robichaux and Scherer render obvious claim 1’s “high pass filter which receives as an input the difference signal in which low frequency components are absent.” *Id.* at 30–36, 47–50, 56–57.

⁵ At this stage, we need not address whether claim 1’s preamble is limiting, as Petitioner has shown adequately, for purposes of institution, that the preamble is satisfied by Robichaux.

Petitioner asserts that Scherer's "control system includes a transient control branch having a high-pass filter 4 that isolates the dynamic desired torque component (M_d) of the desired torque signal M_{des} ." ⁶ *Id.* at 47. Petitioner asserts that "[a person of ordinary skill in the art] would have been motivated to incorporate Scherer's transient torque control system, including high-pass filter 4, into Robichaux's engine controller to control torque during transient conditions." *Id.* at 49. Petitioner contends that a person of ordinary skill in the art would have had a reasonable expectation of success in implementing a combination in which "Robichaux's torque signal TQ_ERR would be transmitted to Scherer's transient control branch instead of Robichaux's PID controller 220, and Scherer's high-pass filter 4 would then output a filtered difference signal with low-frequency components removed." *Id.* at 50.

In support of its position that a person of ordinary skill in the art would have been motivated to so combine the references' teachings, Petitioner asserts that

Robichaux's proportional-integral-derivative (PID) controller 220 processes the torque error signal during steady-state conditions. EX1003, ¶85; EX1020, ¶0032. Robichaux's PID controller "is not active during certain transient torque limiting control modes." EX1020, ¶0032; EX1003, ¶¶86-87. Accordingly, Robichaux invited combinations with references disclosing transient control functionality to process the torque demand signal during transient conditions. EX1003, ¶87.

Id. at 32. According to Petitioner, Scherer's transient control branch and high pass filter 4 "[r]emoving the desired torque signal's low-frequency

⁶ In the case of Scherer's Figure 1 embodiment, Petitioner's discussion of "a transient control branch" refers to Scherer's ignition point adjusting branch.

component allows Scherer's controller to 'react very rapidly to sudden changes of the engine torque,' arising during transient engine operations." *Id.* at 33. In view of this, Petitioner argues that a person of ordinary skill in the art would have been motivated to add Scherer's transient control branch to Robichaux's system "[t]o address dynamic torque changes in Robichaux's system." *Id.* at 34. Petitioner argues that "[c]ombining Scherer's transient control branch with Robichaux's controller would have merely been applying a known technique (Scherer's transient control) in a similar, known device (Robichaux's controller) in the same way." *Id.*

This allegedly obvious combination of the references' teachings would also have claim 1's "transient torque controller," Petitioner contends. *Id.* at 51–54. Petitioner explains that Scherer's transient control system has certain units other than high pass filter 4 for adjusting torque output. *Id.*

Regarding claim 7, Petitioner relies on substantially the same reasoning that it allegedly would have been obvious to combine the teachings of Robichaux and Scherer. *Id.* at 30–36, 54–57. Petitioner asserts that combining Scherer's transient torque control system with Robichaux's system would have resulted in a method meeting all of the limitations of claim 7. *Id.* at 54–57.

Patent Owner argues that "[a person of ordinary skill in the art] would not consider combining *Scherer* with *Robichaux* because they teach away from each other and from the challenged claims of the '565 patent." Prelim. Resp. 20. Patent Owner elaborates that "the inventors of these prior art references were inarguably at least [persons of ordinary skill in the art] but did not themselves think to combine the individually known elements to arrive at the combination." *Id.* Patent Owner contends this "is itself the

best, most objective, and most contemporaneous evidence of non-obviousness of the claimed invention set forth and patentably defined in the challenged claims of the '565 patent.” *Id.* Patent Owner faults Petitioner’s obviousness assertions on the basis that “a proper prior art analysis would explain where the references themselves provide the teaching, motivation or suggestion to combine their teachings.” *Id.* at 22.

Patent Owner also argues that Petitioner’s obviousness contentions derive from improper hindsight. *Id.* at 22–26. Patent Owner argues that each of the references cited by Petitioner fails to “disclose a key element of the challenged claims of the '565 patent, namely, ‘a high pass filter which receives as input the difference signal and outputs a filtered difference signal in which low frequency components are absent.’” *Id.* at 23. Patent Owner explains that Robichaux does not teach a high pass filter, and Scherer’s high pass filter 4 “receives a desired engine torque signal and outputs a dynamic torque component.” *Id.* at 25. Patent Owner concludes that “[c]ombining these two prior art references, even in hindsight, would result in a desired engine torque signal which is high-pass filtered, and a ‘difference signal’ which is not high-pass filtered.” *Id.* at 26.

Additionally, Patent Owner argues “*Scherer* does not disclose a stratified charge operation mode for a DISI engine as the '565 patent discloses and claims.” Prelim. Resp. 4.

Petitioner argues that Patent Owner’s observation that neither Robichaux nor Scherer teaches a high pass filter applied to a difference improperly attacks the teachings of the references individually. Pet. Reply 2–3. In combination, not individually, Robichaux and Scherer render

obvious applying a high pass filter to a difference signal, Petitioner emphasizes. *Id.*

Petitioner also argues that the references do not teach away. *Id.* at 4–5. Petitioner argues that for a reference to teach away, it must “criticize, discredit, or otherwise discourage the solution claimed.” *Id.* at 4 (quoting *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004)). Under this test, Petitioner asserts that Patent Owner does not identify any way in which the cited references teach away from the claimed invention of the ’565 patent.

Additionally, Petitioner argues that the Supreme Court rejected Patent Owner’s rigid understanding of the teaching, suggestion, or motivation test. Pet. Reply 6 (citing *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007)).

In response, Patent Owner reiterates that neither Robichaux nor Scherer teaches high pass filtering a difference signal. Sur-reply 2–4. Patent Owner argues that if a person of ordinary skill in the art had considered combining the references’ teachings, “the [person of ordinary skill in the art] would have been taught to ‘high-pass filter’ an input to a comparator that outputs a ‘difference signal,’ rather than filtering the ‘difference signal.’” *Id.* at 3.

Weighing the parties’ arguments and evidence, at this stage, we determine Petitioner has demonstrated a reasonable likelihood of prevailing on its assertion that claims 1 and 7 would have been obvious in view of Robichaux and Scherer. Petitioner identifies reasons associated with the references’ teachings that a person of ordinary skill in the art would have for adding Scherer’s transient torque controller to Robichaux’s system. Specifically, Petitioner explains that Scherer teaches transient torque control provisions with high pass filter 4, and Robichaux indicates a need during

transient conditions to provide the torque error TQ_ERROR of block 218 to transient control provisions like those of Scherer. Pet. 32–34, 47–50. Patent Owner does not dispute Petitioner’s contention that Robichaux indicates a need for transient torque control in lieu of PID controller 220 during transient conditions. Pet. 32, 47; *see generally* Prelim. Resp.; Sur-reply. Nor does Patent Owner dispute Petitioner’s contention that Scherer indicates its transient control branch, with its high pass filter 4, provides effective transient torque control in transient circumstances. Pet. 33, 47–49; *see generally* Prelim. Resp.; Sur-reply. At this stage, Petitioner has shown sufficiently that a person of ordinary skill in the art would have had a reason to add Scherer’s transient control branch with its high-pass filter 4 to Robichaux’s system.

Specifically, Petitioner shows sufficiently that a person of ordinary skill in the art would have had reason to modify Robichaux’s system to send the torque error TQ_ERROR from block 218 to high pass filter 4 of Scherer’s transient control branch, so that the transient torque control branch can respond to the transient circumstance in lieu of Robichaux’s PID controller 220. Pet. 32–34, 47–50. It appears that such a combination of the references’ teachings would have claim 1’s “high pass filter which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent.” Similarly, such a combination of the references’ teachings apparently would include claim 7’s step of “filtering out a plurality of low frequency components from the difference signal.”

At this stage, we do not agree with Patent Owner’s arguments that the references teach away. Patent Owner’s observation that the prior art

references' inventors did not teach expressly the invention recited in the claims of the '565 patent does not establish teaching away, as it does not demonstrate that the references criticize, discredit, or otherwise discourage use of the invention recited in the claims of the '565 patent. *See in re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). Nor do any of Patent Owner's other arguments demonstrate that the references teach away.

Additionally, at this stage, we do not agree with Patent Owner that Petitioner's arguments stem from improper hindsight. As explained above, Petitioner cites Scherer's express disclosure of advantages associated with its transient control branch (including its high pass filter 4) and Robichaux's indication of a need for additional transient control provisions as disclosures of the cited references that would have provided a reason to combine the references' teachings.⁷ Pet. 32–34, 47–50; Pet. Reply 6. Petitioner's arguments sufficiently support its assertion that it would have been obvious to combine the references' teachings by sending the torque error TQ_ERROR from block 218 of Robichaux's system to high pass filter 4 of Scherer's transient control branch. Patent Owner's emphasis that Scherer teaches sending a desired engine torque signal to high pass filter 4 may support a conclusion that another obvious combination of the references' teachings would involve high pass filtering a desired engine torque signal.

⁷ To the extent Petitioner's obviousness contentions do not rest entirely on express motivations from the references, we agree with Petitioner that Patent Owner misunderstands the law on obviousness when arguing that Petitioner has to show "the references themselves provide the teaching, motivation or suggestion to combine their teachings." *See KSR*, 550 U.S. at 417 (explaining that an obviousness "analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim.").

But, at this stage, it does not persuade us that the only possible obvious combination of the references' teachings would have been high pass filtering a desired engine torque signal. *See Dome Patent L.P. v. Lee*, 799 F.3d 1372, 1381 (Fed. Cir. 2015) (noting possibility of multiple obvious combinations of prior art).

We also find unpersuasive Patent Owner's argument that "*Scherer* does not disclose a stratified charge operation mode for a DISI engine as the '565 patent discloses and claims." Prelim. Resp. 4. This argument is not commensurate in scope with independent claims 1 and 7. Ex. 1001, 4:2–22, 4:54–65. Of the challenged claims, only claim 4 recites a stratified mode. *Id.* at 4:35–39. As discussed below in Section II.G.2, Petitioner relies on Suzuki as teaching stratified mode operation. Pet. 80–85.

For the foregoing reasons, we find Petitioner has demonstrated a reasonable likelihood of prevailing on its assertion that claims 1 and 7 would have been obvious over Robichaux and Scherer.

F. Alleged Obviousness of Claims 2 and 3 over Robichaux, Scherer, and Takahashi

1. Overview of Takahashi

Takahashi "is related to the method and system for simultaneous control of the throttle valve and fuel injection to ensure that the torque and air fuel ratio of the automobile engine will reach target values." Ex. 1008, 1:6–9.

Takahashi shows one embodiment of its "simultaneous torque and air fuel ratio control system" in Figure 2, which is reproduced below.

FIG. 2

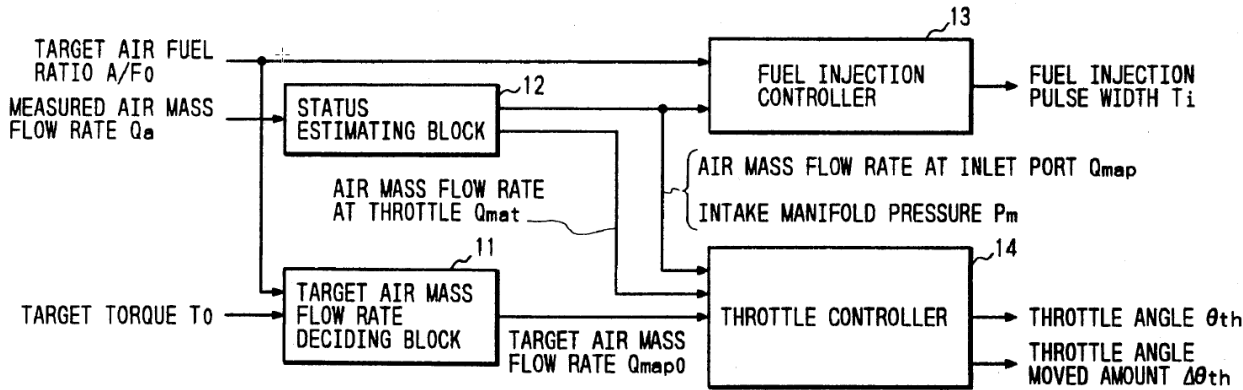


Figure 2 is a block diagram of simultaneous air fuel ratio and torque control with target air mass flow rate deciding block 11, status estimating block 12, fuel injection controller 13, and throttle controller 14.⁸ *Id.* at 2:35–36, 3:16–29.

Target air mass flow rate deciding block 11 determines a target air mass flow rate based on target torque T_0 , engine speed N , target air fuel ratio A/F_0 , spark advance θ_{adv} , constant K , and specified functions F_1 , F_2 , F_3 . *Id.* at 3:28–40.

Takahashi describes the operation of status estimating block 12 in more detail with reference to Figure 3, which is reproduced below.

⁸ One portion of the text of Takahashi refers to “target air mass flow rate deciding block 15.” Ex. 1008, 3:22–23. This appears to be a typographical error. It appears that the text should refer to “target air mass flow rate deciding block 11.” In Figure 2, reference numeral 11 is used to identify “TARGET AIR MASS FLOW RATE DECIDING BLOCK 11.” Additionally, another portion of the text of Takahashi states that “[b]lock 11 calculates the target air mass flow rate.” *Id.* at 3:28.

FIG. 3

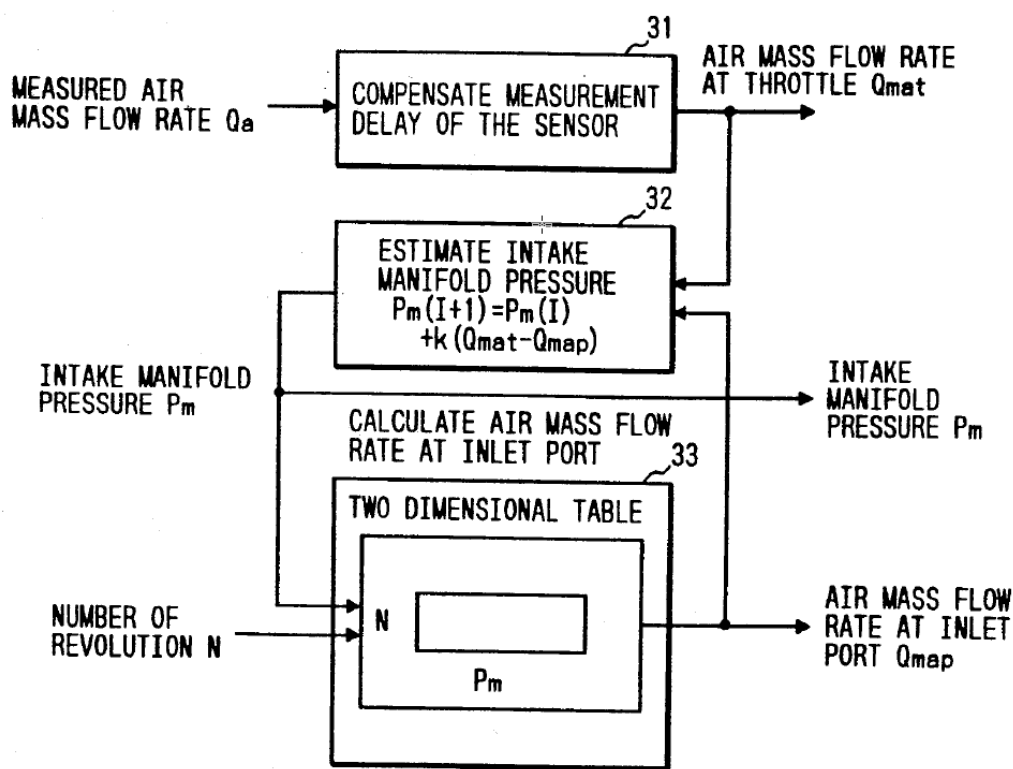


Figure 3 is a block diagram of the status estimating block, which includes blocks 31–33. *Id.* at 2:37–38, Fig. 3. Takahashi explains that

In block 31, measured air mass flow rate Q_a is subjected to the response delay compensation for the air mass flow sensor. Namely, the air mass flow rate at throttle Q_{mat} is calculated and updated from measured air mass flow rate Q_a according to [an equation using certain variables].

Id. at 4:6–39. Takahashi also explains that

In block 32, intake manifold pressure P_m calculated from the air mass flow rate at throttle Q_{mat} which is calculated in block 31, and air mass flow rate at inlet port Q_{map} which is calculated by searching the table 33 according to [an equation using certain variables].

Id. at 4:49–68. Takahashi further explains that “[b]lock 33 calculates the air mass flow rate at inlet port Q_{map} by searching the two dimensional

table for the intake manifold pressure and engine speed, where the data on air mass flow rate taken in during engine operation in the stationary status are stored.” *Id.* at 5:1–5.

Takahashi discusses fuel injection control in greater detail in connection with Figure 4, which is reproduced below.

FIG. 4

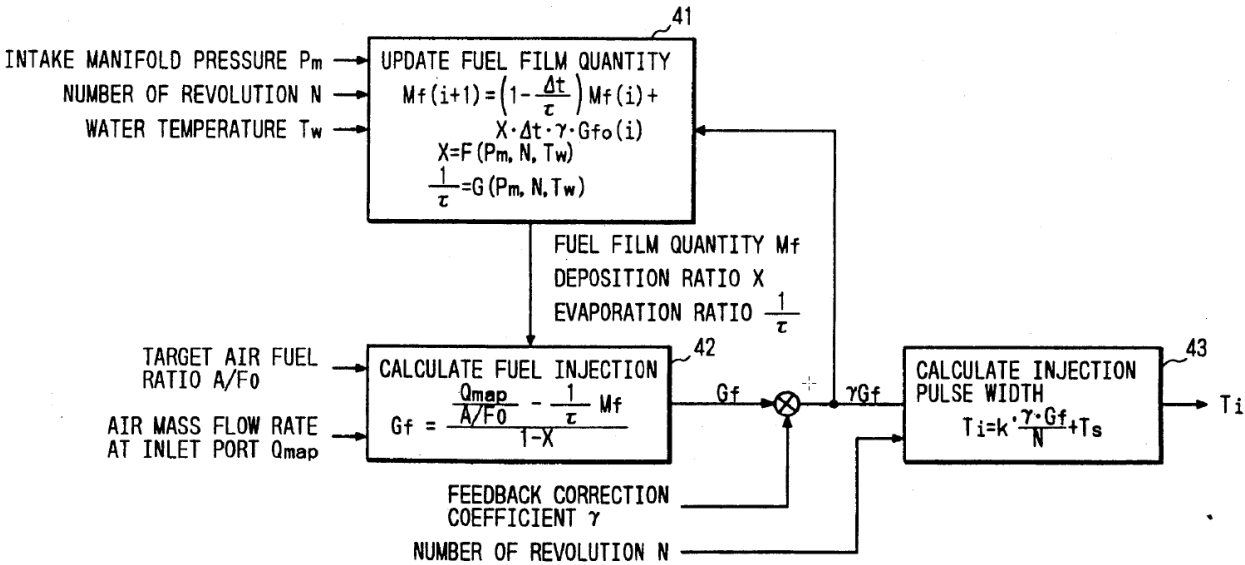


Figure 4 is a block diagram of the fuel injection control system, which includes blocks 41–43. *Id.* at 2:39–40, Fig. 4. Takahashi explains that “[b]lock 41 calculates the deposition ratio X of the injected fuel onto the intake manifold and evaporation ratio ($1/\tau$) of deposited fuel according to [certain expressions].” *Id.* at 5:12–15. Takahashi also explains that “block 42 calculates the fuel injection quantity using the value calculated in block 41 according to [a certain expression].” *Id.* at 5:53–55. Based on another

equation, the fuel injection pulse width T_i is calculated by block 43.⁹ *Id.* at 5:66–6:9.

Takahashi discusses throttle control in greater detail with reference to Figure 5, which is reproduced below.

FIG. 5

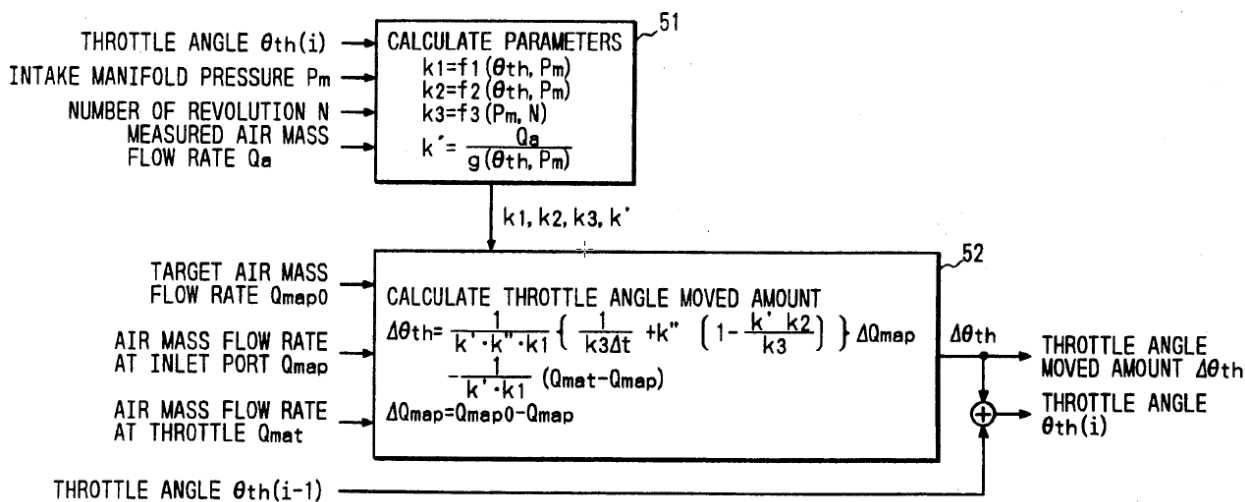


Figure 5 is a block diagram of the throttle control system, which includes blocks 51 and 52. *Id.* at 2:41–42; Fig. 5. Takahashi explains that “[b]lock 51 calculates the said various parameters. In block 52, throttle angle moved amount $\Delta\theta_{th}$ is calculated from the calculated parameters. Further, throttle angle move amount $\Delta\theta_{th}$ is added to the throttle angle $\theta_{th}(i-1)$ one time unit before, thereby calculating the current throttle angle $\theta(i)$.” *Id.* at 7:62–68.

Takahashi discusses another embodiment “which detects the air mass flow rate indirectly from the measured intake manifold pressure.” *Id.* at

⁹⁹ Although the text states that “[b]lock 42 calculates the fuel injection pulse width T_i ,” this appears to be a typographical error, given that block 43 in Figure 4 includes the text “CALCULATE INJECTION PULSE WIDTH.”

10:32–35. In connection with this disclosure, Takahashi presents Figure 14, which is reproduced below. *Id.* at 10:42–44.

FIG. 14

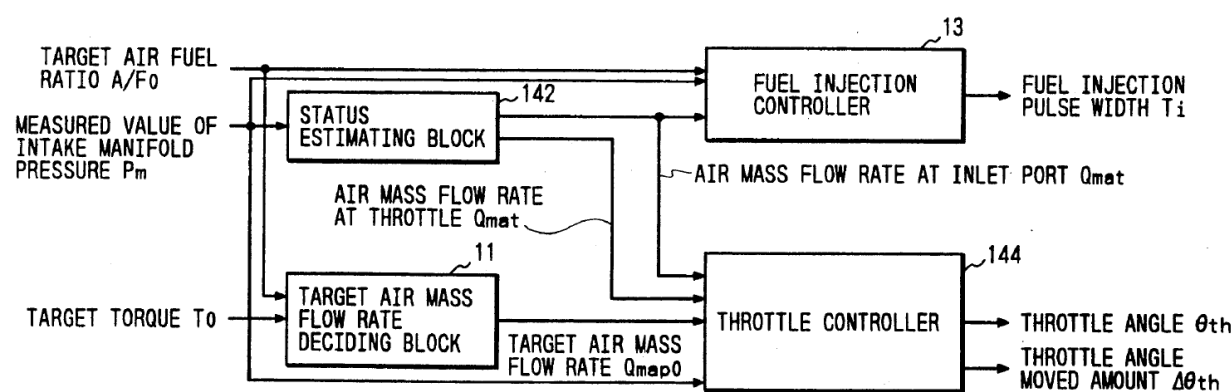


Figure 14 “is a block diagram of simultaneously controlling air-fuel ratio and torque, in said engine control system having a pressure sensor.” *Id.* at 2:62–64. Takahashi explains that “[t]he target air fuel ratio, target torque and intake manifold pressure are input as major input signals, thereby calculating the fuel injection pulse, throttle angle and throttle angle moved amount.” *Id.* at 10:44–47. In connection with this embodiment, Takahashi further discusses the status estimating block in more detail in connection with Figure 15, which is reproduced below.

FIG. 15

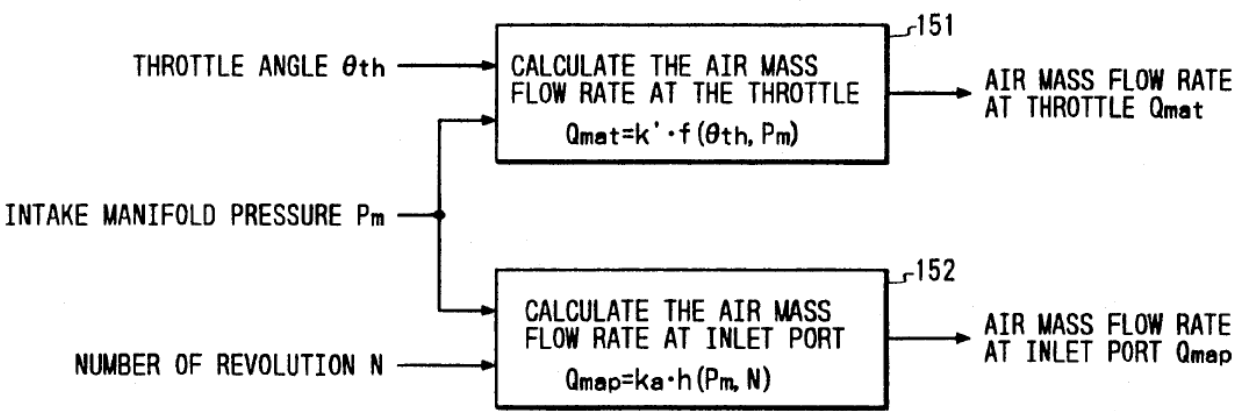


Figure 15 “is a block diagram of the status estimating block in FIG. 14.” *Id.* at 2:65–66. Takahashi explains that

Block 151 calculates the air mass flow rate at the throttle from the throttle angle and detected intake manifold pressure according to the Expression 12. Block 152 calculates the air mass flow rate at the inlet port from the intake manifold pressure and the detected engine speed according to [a certain expression].

Id. at 10:51–57.

2. Discussion

Claim 2 depends from claim 1, and claim 3 depends from claim 2. Ex. 1001, 4:23–28. In addition to the limitations of independent claim 1, claim 2 recites “wherein the estimated air charge signal is produced by an air charge controller which receives as inputs an air charge demand signal, a throttle position signal, an engine speed signal, a manifold pressure signal and an air charge temperature signal.” *Id.* at 4:23–26. Claim 3 adds that “the air charge demand signal is produced by an air charge demand

controller which receives as inputs the desired torque signal, a desired spark angle signal and a desired air/fuel ratio.” *Id.* at 4:27–30.¹⁰

Building on the challenge of claim 1 as obvious over Robichaux and Scherer, Petitioner cites Takahashi in combination with Robichaux and Scherer as teaching the limitations added by claims 2 and 3. Pet. 58–75. Petitioner cites Takahashi, for example, as teaching status estimating block 142 and throttle controller 144 (Figure 14), which Petitioner contends correspond to the “air charge controller” recited in claim 2. *Id.* at 67–71. Petitioner asserts that Takahashi teaches performing its engine control based on the specific parameters recited in claims 2 and 3. *Id.* at 65–75. Petitioner asserts that it would have been obvious to implement these aspects of Takahashi’s teachings with the teachings of Robichaux and Scherer. *Id.* at 58–75. For example, Petitioner asserts that a person of ordinary skill in art would have pursued the control “details provided by Takahashi’s air charge control unit for modifying Robichaux’s analogous air charge controller because combining Takahashi’s teachings with Robichaux and Scherer would have yielded predictable benefits and results—for example, precisely controlling the air mass flow rate at the inlet port of the engine cylinder.” *Id.* at 63.

At this stage, Patent Owner does not dispute Petitioner’s challenge of claims 2 and 3 as allegedly obvious over Robichaux, Scherer, and Takahashi separately from the challenge of independent claims 1 and 7 as allegedly obvious over Robichaux and Scherer. *See generally* Prelim. Resp.

¹⁰ The Certificate of Correction on page 7 of Exhibit 1001 clarifies that the word “ratio” appears before the period.

Our review of Petitioner’s arguments and evidence persuades us that Petitioner has demonstrated a reasonable likelihood of prevailing on its challenge of claims 2 and 3 as allegedly obvious over Robichaux, Scherer, and Takahashi.

G. Alleged Obviousness of Claim 4 over Robichaux, Scherer, and Suzuki

1. Overview of Suzuki

Suzuki “is directed to a control apparatus, or controller, for a direct-injection spark-ignition type engine.” Ex. 1005, 2:52–53. Suzuki shows an exemplary engine in Figure 2, which is reproduced below.

FIG.2

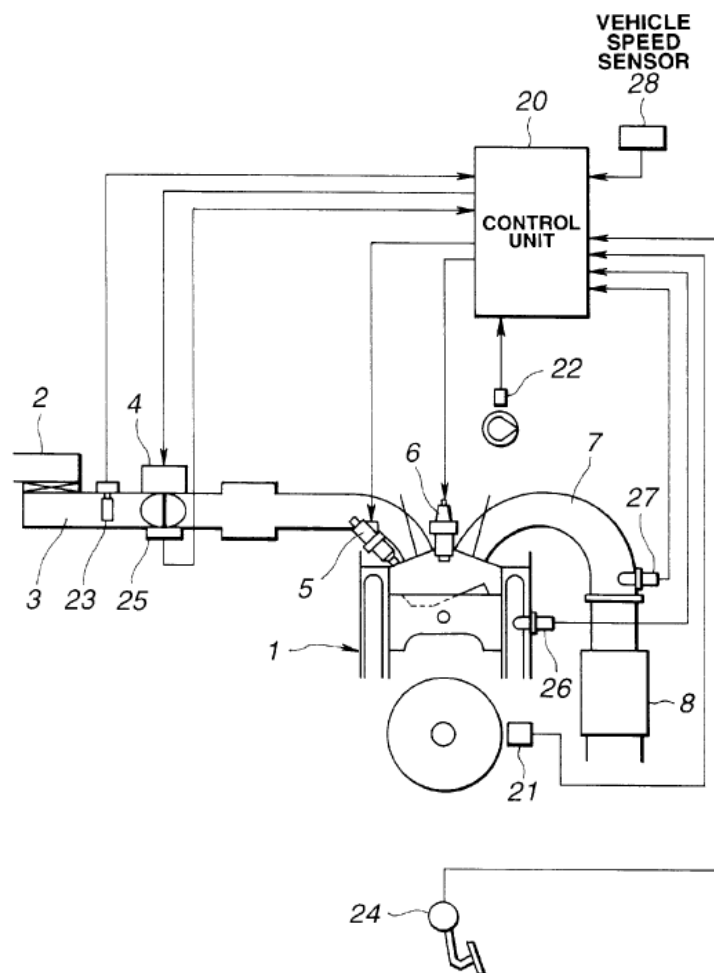


Figure 2 shows engine 1, which includes intake passage 3, throttle valve 4, fuel injector 5, spark plug 6, exhaust passage 7, controller 20, accelerator sensor 24, and various other components. *Id.* at 3:24–43, 3:61–4:5, 4:18–21.

Engine 1 is “a direct-injection spark-ignition engine.” *Id.* at 3:23–24. Controller 20 controls throttle valve 4, which controls air intake through intake passage 3 into the combustion chamber. *Id.* at 3:24–31. In response to a signal from controller 20, fuel injector 5 injects fuel directly into the combustion chamber. *Id.* at 3:33–34. The fuel mixes with air in the combustion chamber, and spark plug 6 generates a spark to combust the mixture of fuel and air. *Id.* at 3:38–45. Exhaust gases leave the combustion chamber through exhaust passage 7. *Id.* at 3:62–63.

Fuel injector 5 can introduce fuel into the combustion chamber during the intake stroke or the compression stroke. *Id.* at 3:39–44. If fuel injector 5 injects fuel during the intake stroke, the fuel forms a homogeneous mixture with the air in the combustion chamber. *Id.* at 3:39–42. If fuel injector 5 injects fuel during the compression stroke, the fuel forms a stratified mixture with the air around spark plug 6. *Id.* at 3:42–44. “The combustion modes include homogenous stoichiometric combustion . . . , homogeneous lean combustion . . . , and stratified lean combustion.” *Id.* at 3:46–50. Suzuki discusses provisions for switching between homogeneous and stratified combustion modes in connection with Figures 1(A) and 1(B), which are reproduced below.

FIG.1(A)

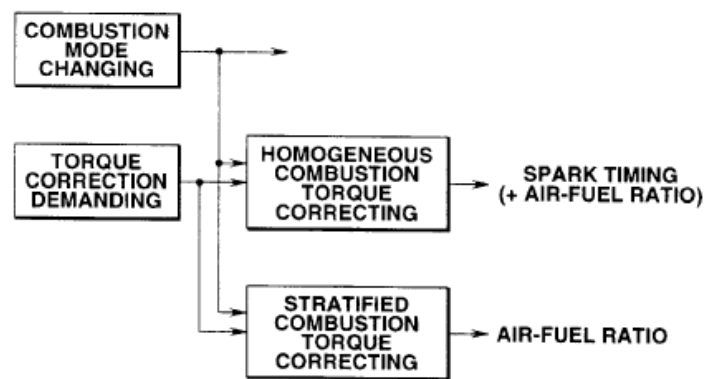
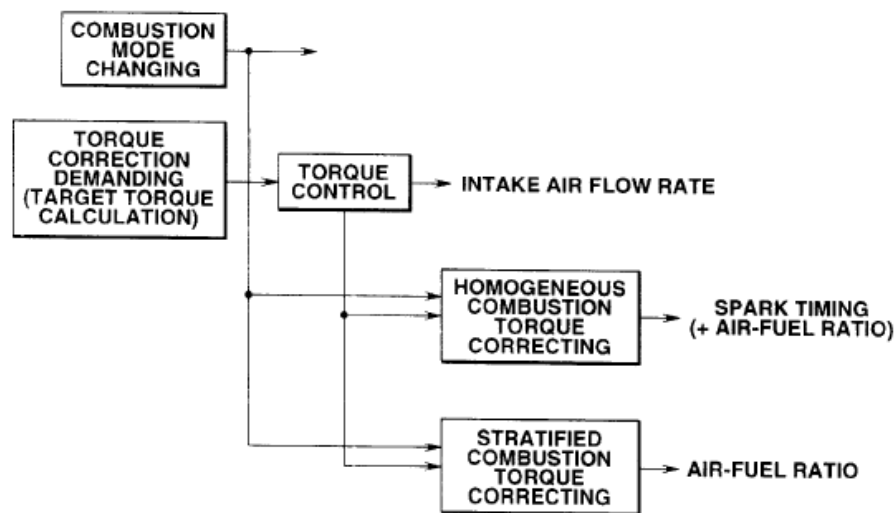


FIG.1(B)



Figures 1(A) and 1(B) are “block diagrams showing the overall arrangement of the invention.” *Id.* at 1:66–67.

In Figure 1(A), there is shown a combustion mode changing section, a torque correction demanding section, a homogeneous combustion torque correcting section, and a stratified combustion torque correcting section. *Id.* at 2:54–3:4. Combustion mode changing section serves to make “a combustion change between homogeneous combustion (wherein fuel is

injected during an intake stroke to diffuse the fuel so as to form a homogeneous mixture in the combustion chamber) and stratified combustion (wherein fuel is injected during a compression stroke to form a stratified mixture around the spark plug).” *Id.* at 2:55–61. The torque correction demanding section generates a torque correction demand according to engine operating conditions. *Id.* at 2:61–63. During homogeneous combustion, the homogeneous torque correcting section responds to the torque correction demand by “correcting at least the spark timing in order to make a torque correction during homogeneous combustion.” *Id.* at 2:64–3:1. During stratified combustion, the stratified torque correcting section responds to the torque correction demand “and corrects at least the air-fuel ratio in order to make a torque correction.” *Id.* at 3:1–3.

Another overall arrangement appears in Figure 1(B). *Id.* at 3:5. In addition to the sections of the arrangement of Figure 1(A), the arrangement of Figure 1(B) includes a torque control section, which responds “to the torque correction demand and controls the amount of air permitted to enter the engine in order to control the torque.” *Id.* at 3:12–15. Suzuki explains that

[b]ecause air intake cannot be changed rapidly, a homogenous combustion torque correcting section corrects at least the spark timing in order to make a torque correction with a fast response (compared with the delay associated with intake air flow rate control) during homogenous combustion. A stratified combustion torque correcting section corrects at least the air-fuel ratio to make torque correction during stratified combustion.

Id. at 3:15–22.

Suzuki discusses details of one method of correcting torque in connection with Figure 6, which is reproduced below.

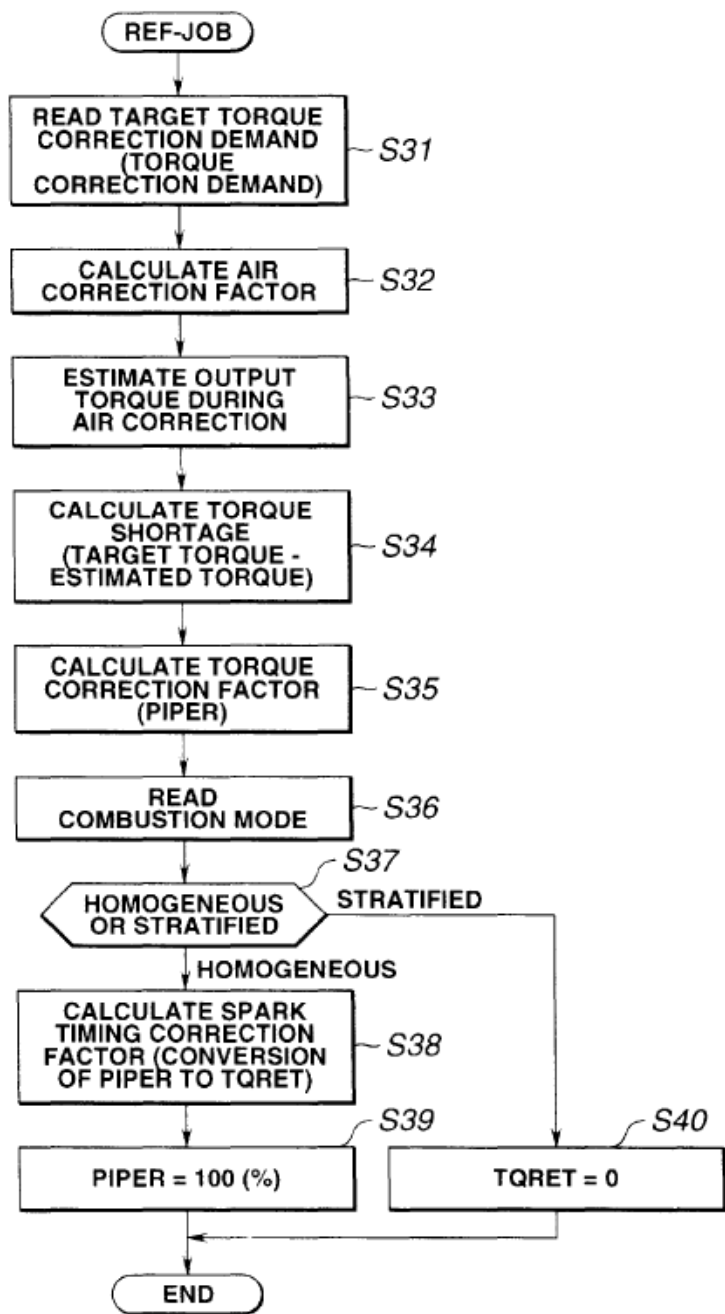


Figure 6 is a flow diagram illustrating “a torque correcting routine.” *Id.* at 2:10–11, 7:11–12.

In step S31, “a target torque tTRQ calculated by torque demand control is retrieved. The parameter tTRQ includes a torque correction demand (demand for increasing or decreasing the torque) resulting from gear shifting of the transmission, turning on the air conditioner, recovery from a fuel cut, or the like.” *Id.* at 7:14–19. Following this,

[i]n step S32, an air correction factor to obtain the target torque (the torque correction demand) is calculated to control the degree of opening of the electronic controlled throttle valve 4.

In step S33, the output torque during intake air correction is estimated.

In step S34, the estimated torque is subtracted from the target torque (which is based on the torque demand control target torque or the torque correction demand calculated at step S31) to calculate the torque shortage due to the delay involved with changing the amount of intake air.

Id. at 7:29–39.

At step S36, the combustion mode is read and it is ascertained whether it is the homogeneous or stratified combustion mode. *Id.* at 7:45–50.

Depending on which combustion mode is active, in step S38 or step S40, different control parameters are set. *Id.* at 7:51–64. Subsequently, control proceeds according to a spark timing calculation routine and a fuel delivery requirement calculation routine. *Id.* at 7:65–67.

For the embodiment discussed in connection with Figure 6, Suzuki shows response waveforms in Figure 13, which is reproduced below.

FIG.13

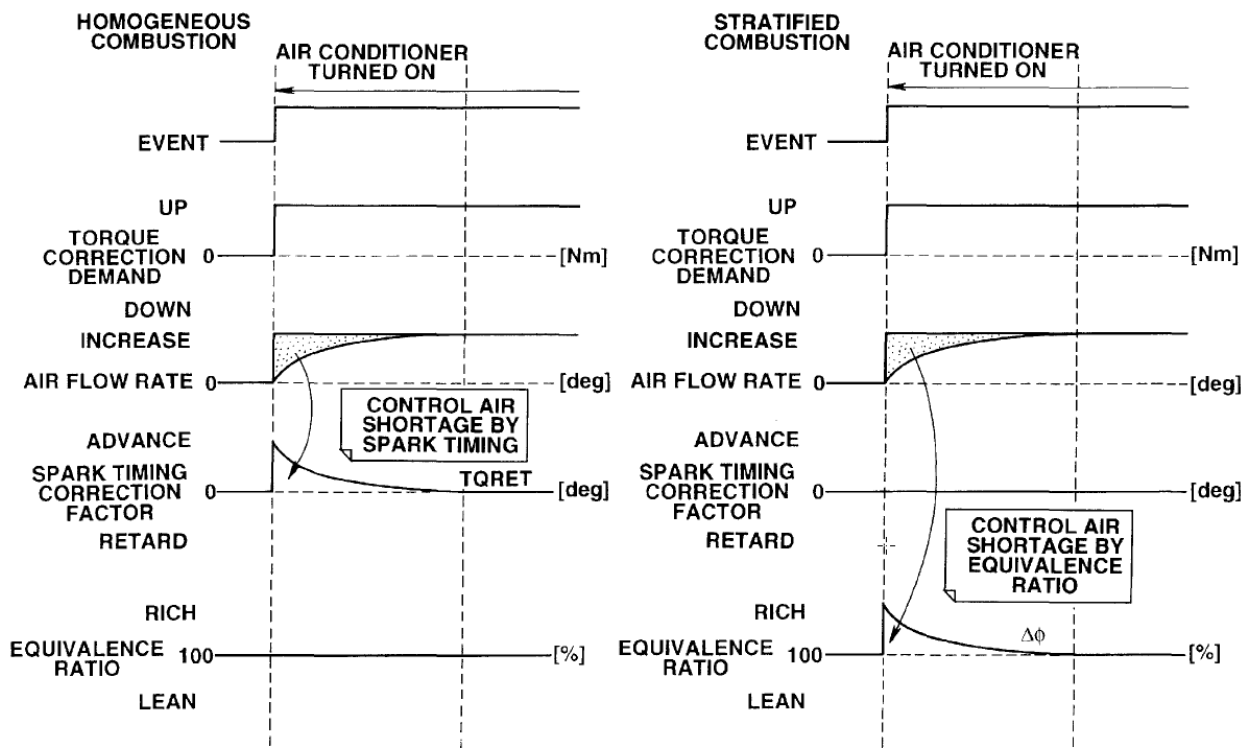


Figure 13 shows, for both homogeneous combustion and stratified combustion, variation in certain values, such as torque correction demand, air flow rate, spark timing correction factor, and equivalence ratio in response to activation of an air conditioner. *See id.*, Fig. 13. Suzuki explains that

FIG. 13 shows response waveforms for the second embodiment. Assuming that a torque correction (torque up) demand is produced when the air conditioner is turned on, the amount of air to the engine increases; however, a torque shortage occurs because of the delay in increasing the actual amount of air to the engine. The spark timing is corrected to correct the torque shortage during homogeneous combustion and the equivalence ratio (air-fuel ratio) is corrected, without correcting the spark

timing, to correct the torque shortage during stratified combustion.

Id. at 8:51–60.

2. Discussion

Claim 4 depends from claim 1. Ex. 1001, 4:31. In addition to the limitations of claim 1, claim 4 adds limitations related to “operating in a stratified mode or a homogeneous mode.” *Id.* at 4:34–44.

Building from the challenge of claim 1 as allegedly obvious over Robichaux and Scherer, Petitioner asserts that the additional limitations of claim 4 would have been obvious over Suzuki in combination with Robichaux and Scherer. Pet. 75–89. Petitioner argues that it would have been obvious to implement certain of Suzuki’s teachings regarding stratified combustion and homogeneous combustion with the teachings of Robichaux and Scherer. *Id.* Petitioner argues, for example, that “a [person of ordinary skill in the art would have been motivated to modify Robichaux’s engine controller to incorporate Suzuki’s dual-combustion-mode control to improve fuel efficiency while minimizing the effect on performance and exhaust.” *Id.* at 79.

At this stage, Patent Owner does not dispute Petitioner’s challenge of claim 4 as allegedly obvious over Robichaux, Scherer, and Suzuki separately from Petitioner’s challenge of claim 1 as allegedly obvious over Robichaux and Scherer.

Our review of Petitioner’s arguments and evidence persuades us that Petitioner has demonstrated a reasonable likelihood of prevailing on its challenge of claim 4 as allegedly obvious over Robichaux, Scherer, and Suzuki.

H. Alleged Obviousness of Claims 5 and 6 over Robichaux, Scherer, Suzuki, and Takahashi

Claim 5 depends from claim 4, and claim 6 depends from claim 5. Ex. 1001, 4:45–53. In addition to the limitations of claim 4, claims 5 and 6 add the same limitations recited in claims 2 and 3. Ex. 1001, 4:23–30, 4:45–53.

Building from the challenge of claim 4 as allegedly obvious over Robichaux, Scherer, and Suzuki, Petitioner asserts that the limitations added by claims 5 and 6 would have been obvious over Takahashi combined with Robichaux, Scherer, and Suzuki. Pet. 91–94. Petitioner argues, for example, that “a [person of ordinary skill in the art] would have been motivated to combine the teachings of Takahashi with Robichaux, Scherer, and Suzuki so that Robichaux’s controller converges the engine output torque to the demand torque more precisely.” *Id.* at 92.

At this stage, Patent Owner does not dispute Petitioner’s challenge of claims 5 and 6 as allegedly obvious over Robichaux, Scherer, Suzuki, and Takahashi separately from Petitioner’s challenge of claim 1 as allegedly obvious over Robichaux and Scherer.

Our review of Petitioner’s arguments and evidence persuades us that Petitioner has demonstrated a reasonable likelihood of prevailing on its assertion that claims 5 and 6 would have been obvious over Robichaux, Scherer, Suzuki, and Takahashi.

III. CONCLUSION

Based on the evidence before us, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing at least on its assertion

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Patent 6,581,565 B2

that claims 1–7 of the '565 patent are unpatentable. Accordingly, we institute trial on all the challenges in the Petition.

At this stage of the proceeding, the Board has not made a final determination on the construction of any claim term or the patentability of any challenged claim.

IV. ORDER

Upon consideration of the record before us, it is:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–7 of the '565 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the '565 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

IPR2020-00445
Patent 6,581,565 B2

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
Petitioner

v.

MICHIGAN MOTOR TECHNOLOGIES LLC,
Patent Owner

IPR2020-00444
Patent 6,581,565

**NOTICE OF REMOTE DEPOSITION
OF C. ARTHUR MACCARLEY, PH.D., P.E.**

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Patent Trial and Appeal Board
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
Submitted Electronically via PTAB E2E

Pursuant to 37 C.F.R. § 42.53, Patent Owner, Michigan Motor Technologies LLC (“Patent Owner”), by and through its attorneys, will conduct examination by deposition of C. Arthur MacCarley, Ph.D. PE.

Dr. MacCarley’s deposition will be conducted remotely on September 28, 2020, from 9:00 am to 5:00 pm ET, using videoconferencing means. The deposition will take place before a court reporter or other officer authorized to administer oaths and may be recorded by video and using audiotape and/or stenographic means.

Patent Owner will meet and confer with Petitioner to ensure that deponent has technology sufficient to attend a remote deposition and will conduct testing among the parties on the videoconferencing platform to establish that Internet bandwidth is sufficient, and the downloaded software is functioning correctly.

Respectfully submitted,

MICHIGAN MOTOR TECHNOLOGIES LLC,

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Attorney for Patent Owner

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies that on August 26, 2020, the foregoing *Notice of Deposition of C. Arthur MacCarley, Ph.D. PE.* is being served via electronic mail upon the following counsel of record for
Petitioner:

<u>Lead Counsel:</u> Michael D. Specht, Reg. No. 54,463 mspecht-PTAB@sternekessler.com STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C. 1100 New York Avenue, N.W. Washington, D.C. 20005 Tel.: 202-371-2600 Fax: 202-371-2540	<u>Backup Counsel:</u> Jason A. Fitzsimmons, Reg. No. 65,367 jfitzsimmons-PTAB@sternekessler.com Daniel E. Yonan, Reg. No. 53,812 dyonan-PTAB@sternekessler.com Kyle Conklin, Reg. No. 59,425 dyonan-PTAB@sternekessler.com John D. Higgins, Reg. No. 74,992 jhiggins-PTAB@sternekessler.com PTAB@sternekessler.com STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C. 1100 New York Avenue, N.W. Washington, D.C. 20005 Tel.: 202-371-2600 Fax: 202-371-2540
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
Petitioner

v.

MICHIGAN MOTOR TECHNOLOGIES LLC,
Patent Owner

IPR2020-00445
Patent 6,581,565

**NOTICE OF REMOTE DEPOSITION
OF C. ARTHUR MACCARLEY, PH.D., P.E.**

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Pursuant to 37 C.F.R. § 42.53, Patent Owner, Michigan Motor Technologies LLC (“Patent Owner”), by and through its attorneys, will conduct examination by deposition of C. Arthur MacCarley, Ph.D., P.E..

Dr. MacCarley’s deposition will be conducted remotely on October 5, 2020, from 9:00 am to 5:00 pm ET, using videoconferencing means. The deposition will take place before a court reporter or other officer authorized to administer oaths and may be recorded by video and using audiotape and/or stenographic means.

Patent Owner will meet and confer with Petitioner to ensure that deponent has technology sufficient to attend a remote deposition and will conduct testing among the parties on the videoconferencing platform to establish that Internet bandwidth is sufficient, and the downloaded software is functioning correctly.

Respectfully submitted,

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
Petitioner

v.

MICHIGAN MOTOR TECHNOLOGIES LLC,
Patent Owner

IPR2020-00445
Patent 6,581,565

PATENT OWNER'S UPDATED EXHIBIT LIST

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Alexandria, VA 22313-1450
Submitted Electronically via PTAB E2E

Patent Owner submits this Updated Exhibit List to accompany filing of Exhibit 2003, the October 5, 2020 deposition transcript of C. Arthur MacCarley, Ph.D.

Exhibit	Description
2001	Expert Declaration of Dr. Russell Leonard
2002	Affidavit of Ms. Robyn T. Williams
2003	Deposition transcript of C. Arthur MacCarley, Ph.D. taken October 5, 2020

DEVLIN LAW FIRM LLC

Dated: October 14, 2020

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies that on October 14, 2020, the foregoing document is being served via electronic mail upon the following counsel of record for Petitioner:

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Deposition of:
C. Arthur MacCarley , PhD, PE

October 5, 2020

In the Matter of:
**Volkswagen Group Of America, Inc.
Vs. Michigan Motor Technologies LLC**

Veritext Legal Solutions
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MMT Exhibit 2003
IPR2020-00445

UNITED STATES PATENT AND TRADEMARK OFFICE

09:34:33

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,

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v.

MICHIGAN MOTOR TECHNOLOGIES LLC,

Patent Owner.

Case IPR2020-00445

Patent 6,581,565

REMOTE VIDEOCONFERENCED AND

VIDEOTAPED DEPOSITION OF

C. ARTHUR MacCARLEY, PhD, PE

DATE TAKEN: OCTOBER 5, 2020

REPORTED BY: PAUL J. FREDERICKSON, CSR

JOB NO. 4236453

Veritext Legal Solutions

215-241-1000 ~ 610-434-8588 ~ 302-571-0510 ~ 202-803-8830

MMT Exhibit 2003

IPR2020-00445

1 UNITED STATES PATENT AND TRADEMARK OFFICE

2 -----
3
4 BEFORE THE PATENT TRIAL AND APPEAL BOARD
5 -----

6 VOLKSWAGEN GROUP OF AMERICA, INC.,
7 Petitioner

8 v.

9 MICHIGAN MOTOR TECHNOLOGIES LLC,
10 Patent Owner.
11 -----

12 Case IPR2020-00445

13 Patent 6,581,565
14 -----

15
16
17 Remote Videoconferenced and
18 Videotaped Deposition of C. ARTHUR
19 MacCARLEY, PhD, PE, the witness herein, at
20 9:39 a.m. Pacific Time, pursuant to
21 notice, reported by certified court
22 reporter Paul J. Frederickson, CSR. All
23 parties appeared remotely and the witness
24 was sworn remotely.
25

A P P E A R A N C E S

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I N D E X

C. ARTHUR MacCARLEY, PhD, PE
By Mr. Devlin: 6

Request for information: None
Request for documents: None

INDEX TO EXHIBITS

No Exhibits marked

1	OCTOBER 5, 2020	
2	[9:39 a.m.]	09:39:06
3	THE COURT REPORTER: Starting	09:39:15
4	with Robyn, let's make your	09:39:17
5	appearances.	09:39:18
6	MS. WILLIAMS: Robyn Williams	09:39:19
7	for patent owner Michigan Motor	09:39:20
8	Technologies.	09:39:24
9	MR. DEVLIN: Tim Devlin for	09:39:24
10	patent owner Michigan Motors.	09:39:27
11	MR. CONKLIN: Kyle Conklin on	09:39:30
12	behalf of petitioner Volkswagen Group	09:39:32
13	of America.	09:39:36
14	MR. HIGGINS: John Higgins on	09:39:36
15	behalf of petitioner Volkswagen Group	09:39:38
16	of America.	09:39:38
17	THE WITNESS: I'm Art MacCarley.	09:39:43
18	I'm the expert being deposed.	09:39:47
19	C. ARTHUR MacCARLEY, PhD, PE	09:39:47
20	being duly sworn on oath, was	09:39:47
21	examined and testified	09:39:47
22	as follows:	09:39:47
23	THE COURT REPORTER: Okay. You	09:39:47
24	may proceed.	09:40:50
25	MR. DEVLIN: Okay.	09:41:44

1	EXAMINATION	09:42:08
2	BY MR. DEVLIN:	09:42:08
3	Q. Okay. All right. Thank you.	09:42:34
4	Am I coming through okay?	09:42:35
5	A. I hear you okay.	09:42:36
6	Q. So, Dr. MacCarley, good to see	09:42:56
7	you again, sir.	09:43:00
8	A. Good morning.	09:43:02
9	Q. You understand that we're here	09:43:04
10	for another deposition today?	09:43:05
11	A. Yes.	09:43:05
12	Q. And this is for -- again for the	09:43:08
13	'565 patent; right?	09:43:14
14	A. Yes, '565. Thank you.	09:43:15
15	Q. Thank you.	09:43:18
16	And in this IPR proceeding this	09:43:19
17	is the 445 IPR proceeding. Do you	09:43:24
18	understand that?	09:43:28
19	A. Yes. I didn't have the number	09:43:35
20	but sounds right.	09:43:37
21	Q. Okay. Thank you.	09:43:38
22	And the one thing I wanted to	09:43:40
23	confirm is that you've submitted a single	09:43:42
24	declaration in this proceeding; is that	09:43:44
25	correct?	09:43:46

1 A. There were two declarations 09:43:50
2 filed related to '565. This is the second 09:43:51
3 of the two. 09:43:54

4 Q. Right. 09:43:55

5 And to be clear one of those was 09:43:57
6 in a separate proceeding and the other 09:43:59
7 declaration is in this proceeding; correct? 09:44:01

8 A. Correct. 09:44:03

9 Q. Great. Okay. 09:44:05

10 And I'm just going to ask you, 09:44:07
11 do you have a copy of the declaration handy 09:44:09
12 that you submitted in this proceeding? 09:44:12

13 A. I do. 09:44:14

14 Q. All right. Thank you. 09:44:15

15 And for the record that's been 09:44:17
16 marked as Exhibit 1003 in IPR 445. 09:44:19

17 Dr. MacCarley, we went through 09:44:30
18 some basics last week just in terms of just 09:44:31
19 our interaction today, but let's go through 09:44:34
20 them again just so we make sure we're on the 09:44:36
21 same page. 09:44:38

22 You understand in this 09:44:38
23 deposition I'll be asking you questions and 09:44:39
24 you'll provide answers to those questions to 09:44:42
25 the extent that you can? 09:44:43

1	A. I do.	09:44:44
2	Q. And if any of my questions are	09:44:46
3	unclear let me know. I'll be happy to	09:44:47
4	clarify it. Okay?	09:44:49
5	A. Okay.	09:44:50
6	Q. You understand you're under oath	09:44:52
7	today?	09:44:53
8	A. I do.	09:44:53
9	Q. You've sworn to tell the truth,	09:44:55
10	the whole truth and nothing but the truth?	09:44:56
11	A. I did.	09:44:58
12	Q. And you'll do that?	09:44:58
13	A. Of course.	09:44:59
14	Q. We'll take breaks today every	09:45:02
15	hour or so. If you need a break in between	09:45:04
16	just let us know. We're happy to do that.	09:45:07
17	All right?	09:45:09
18	A. Okay.	09:45:10
19	Q. We'll try to talk slowly today	09:45:12
20	because we're having a little bit of audio	09:45:15
21	issue, and we'll also try to let each other	09:45:18
22	finish before the other starts. I know	09:45:20
23	that's sometimes hard over these video	09:45:22
24	depositions, but I'll do my best and if you	09:45:27
25	could do the same that would be great.	09:45:29

1	Okay?	09:45:30
2	A. Okay.	09:45:31
3	Q. We'll ask for verbal responses,	09:45:32
4	no nods of the head or anything like that,	09:45:35
5	so the court reporter can take down the	09:45:37
6	verbal response. All right?	09:45:39
7	A. Okay.	09:45:41
8	Q. Is there anything today, medical	09:45:42
9	or otherwise, that would prevent you from	09:45:44
10	giving complete and accurate testimony	09:45:46
11	today?	09:45:48
12	A. No.	09:45:48
13	Q. And other than this Zoom	09:45:50
14	interface that we're on right now, are you	09:45:52
15	in contact at all with any of the attorneys	09:45:54
16	for Volkswagen?	09:45:57
17	A. No.	09:45:57
18	Q. And will you let us know if that	09:45:59
19	changes at all today?	09:46:01
20	A. Of course.	09:46:02
21	Q. Thank you.	09:46:02
22	I want to talk first about the	09:46:10
23	process by which this declaration was	09:46:11
24	created. And when I say "this declaration,"	09:46:16
25	I mean the single one submitted in this IPR.	09:46:19

1	Are you with me?	09:46:23
2	A. I understand.	09:46:24
3	Q. Okay. Thank you.	09:46:25
4	So I want it talk a little bit	09:46:25
5	about that.	09:46:27
6	What was the starting point for	09:46:29
7	the creation of this declaration? How did	09:46:30
8	you begin your work in any way, shape or	09:46:33
9	form?	09:46:36
10	MR. CONKLIN: Objection, form.	09:46:38
11	A. The complete process began with	09:46:46
12	numerous discussions between myself and the	09:46:48
13	attorneys for Sterne Kessler formulating --	09:46:51
14	first of all understanding the issues,	09:46:56
15	formulating a declaration plan, identifying	09:47:01
16	potential prior art references, both patents	09:47:14
17	and in common publications. Some written	09:47:18
18	correspondence fleshing out what eventually	09:47:26
19	became parts of the declaration, usually my	09:47:30
20	input to them, technical advice. And then	09:47:33
21	the drafting of the declaration which began	09:47:38
22	with just a standard framework provided by	09:47:40
23	the attorneys with the usual boilerplate	09:47:44
24	plate in place for an IPR.	09:47:48
25	Q. Thank you.	09:47:54

1	Let's go back over a couple of	09:47:55
2	those steps. I think one thing you	09:47:57
3	mentioned was formulating a declaration	09:47:59
4	plan. What did you mean by that? What's a	09:48:03
5	declaration plan, I mean?	09:48:05
6	MR. CONKLIN: Objection, form.	09:48:07
7	A. All I meant was getting an idea	09:48:15
8	of what we had to do. There was nothing	09:48:18
9	formal about it.	09:48:20
10	Q. Thank you.	09:48:21
11	When you say "we" there you mean	09:48:24
12	you and the Sterne Kessler attorneys?	09:48:25
13	A. Oh, mainly I am referring to	09:48:27
14	myself, but in as much as I was engaged by	09:48:29
15	Sterne Kessler I sometimes use the word	09:48:32
16	"we."	09:48:36
17	Q. Were you working with the Sterne	09:48:38
18	Kessler attorneys at all in formulating that	09:48:40
19	declaration plan?	09:48:41
20	A. Yes.	09:48:41
21	Q. In what ways did you provide	09:48:56
22	input to that declaration plan and in what	09:48:58
23	ways did they provide input?	09:49:00
24	MR. CONKLIN: Objection, form.	09:49:03
25	BY MR. DEVLIN:	09:49:04

1	Q.	Was it a mixed effort?	09:49:08
2	A.	It was a collaborative effort	09:49:10
3		with, for instance, sections that were	09:49:15
4		entirely recitations of legal principles	09:49:23
5		being mostly supplied by them. Sections	09:49:25
6		that formed the technical opinions, the way	09:49:29
7		the prior art was applied, combinations of	09:49:34
8		those. It was based primarily on my input.	09:49:37
9	Q.	Did you have any input into the	09:49:45
10		legal standards sections?	09:49:47
11	A.	Yes.	09:49:47
12	Q.	In what ways?	09:49:50
13	A.	I've done quite a few IPRs	09:49:59
14		before. I've drafted a number of IPRs	09:50:04
15		before. This is standard boilerplate that	09:50:08
16		has to appear at the front of almost every	09:50:10
17		IPR, so the language is very familiar to me.	09:50:12
18		The actual words here were for the most part	09:50:15
19		crafted and put to paper by the Sterne	09:50:20
20		Kessler attorneys in who -- who have the	09:50:23
21		expertise in that area.	09:50:27
22		Some elements of it I had to	09:50:28
23		enter, for instance, those related to a	09:50:35
24		person of ordinary skill in the art, which I	09:50:40
25		defined.	09:50:42

1 Is that adequate? 09:50:44

2 Q. Thank you. 09:50:45

3 And then conversely did they 09:50:47

4 have any input on the technical sections? 09:50:49

5 A. Yes. 09:50:54

6 Q. How so? 09:50:54

7 A. In our preliminary discussions, 09:50:55

8 keeping in mind that both attorneys do have 09:50:59

9 technical backgrounds, we sorted out a 09:51:02

10 number of the interpretations of both '565 09:51:11

11 and the selected prior art patents 09:51:17

12 collaboratively, checking each other's 09:51:23

13 understanding and interpretation of the 09:51:26

14 words, which I'm sure you know can be 09:51:27

15 sometimes a little bit obtuse in patent 09:51:30

16 language. But the technical content 09:51:33

17 underlying all of the arguments originates 09:51:39

18 from either me or just common sense 09:51:41

19 engineering knowledge. 09:51:45

20 Q. Let me talk about the step of 09:51:49

21 identifying the prior art. Could you tell 09:51:51

22 me how that took place? 09:51:53

23 A. The staff at Sterne Kessler, who 09:52:10

24 have expertise in searching and can do so 09:52:14

25 more efficiently than I can, identified a 09:52:18

1 number of patents, some of which I selected 09:52:21
2 for use in this declaration with the 09:52:25
3 approval of the attorneys. Is that 09:52:31
4 adequate? 09:52:38

5 Q. Yeah. Let me drill down a 09:52:40
6 little bit. And thank you. I know some of 09:52:42
7 these questions are sort of open-ended, and 09:52:44
8 I think your -- your -- in terms of the 09:52:46
9 depth and specificity of your answers, it's 09:52:52
10 been fine from my perspective, but if I have 09:52:54
11 followups I'll just -- I'll ask them. 09:52:56

12 So in other words this is just 09:53:00
13 you and I talking right here in terms of, 09:53:03
14 you know, making this efficient. I think 09:53:05
15 you're answering in a way that is efficient 09:53:08
16 and giving me information that I can decide 09:53:10
17 whether I want to drill down rather than 09:53:12
18 you, you know, give every tiny little detail 09:53:14
19 which could take, you know, minutes and 09:53:18
20 minutes on a given answer. I'm inferring 09:53:19
21 that's the nature of your question and I 09:53:21
22 guess that's my feedback. It's your 09:53:23
23 depo- -- it's my deposition but you're the 09:53:25
24 one under oath. So of course always answer 09:53:27
25 in the way that you feel is appropriate. 09:53:28

1	All right?	09:53:30
2	A. I assume so. I'm not exactly	09:53:33
3	sure what you meant by the last comment, but	09:53:36
4	it probably doesn't matter.	09:53:38
5	Q. Oh, I simply meant to say I'm	09:53:40
6	not -- me giving you some feedback right	09:53:42
7	now. I'm not trying to dictate at all how	09:53:44
8	you answer. Okay? That's up to you. I'll	09:53:46
9	ask the questions. You decide on your	09:53:49
10	answers. Fair enough?	09:53:50
11	A. Fair enough.	09:53:51
12	Q. Okay. Thank you.	09:53:52
13	When the -- do you know the	09:54:00
14	identities of the folks at Sterne Kessler	09:54:03
15	who did the prior art searching?	09:54:08
16	A. No. I assume that the attorneys	09:54:17
17	that I worked with had something to do with	09:54:20
18	it, but I know that they have a staff that	09:54:22
19	is very skilled at this, and I have never	09:54:28
20	inquired as to their names.	09:54:31
21	Q. Did you have any input in	09:54:35
22	formulating the scope of their search	09:54:37
23	keyword terms, anything like that?	09:54:42
24	MR. CONKLIN: Objection, form.	09:54:45
25	A. I'm sorry, could you ask that	09:54:52

1 question again? 09:54:55

2 Q. Sure. Let my try a different 09:54:57
3 question and see if it's easier. 09:54:59

4 Did you have any input at all on 09:55:02
5 the search for prior art that those folks at 09:55:04
6 Sterne Kessler did? 09:55:07

7 A. I believe the search which 09:55:08
8 followed our initial technical discussions 09:55:16
9 was informed by my input during those 09:55:18
10 discussions. So I believe that's a yes to 09:55:21
11 your question. 09:55:28

12 Q. Did you ever specifically 09:55:29
13 discuss what the field or scope of that 09:55:33
14 search would be with anyone? 09:55:36

15 A. I don't recall ever using those 09:55:46
16 words. 09:55:48

17 Q. Did you ever provide any -- let 09:55:49
18 me back up a second. 09:55:52

19 You understand that sometimes 09:55:54
20 electronic searching is done using keywords 09:55:56
21 or strings of keywords these days? Do you 09:55:58
22 have some understanding of that? 09:56:01

23 A. Yes. 09:56:01

24 Q. Did you provide any keywords or 09:56:03
25 strings of keywords as suggestions to assist 09:56:05

1 with their search? 09:56:09

2 A. I don't recall specifically 09:56:18

3 saying "search on these keywords." But I 09:56:20

4 also want to point out that the prior art 09:56:23

5 that we're using is not just the referenced 09:56:25

6 patents. There are highly applicable 09:56:28

7 general engineering references which for the 09:56:34

8 most part I located on my own. And some of 09:56:37

9 those I located using typical public search 09:56:40

10 mechanisms and some were simply documents 09:56:45

11 that I already owned. 09:56:48

12 Q. Understood. And then you've 09:56:51

13 anticipated a next series of questions. So 09:56:53

14 let me tell you where I'm going and then 09:56:55

15 I'll ask the specific question. 09:56:56

16 I want to try to understand to 09:56:58

17 the extent you recall which of the 09:56:59

18 references that are listed as exhibits in 09:57:03

19 this IPR, which of those were the product of 09:57:07

20 the Sterne Kessler search versus your own 09:57:13

21 searching or gathering or prior ownership? 09:57:17

22 So do you have any recollection of which 09:57:23

23 came from Sterne Kessler and which came from 09:57:25

24 your own searching? 09:57:30

25 MR. CONKLIN: Objection, form. 09:57:38

1 A. I believe that the four prior 09:57:44
2 patents cited in this declaration came from 09:57:49
3 the Sterne Kessler research staff. Not all 09:57:52
4 at the same time. In particular the latter 09:57:57
5 patent was most definitely related to 09:58:01
6 technical feedback that I provided when I 09:58:03
7 was studying the first options. 09:58:06

8 Q. Thank you. 09:58:14

9 And the four references -- let 09:58:14
10 me just make sure I'm with you and then you 09:58:16
11 had mentioned one called the -- the latter 09:58:19
12 reference. So there -- if you look in your 09:58:25
13 declaration, and there is a table of 09:58:29
14 contents, why don't you turn to that? 09:58:33

15 A. I'm there. 09:58:40

16 Q. Okay. 09:58:40

17 And you see about -- on the 09:58:41
18 first page it's labeled letter "i," first 09:58:45
19 page of the table of contents about 09:58:49
20 three-quarters of the way down there's a 09:58:52
21 "Summary of the Applied References" section. 09:58:54

22 Do you see that? 09:58:56

23 A. Yes. 09:58:56

24 Q. And then there are listed under 09:58:58
25 that four references: A, B, C and D. 09:59:00

1	Do you see those?	09:59:05
2	A. I do.	09:59:05
3	Q. Okay.	09:59:05
4	Are those the four references	09:59:06
5	that you were just referring to in your	09:59:08
6	previous answer?	09:59:10
7	A. Yes.	09:59:10
8	Q. Okay. Great.	09:59:10
9	And when you said the latter of	09:59:13
10	those, were you referencing reference:	09:59:15
11	"D. Suzuki"?	09:59:18
12	A. No, I was referencing:	09:59:20
13	"A. Robichaux."	09:59:21
14	Q. Thank you. Okay.	09:59:23
15	Can you tell us a little more	09:59:24
16	about how that timing process happened? So	09:59:26
17	you said that was the product of additional	09:59:29
18	feedback from you. Did I understand you	09:59:31
19	right?	09:59:34
20	MR. CONKLIN: Objection, form.	09:59:34
21	A. It's fair to say that's correct.	09:59:42
22	Q. And what do you mean by that?	09:59:44
23	Explain to me a little bit more in more	09:59:47
24	detail what happened there. What prompted	09:59:48
25	the additional searching, et cetera?	09:59:51

1 MR. CONKLIN: Objection, form. 09:59:53

2 A. Gosh, I -- forgive me, but could 09:59:59

3 you narrow that question a little bit so I 10:00:02

4 can answer more specifically? 10:00:05

5 Q. Sure. 10:00:05

6 Let me give you an example. Did 10:00:08

7 you find that the other references were sort 10:00:10

8 of missing some detail or lacking in some 10:00:12

9 way and suggested that there be some 10:00:15

10 additional searching that took place? Did 10:00:16

11 that happen? 10:00:19

12 A. No. 10:00:19

13 Q. Okay. 10:00:19

14 So what did happen at sort of 10:00:22

15 that level of detail? 10:00:24

16 A. I don't remember exactly during 10:00:33

17 the brief period between the identification 10:00:38

18 of Suzuki Takahashi and Scherer and then 10:00:41

19 slightly afterwards Robichaux, but 10:00:46

20 chronologically Robichaux followed the 10:00:49

21 others. I -- I specifically analyzed that, 10:00:52

22 I recall, at the -- at the suggestion, at 10:01:00

23 the request of the attorneys, and felt that 10:01:06

24 it was a nice enhancement to valid arguments 10:01:10

25 already in place. 10:01:17

1	Q.	All right.	10:01:17
2		I think you mentioned,	10:02:55
3		Dr. MacCarley, that at some point the	10:02:58
4		attorneys provided a framework draft to you.	10:02:59
5		Did I get that right?	10:03:02
6	A.	Yes.	10:03:07
7	Q.	What does that framework draft	10:03:08
8		look like?	10:03:10
9	A.	Well, as I understand it from my	10:03:12
10		prior experience, it's pretty much a	10:03:18
11		standard format for IPR declarations. It's	10:03:21
12		a legal format that is expected, and they	10:03:26
13		provided that. It included the appropriate	10:03:32
14		sections in the order that they are supposed	10:03:35
15		to appear. The legal areas, as I mentioned	10:03:37
16		before, were mostly fleshed out by them and	10:03:40
17		then made -- made correct by me.	10:03:45
18		That is what I'm referring to as	10:03:57
19		the framework.	10:03:58
20	Q.	Thank you.	10:03:59
21		And did you produce a draft from	10:04:00
22		that framework?	10:04:02
23	A.	Yes.	10:04:02
24	Q.	And what happened after that	10:04:05
25		with that draft?	10:04:06

1 A. There was quite a bit of back 10:04:07
2 and forth through many partially developed 10:04:11
3 versions. It was incremental. So this was 10:04:17
4 the natural process of collaboratively 10:04:22
5 creating a final document. But once again, 10:04:28
6 all of the technical opinions in this 10:04:32
7 document are either from me, strongly 10:04:37
8 supported by me or simply common engineering 10:04:42
9 knowledge. 10:04:47

10 Q. When you say that one option of 10:04:49
11 strongly supported by you, I take it that 10:04:52
12 means it might have been a suggestion that 10:04:54
13 came from the -- one of the attorneys but 10:04:57
14 you nevertheless supported it and then 10:04:59
15 adopted it and put it in your report. Am I 10:05:02
16 understanding you right? 10:05:05

17 A. That would be fair. 10:05:07

18 MR. CONKLIN: Objection, form. 10:05:17

19 BY MR. DEVLIN: 10:05:17

20 Q. I want to go back a little bit 10:05:48
21 further in time. Do you remember when you 10:05:50
22 were first retained as an expert for this 10:05:54
23 particular proceeding? 10:05:56

24 A. Approximately. 10:06:00

25 Q. When was that approximately? 10:06:01

1	A.	Around the end of November 2019.	10:06:08
2	Q.	And who retained you?	10:06:10
3	A.	The legal firm of Sterne	10:06:12
4		Kessler.	10:06:17
5	Q.	About how many hours have you	10:06:22
6		billed in connection for your work in this	10:06:24
7		IPR proceeding?	10:06:29
8	A.	It's hard for me to sort out	10:06:36
9		those hours from the total number of hours	10:06:38
10		which I had given to you at the last	10:06:42
11		deposition because MMT asserted an entire	10:06:47
12		portfolio against Volkswagen of which I was	10:06:51
13		engaged to consult on four of the of the	10:06:57
14		asserted patents. The work ran currently,	10:07:01
15		so it is difficult for me to sort out how	10:07:08
16		much time was spent on each. You have the	10:07:10
17		total of all four.	10:07:12
18	Q.	Thank you.	10:07:13
19		For this transcript can you	10:07:15
20		remind us of that total?	10:07:16
21	A.	I never totaled it at the time	10:07:19
22		of the declaration -- at the time you asked	10:07:20
23		before, but I think it was overall about 200	10:07:22
24		hours.	10:07:27
25	Q.	On those -- you mentioned that	10:07:27

1	you were retained with respect to four	10:07:42
2	patents that had been asserted by MMT. Did	10:07:45
3	I get that right?	10:07:48
4	A. To consult on them, yes.	10:07:50
5	Q. Thank you.	10:07:55
6	And so my question is for each	10:07:56
7	of them are you doing any work beyond work	10:08:01
8	related to the IPR proceedings?	10:08:07
9	MR. CONKLIN: Objection, scope.	10:08:09
10	Objection, privilege.	10:08:11
11	Art, do not divulge any	10:08:14
12	information that will reveal the	10:08:15
13	content of our conversations.	10:08:18
14	A. I think the question -- I think	10:08:29
15	the answer to your question about any of the	10:08:30
16	work is no. I'm not -- I'm not in any other	10:08:32
17	way involved in those proceedings.	10:08:38
18	Q. Without identifying any -- let	10:08:43
19	me restart this question.	10:09:10
20	Without revealing the content of	10:09:13
21	any communications you've had with any	10:09:15
22	attorneys, I'm not asking that, I just want	10:09:17
23	to ask you do you recall how many attorneys	10:09:20
24	total at Sterne Kessler, different	10:09:25
25	individual attorneys you've interacted with,	10:09:29

1	regarding this particular IPR proceeding?	10:09:31
2	A. Assuming that's a fair question,	10:09:36
3	I've only interacted with Kyle and John on	10:09:50
4	this particular IPR.	10:09:54
5	Q. And that's Kyle Conklin and John	10:09:58
6	Higgins; is that right?	10:10:01
7	A. That's correct.	10:10:03
8	Q. Do you know about how many total	10:10:05
9	hours or how much time total you've	10:10:06
10	interacted with them with respect to this	10:10:08
11	IPR proceeding? Just roughly.	10:10:11
12	A. I --	10:10:14
13	MR. CONKLIN: Objection, form.	10:10:18
14	A. I think I already answered that	10:10:24
15	question, and my guess, again with the	10:10:26
16	caveats I mentioned before, is maybe 100	10:10:30
17	hours.	10:10:32
18	Q. Let me be clear of my question	10:10:34
19	so we don't have a -- maybe I wasn't quite	10:10:35
20	clear. So what -- but maybe I was but I	10:10:39
21	just want to confirm.	10:10:42
22	What I'm asking for now is not	10:10:43
23	total time worked but the total time that	10:10:45
24	you were actually interacting with	10:10:47
25	attorneys.	10:10:50

1 Was that 100 hours or something, 10:10:53
2 some part of that? 10:10:56
3 A. Oh, as in realtime 10:10:57
4 communication? Is that what you mean? 10:11:02
5 Q. Correct, yes. Thank you. 10:11:03
6 A. Honestly I could not. It's not 10:11:06
7 something I keep track of or keep records 10:11:09
8 of. It's an appropriate amount of time to 10:11:11
9 maintain for progress leading to the 10:11:14
10 completion of the declaration. 10:11:19
11 Q. All right. Thanks. 10:11:25
12 It's fair to say that you've 10:11:56
13 read the '565 patent at some point? 10:11:57
14 A. That would be fair to say, yes. 10:12:00
15 Q. Did that happen early in the 10:12:05
16 process of your analysis or later? Was it 10:12:07
17 first thing? 10:12:11
18 MR. CONKLIN: Objection, form. 10:12:12
19 A. I don't think it was the first 10:12:17
20 thing, but it was certainly early in the 10:12:18
21 process. 10:12:20
22 Q. What would have been the first 10:12:25
23 thing that you recall? 10:12:26
24 A. First I should say I'm not -- 10:12:33
25 I'm not sure. I didn't consider the early 10:12:34

1 chronology to be that important, but I 10:12:41
 2 assume that I started by standing the 10:12:41
 3 complaint to be confident that this is 10:12:43
 4 something I could be helpful with. 10:12:45

5 Q. In terms of -- so thank you for 10:13:00
 6 that clarification, and let me be a little 10:13:02
 7 bit more specific. 10:13:04

8 When we -- well, let me just 10:13:06
 9 cancel that question. 10:13:14

10 MR. DEVLIN: Tell you what. Why 10:13:16
 11 don't we take a ten-minute break? 10:13:18
 12 Does that work? 10:13:21

13 THE WITNESS: If you wish. I 10:13:24
 14 don't need a break but that's fine. 10:13:25

15 MR. DEVLIN: All right. I think 10:13:27
 16 it will move us along. Yeah, let's 10:13:29
 17 just take a ten-minute break. 10:13:31

18 Thank you. 10:13:33

19 THE COURT REPORTER: We're off 10:13:39
 20 the record. 10:13:39

21 [Recess at 10:14 a.m.] 10:13:41

22 [Resuming at 10:29 a.m.] 10:14:06

23 THE COURT REPORTER: We're back 10:29:50
 24 on the record. 10:29:51

25 MR. DEVLIN: Thank you. 10:29:53

1	EXAMINATION CONTINUING	10:29:53
2	BY MR. DEVLIN:	10:29:53
3	Q. Dr. MacCarley, welcome back. I	10:29:55
4	want to talk a little bit about the Scherer	10:29:56
5	reference. And do you have a copy of that	10:30:00
6	that you can pull up on your screen?	10:30:05
7	A. I do. Let me -- let me do that.	10:30:08
8	Q. Sure.	10:30:13
9	And I'll just note while you're	10:30:13
10	doing that for the record that it's	10:30:15
11	Exhibit 1007.	10:30:18
12	[Deposition Exhibit 1007 marked	10:30:18
13	for identification.]	10:30:18
14	BY MR. DEVLIN:	10:30:18
15	Q. And while you're at it, Doctor,	10:30:20
16	if you haven't already, please pull up a	10:30:23
17	copy or get a hard copy handy of the '565	10:30:25
18	patent. And let me know when you have both	10:30:29
19	of those handy.	10:30:33
20	A. Okay.	10:30:34
21	Q. All right.	10:30:34
22	"Okay" meaning you've got both	10:30:42
23	of them up?	10:30:44
24	A. Yes.	10:30:44
25	Q. All right. Great.	10:30:47

1	Could you turn to column 4 of	10:30:51
2	the '565 patent? It will be really the last	10:30:53
3	page of the original patent before those	10:30:56
4	certificates of correction.	10:31:02
5	A. Okay.	10:31:07
6	Q. And you see we're looking at on	10:31:07
7	the left -- sorry, the right-hand side of	10:31:10
8	the page under column 4 are some of the	10:31:12
9	claims including claim 1. Are you there?	10:31:14
10	A. I see it, yes.	10:31:17
11	Q. Okay.	10:31:19
12	And I want to focus for a moment	10:31:21
13	on the fourth or so element down which says	10:31:25
14	"a comparator" at the start of it.	10:31:30
15	Do you see that?	10:31:33
16	A. I see it.	10:31:34
17	Q. And if we could agree that	10:31:35
18	comparator receives two inputs as recited in	10:31:37
19	the claim; right?	10:31:40
20	A. Correct.	10:31:41
21	Q. One is an estimated torque	10:31:44
22	signal and the second is a desired torque	10:31:47
23	signal; right?	10:31:50
24	A. Correct, yes.	10:31:51
25	Q. Okay.	10:31:52

1 Keeping that in mind if we can, 10:31:56
2 but certainly keep that patent handy as 10:31:57
3 needed, please take a look at Scherer. And 10:32:00
4 I specifically want to direct you to 10:32:05
5 column 6 of Scherer. 10:32:09
6 A. I'm at column 6. 10:32:38
7 Q. All right. 10:32:38
8 And you see right at the start 10:32:39
9 of column 6 near about the third line it 10:32:41
10 starts with a discussion of the embodiment 10:32:45
11 of figure 3. 10:32:47
12 Do you see that? 10:32:49
13 A. Yes. 10:32:52
14 Q. All right. 10:32:52
15 Why don't you go ahead and just 10:32:56
16 read that to yourself? In particular I'm 10:32:58
17 going to ask you a question about the -- the 10:32:59
18 second paragraph there. So the second full 10:33:07
19 paragraph in column 6. But I think it's 10:33:10
20 probably useful for you to read, you know, 10:33:12
21 where it starts with "Figure 3 again shows" 10:33:14
22 around line 3 of column 6. Read that 10:33:19
23 paragraph and then the following paragraph 10:33:21
24 or two to yourself and just let me know when 10:33:24
25 you've read those. 10:33:27

1	[Pause.]	10:33:42
2	A. I believe I've covered what you	10:34:10
3	directed me to.	10:34:12
4	Q. Great.	10:34:13
5	And my question specifically	10:34:13
6	relates to the lower part of that second	10:34:14
7	full paragraph. It's around lines 25 to 30	10:34:17
8	or so.	10:34:20
9	Do you see that?	10:34:22
10	A. Okay. Hold on, I need to read	10:34:23
11	further.	10:34:26
12	[Pause.]	10:34:45
13	A. Okay.	10:34:49
14	Q. Thank you.	10:35:21
15	And my question is this. Can we	10:35:23
16	agree that in the embodiment of figure 3 of	10:35:25
17	Scherer, the system is performing that	10:35:29
18	comparator function from claim 1 of the '565	10:35:38
19	patent? So to that comparative element, I	10:35:47
20	mean.	10:35:53
21	MR. CONKLIN: Objection, form.	10:35:53
22	A. I don't believe we do agree.	10:36:17
23	Q. Why not?	10:36:18
24	A. Could you clarify what -- you	10:36:19
25	referred to a comparator in figure 1. Could	10:36:23

1 correctly, you're suggesting that -- or 10:38:07
 2 you're asking if the difference in operation 10:38:10
 3 labeled 15 in figure 3 represents a torque 10:38:17
 4 comparison. Is that correct? 10:38:22

5 Q. Yes. And in particular a 10:38:25
 6 comparison between an estimated torque and a 10:38:28
 7 desired torque. 10:38:31

8 A. I don't believe it does. 10:38:35

9 Q. Why not? 10:38:37

10 A. Scherer does not, prior to that 10:38:47
 11 point, disclose the subtraction of actual 10:38:51
 12 torque from the desired torque to create a 10:38:56
 13 torque error. This element that you have 10:38:59
 14 pointed to is an alternative to the 10:39:05
 15 high-pass filter specified and what we 10:39:17
 16 actually reference in figure 1. 10:39:19

17 Q. You mean figure 1 of Scherer; 10:39:24
 18 right? 10:39:26

19 A. In figure 1 of Scherer. That's 10:39:26
 20 correct. 10:39:29

21 I would like to point out that 10:39:31
 22 we do not refer to the second embodiment 10:39:34
 23 anywhere in our declaration. So this is a 10:39:37
 24 new question you're asking me. 10:39:43

25 Q. Sure. Well, let's work through 10:39:44

1	it.	10:39:46
2	Well, first of all, let's start	10:39:50
3	back at claim 1 of the '565. We've got a	10:39:54
4	couple of things going on here. We've got a	10:39:58
5	comparator; right?	10:40:00
6	A. Got it.	10:40:01
7	Q. And that comparator has two	10:40:06
8	inputs and an output; right?	10:40:08
9	A. That's correct.	10:40:09
10	Q. And the output is the difference	10:40:12
11	of the two inputs?	10:40:14
12	A. Okay.	10:40:16
13	Now go up to the diagram	10:40:18
14	immediately above that. I believe in '565	10:40:20
15	it's figure 3.	10:40:24
16	Q. Sure.	10:40:25
17	A. Go ahead.	10:40:31
18	Q. So the output of that comparator	10:40:32
19	is the difference of the inputs?	10:40:37
20	A. That's correct.	10:40:46
21	Q. Thank you.	10:40:46
22	So looking back at Scherer,	10:40:49
23	figure 3 as described in column 6. Let me	10:40:56
24	know when you're there.	10:40:58
25	A. I'm at figure 3 in Scherer.	10:41:14

1	Were you looking for the text reference to	10:41:15
2	it?	10:41:18
3	Q. Yes. So that begins at	10:41:19
4	column 6. And feel free to refer back and	10:41:21
5	forth between them.	10:41:23
6	A. Oh, I see it.	10:41:25
7	Q. Thanks.	10:41:28
8	And if you go down to about line	10:41:29
9	25 of column 6 of Scherer. Are you there?	10:41:32
10	A. Yes.	10:41:40
11	Q. What we see is a reference to	10:41:40
12	an:	10:41:48
13	"...estimated value (MIS)...."	10:41:49
14	Do you see that?	10:41:52
15	A. I see it.	10:41:58
16	Q. And that value MIS is an	10:41:58
17	estimated torque signal; right?	10:42:01
18	A. MIS is stated to be a	10:42:51
19	quasi-static engine torque, and it is	10:42:54
20	subtracted from the demanded desired engine	10:43:01
21	torque and the resulting differences	10:43:09
22	transmitted to the dead zone block 6.	10:43:14
23	Q. Great. Yeah, we'll get to all	10:43:14
24	of it, but let's just focus on that MIS.	10:43:15
25	MR. DEVLIN: And for the court	10:43:18

1 reporter's benefit, that's a big 10:43:19
 2 capital M and then subscript capital I 10:43:21
 3 capital S. You'll see it in the 10:43:26
 4 document. 10:43:28

5 BY MR. DEVLIN: 10:43:28

6 Q. But, Dr. MacCarley, let's focus 10:43:30
 7 on this signal MIS. And it's referred to in 10:43:32
 8 Scherer as an estimated value; right? 10:43:35

9 [Pause.] 10:43:35

10 A. Yes. 10:44:04

11 Q. Thanks. 10:44:05

12 And in fact the paragraph within 10:44:06
 13 column 6 that we're in, but the first part 10:44:09
 14 of it which begins around lines 13 or so, 10:44:13
 15 that is an example of this embodiment of 10:44:16
 16 figure 3 of how that estimate of torque -- 10:44:21
 17 sorry, how that estimated torque signal is 10:44:30
 18 derived; right? 10:44:33

19 A. Yes, at lines 15 through 18 I 10:44:44
 20 believe you're referring to. 10:44:46

21 Q. Thank you. 10:44:47

22 And then the -- so back down to 10:44:51
 23 that sentence that begins at line 25, the 10:44:57
 24 other input there is the "demanded desired 10:45:02
 25 engine torque," and that's referenced as 10:45:07

1	Mdes; right?	10:45:11
2	A. Yes.	10:45:15
3	Q. Okay.	10:45:15
4	And that is a desired torque	10:45:17
5	signal; right?	10:45:19
6	A. Yes.	10:45:19
7	Q. Got it.	10:45:22
8	And the reference Scherer in	10:45:23
9	this embodiment of figure 3 says right here	10:45:26
10	at line 26 or so that they are subtracted	10:45:28
11	from one another. That is, the estimated	10:45:32
12	value, MIS, is subtracted from the desired	10:45:34
13	torque value, Mdes; right?	10:45:41
14	A. Yes.	10:45:45
15	Q. And subtraction right there is	10:45:46
16	another way to say "compared"; right?	10:45:48
17	A. In this context, yes.	10:45:54
18	Q. Thank you.	10:45:55
19	And what's output is a signal	10:45:56
20	that shows the resulting difference between	10:45:58
21	the two; right?	10:46:00
22	A. Yes.	10:46:01
23	Q. Thanks.	10:46:02
24	And I think we've agreed before	10:46:02
25	and can agree again that this figure 3 of	10:46:04

1 Scherer does not have a high-pass filter. 10:46:07
 2 Right? 10:46:12

3 [Pause.] 10:46:29

4 A. I don't believe figure 3 calls 10:46:42
 5 for a high-pass filter after that 10:46:43
 6 differencing operation. 10:46:45

7 Q. Thank you. 10:46:47

8 Now, just so we're clear, in 10:46:48
 9 figure -- the embodiment of figure 1 there 10:46:51
 10 is a high-pass filter but what's filtered is 10:46:54
 11 just that desired engine torque signal Mdes 10:46:57
 12 by itself. Do I have that right? 10:47:04

13 MR. CONKLIN: Objection, form. 10:47:09

14 A. I believe that's correct, 10:47:16
 15 recognizing that the diagram states Mdes as 10:47:18
 16 Msoll. 10:47:23

17 Q. Understood. 10:47:27

18 But you understand that that's 10:47:28
 19 the -- effectively the same desired engine 10:47:29
 20 torque in each case. Fair? 10:47:33

21 A. Okay. 10:47:35

22 Q. Thank you. 10:47:39

23 MR. DEVLIN: I'll tell you what. 10:47:42

24 Let's take another ten-minute break, 10:47:43
 25 and I'll just tell you all I think I 10:47:44

1	may be done. That's why I'm taking	10:47:47
2	it. I just want to check with my	10:47:48
3	team, and I'm telling the -- Kyle,	10:47:50
4	Mr. Conklin as well, just in case he	10:47:53
5	can think about whether he wants to do	10:47:56
6	any redirect and we won't have to take	10:47:58
7	two successive, you know, breaks to do	10:48:01
8	that.	10:48:02
9	So we'll be back on in ten.	10:48:03
10	Thank you.	10:48:07
11	[Recess at 10:48 a.m.]	10:48:08
12	[Resuming at 11:00 a.m.]	10:48:13
13	THE COURT REPORTER: We're back	11:00:44
14	on.	11:00:45
15	MR. DEVLIN: Thank you. I have	11:00:47
16	nothing further.	11:00:48
17	MR. CONKLIN: No further	11:00:48
18	questions from us. We can conclude.	11:00:49
19	THE COURT REPORTER: Thank you.	11:00:52
20	Okay. We're off the record.	11:00:56
21	[Deposition concluded at 11:00	11:02:06
22	a.m.]	11:02:10
23	[Signature reserved.]	11:02:27
24		
25		

C E R T I F I C A T E

I, PAUL J. FREDERICKSON,
California Certified Shorthand
Reporter No. 13164, do hereby certify:

That prior to being examined,
the witness named in the foregoing
deposition was by me remotely sworn or
affirmed to testify to the truth, the
whole truth and nothing but the truth;

That said deposition was taken
down by me remotely in shorthand at,
and thereafter reduced to print by
means of computer-aided transcription;
and the same is a true, correct and
complete transcript of said
proceedings.

I further certify that I am not
interested in the outcome of the
action.

Witness my hand this 5th day of
October 2020.

Paul Frederickson

PAUL J. FREDERICKSON, CSR
CA CSR 13164
Expiration date January 31, 2021

1 Kyle Conklin, Esquire

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3 October 14, 2020

4 RE: Volkswagen Group Of America v. Michigan Motor Technologies

5 10/5/2020, C. Arthur MacCarley , PhD, PE (#4236453)

6 The above-referenced transcript is available for
7 review.

8 Within the applicable timeframe, the witness should
9 read the testimony to verify its accuracy. If there are
10 any changes, the witness should note those with the
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12 The witness should sign the Acknowledgment of
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14 Copies should be sent to all counsel, and to Veritext at
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17 Return completed errata within 30 days from
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19 If the witness fails to do so within the time
20 allotted, the transcript may be used as if signed.

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Volkswagen Group Of America v. Michigan Motor Technologies
C. Arthur MacCarley , PhD, PE (#4236453)

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C. Arthur MacCarley , PhD, PE Date

Volkswagen Group Of America v. Michigan Motor Technologies
C. Arthur MacCarley , PhD, PE (#4236453)

ACKNOWLEDGEMENT OF DEPONENT

I, C. Arthur MacCarley , PhD, PE, do hereby declare that I
have read the foregoing transcript, I have made any
corrections, additions, or changes I deemed necessary as
noted above to be appended hereto, and that the same is
a true, correct and complete transcript of the testimony
given by me.

C. Arthur MacCarley , PhD, PE Date

*If notary is required

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Federal Rules of Civil Procedure

Rule 30

(e) Review By the Witness; Changes.

(1) Review; Statement of Changes. On request by the deponent or a party before the deposition is completed, the deponent must be allowed 30 days after being notified by the officer that the transcript or recording is available in which:

(A) to review the transcript or recording; and

(B) if there are changes in form or substance, to sign a statement listing the changes and the reasons for making them.

(2) Changes Indicated in the Officer's Certificate. The officer must note in the certificate prescribed by Rule 30(f)(1) whether a review was requested and, if so, must attach any changes the deponent makes during the 30-day period.

DISCLAIMER: THE FOREGOING FEDERAL PROCEDURE RULES ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY. THE ABOVE RULES ARE CURRENT AS OF APRIL 1, 2019. PLEASE REFER TO THE APPLICABLE FEDERAL RULES OF CIVIL PROCEDURE FOR UP-TO-DATE INFORMATION.

MMT Exhibit 2003
IPR2020-00445

VERITEXT LEGAL SOLUTIONS
COMPANY CERTIFICATE AND DISCLOSURE STATEMENT

Veritext Legal Solutions represents that the foregoing transcript is a true, correct and complete transcript of the colloquies, questions and answers as submitted by the court reporter. Veritext Legal Solutions further represents that the attached exhibits, if any, are true, correct and complete documents as submitted by the court reporter and/or attorneys in relation to this deposition and that the documents were processed in accordance with our litigation support and production standards.

Veritext Legal Solutions is committed to maintaining the confidentiality of client and witness information, in accordance with the regulations promulgated under the Health Insurance Portability and Accountability Act (HIPAA), as amended with respect to protected health information and the Gramm-Leach-Bliley Act, as amended, with respect to Personally Identifiable Information (PII). Physical transcripts and exhibits are managed under strict facility and personnel access controls. Electronic files of documents are stored in encrypted form and are transmitted in an encrypted fashion to authenticated parties who are permitted to access the material. Our data is hosted in a Tier 4 SSAE 16 certified facility.

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MMT Exhibit 2003
IPR2020-00445

IPR2020-00444
U.S. Patent No. 6,581,565
Patent Owner's Updated Exhibit List

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Volkswagen Group of America, Inc.,
Petitioner

v.

Michigan Motor Technologies LLC,
Patent Owner

Case IPR2020-00444
Patent No. 6,581,565

PATENT OWNER'S UPDATED EXHIBIT LIST

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Patent Trial and Appeal Board
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
Submitted Electronically via PTAB E2E

Patent Owner submits this Updated Exhibit List to accompany filing of Exhibit 2003, the September 28, 2020 deposition transcript of C. Arthur MacCarley, Ph.D.

Exhibit	Description
2001	Expert Declaration of Dr. Russell Leonard
2002	Affidavit of Ms. Robyn Williams In Support of Pro Hac Vice Motion
2003	Deposition transcript of Carl Arthur MacCarley, Ph.D. taken September 28, 2020

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on October 19, 2020, I caused a true and correct copy of the foregoing materials to be served via the Patent Office electronic filing system, and electronic service via email to the following attorneys of record pursuant to Petitioner's consent.

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/s/ Timothy Devlin
Timothy Devlin



Deposition of:
Carl Arthur MacCarley, Ph.D., P.E.

September 28, 2020

In the Matter of:
**Volkswagen Group Of America, Inc.
Vs. Michigan Motor Technologies LLC**

Veritext Legal Solutions
800-462-2233 | calendar-de@veritext.com |

MMT Exhibit 2003
IPR2020-00444

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD
VOLKSWAGEN GROUP OF AMERICA, INC.
Petitioner

v.

MICHIGAN MOTOR TECHNOLOGIES LLC
Patent Owner

IPR2020-00444
Patent 6,581,565

REMOTE DEPOSITION
OF
CARL ARTHUR MacCARLEY, Ph.D., P.E.
Monday, September 28, 2020
Nipomo, California

Reported by: B. Suzanne Hull, CSR No. 13495

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I N D E X

EXAMINATION BY	PAGE
MR. DEVLIN	4

* * NO EXHIBITS WERE MARKED * *

Nipomo, California

Monday, September 28, 2020; 9:32 a.m.

1413 Eucalyptus Road

DR. CARL ARTHUR MacCARLEY,
called as a witness by counsel for Patent Owner, being
first duly sworn, testified as follows:

EXAMINATION

BY MR. DEVLIN:

Q All right. Dr. MacCarley, is this morning or
afternoon where you are from right now?

A Morning. I'm in California.

Q Good morning, sir.

A Good morning.

Q My name -- my name is Tim Devlin. I represent
MMT in this proceeding.

And have you ever been deposed before?

A Yes, I have.

Q About how many times?

A Best of my recollection, nine.

Q Okay. It seems like you are probably familiar
with the process, but let's just go through a ground
rule -- set of couple ground rules to make sure we are
all on the same page.

1 All right?

2 A All right.

3 Q You understand we are here pursuant to an IPR
4 proceeding; right?

5 A I do.

6 Q And in this deposition I will be asking you
7 questions, and you will provide responses to those
8 questions to the extent you are able to do so.

9 Is that fair?

10 A That is fair.

11 Q If any of my questions are unclear, if you need
12 clarification, just let me know, and I'll be happy to
13 clarify.

14 Okay?

15 A Okay.

16 Q You understand your testimony is under oath
17 today?

18 A Yes.

19 Q You have sworn to tell the truth, the whole
20 truth, and nothing but the truth; right?

21 A I do.

22 Q And you'll do that, of course; correct?

23 A Yes.

24 Q Is there anything, medical or otherwise, that
25 would impede your ability to give truthful and accurate

1 testimony today?

2 A Well, the Internet bandwidth connection, but
3 nothing related to me.

4 Q Okay. Thank you.

5 We'll talk about that bandwidth connection in
6 a moment.

7 Let me know -- first, that we will a break or
8 two today, about every hour -- but if you need a break
9 in between, just let us know.

10 All right?

11 A Okay.

12 Q With respect to this Zoom interface we are
13 working on in this deposition, if there are any
14 technical issues at any time, if you can't hear me or
15 hear anyone, just let us know, and we'll figure it out.

16 Okay?

17 A Okay.

18 Q All right. And, lastly, again, I just feel
19 obligated on these Zoom depositions to ask.

20 Are you in contact in any way with any counsel
21 for Volkswagen right now, other than through this Zoom
22 interface?

23 A No.

24 Q Thank you.

25 And if that changes, would you let us know

1 what -- you know, at any period during the -- the time
2 that we are on the record, if you become in contact in
3 any way with any Volkswagen counsel, you will let us
4 know?

5 A I certainly will. The only contact I have now
6 are the people you see on the Zoom conference.

7 Q Thank you, sir.

8 You have submitted a declaration in this
9 proceeding; correct?

10 A Yes.

11 Q Okay. Do you happen to have a hardcopy of that
12 declaration with you?

13 A Yes, I do.

14 Q We'll be talking about some of the other
15 documents that have been identified as exhibits in the
16 proceeding and so forth.

17 Do you have hardcopies of those?

18 A I was instructed to print a clean hardcopy of
19 the declaration but not the exhibits. But I do have
20 them available in .pdf form on my computer. I can
21 reference them.

22 Q Got it. That was my next question.

23 I find it is a little easier if you can look at
24 your own copy and I will look at one on my screen
25 myself, and we'll work it that way. If we need to share

1 a screen at some point, we can do that.

2 Fair enough?

3 A Okay.

4 Q All right. And if there is any question at any
5 time about any of the processes that we are going
6 through, whether they are related to the deposition in
7 general or they are related specifically to something
8 that is inherent in this remote proceeding by video,
9 again, just let us know, and we'll figure it out.

10 Okay?

11 A Okay.

12 Q All right. How was the -- tell us the process
13 by which this declaration was prepared, just generally.

14 A I'm going to make some assumptions embedded in
15 your question. You are probably referring to the amount
16 of effort I put into it and the general time frame and
17 who I worked with.

18 Q Yeah.

19 Why don't you go ahead and answer at that high
20 level, and then we'll drill down.

21 Thank you.

22 A Well, the declaration was, I believe, submitted
23 very early in -- in January. I worked with the
24 attorneys, becoming familiar with the case. And the
25 declaration was a collaborative effort between us,

1 although every statement in it is, indeed, my opinion,
2 and I take full responsibility for it.

3 I believe I prepared adequately in terms of
4 time. There are probably some wordsmithing things that
5 I might want to revisit, but other than that, the
6 declaration is my own, and I feel I adequately prepared
7 for it.

8 Q Let me ask you a couple of specific questions
9 about that answer. First, in terms of wordsmithing, let
10 me ask you this question.

11 Is there anything in your declaration that you
12 now view as incorrect from a substantive standpoint?

13 A Not incorrect, but I would, in maybe one or two
14 places, chosen different adjectives. That is about all.

15 Q Do you have a recollection of the places you
16 are thinking of right now?

17 A Hmmm. I do.

18 Q Why don't we talk about them. Why don't you
19 identify -- just bring us into your declaration to the
20 first such item that you can recall sitting here.

21 A All right. I'm going to search into the
22 declaration.

23 Q Sure. Take a moment, and let us know when you
24 are there.

25 A (Witness complies.)

1 Oh, c'mon. Why am I so slow on this?

2 Hmmm. Uh-huh.

3 Paragraph ninety-four in the declaration. The
4 paragraph reads:

5 "Suzuki does not expressly disclose using
6 a high-pass filter to receive the torque
7 difference signal as an input and output
8 a filtered difference signal in which low
9 frequency components are removed. But Suzuki's
10 spark and fuel correction factor curves in
11 figures twelve through fifteen suggest that
12 a high-pass filter is, in fact, being used."

13 There are tenses and -- further into that. And
14 then there is a diagram below that demonstrates that.

15 I will change the word suggest to -- which is
16 consistent with my later use -- my later reference to
17 the same filter on page sixty-nine at the top. I'll let
18 you go there first.

19 Q My -- the -- my, at least, video just
20 hiccoughed on one of your words; so to be clear, we are
21 looking at the word suggest in the fifth line of
22 paragraph ninety-four.

23 Is that where you are?

24 A I'll have to go back to it, but that's --
25 that's correct, yeah.

1 Q And did I understand you right that -- that if
2 you -- if you could, you would change that to the word
3 implies?

4 A Figures -- that's correct, yes. And it is
5 consistent with my later reference to the same filter on
6 page sixty-nine, in which -- when I say:

7 "A POSA would have understood that Suzuki
8 implicitly discloses a high-pass filter, as
9 recited in claim one."

10 Q Have you ever heard of the concept of
11 inherency?

12 A Yes.

13 Q Do you have any opinions regarding inherency in
14 this proceeding?

15 A I have heard of the concept of inherency. In
16 this context, I'm going to have to ask your assistance
17 or that of counsel to better define that word since
18 I don't use it here.

19 Q I guess that is what I'm asking you.

20 As far as you know, in this declaration have
21 you rendered any opinions regarding inherency? Is that
22 something you -- you feel like you have opined on or no?

23 A I don't use the word inherency that I can
24 recall in the declaration; so that sounds like a no.

25 Q Thank you.

1 And so that was one item.

2 You had mentioned -- a few minutes ago you said
3 one or two -- I'm not sure if you have other examples in
4 your head of things that you might, you know, alter in
5 your declaration now or just -- I'm not trying to put
6 words in your mouth.

7 But are there other examples or items that you
8 can think of sitting here right now?

9 A That was the one that came to mind. If
10 something comes up later, I will inform you.

11 Q Okay. Thank you.

12 By the way, let me note that from time to time,
13 as I did a minute ago, I may reference something you
14 said earlier just to -- to center us or to -- to try to
15 understand it or whatever. I never want you to feel
16 like I'm trying to put words in your mouth. If -- if
17 I describe some of your testimony or summarize or try to
18 repeat some of your testimony and you don't think that
19 I have done it fairly, please let me know, and then
20 we'll -- we'll correct that.

21 Okay?

22 A Thank you.

23 Q Thank you.

24 Let me go a little bit back to where we were
25 a few minutes ago talking about the process by which

1 this declaration was created.

2 Who prepared the initial draft of the
3 declaration?

4 A Hmmm. I believe the initial framework was
5 drafted by the attorneys, lacking most of the technical
6 details that then I provided.

7 Q What do you mean by framework there? Describe
8 for me what you received from the attorneys.

9 A Well, after certain prior references were
10 identified and I attempted to get the arguments out of
11 them, I had the assistance of the attorneys on crafting
12 the actual final language, that it is correct and
13 consistent. Again, this does not suggest that any of
14 this is not my opinion. I'm admitting that I am not an
15 attorney.

16 Q How was the prior art search conducted? Did
17 you conduct that or the attorneys or some combination?

18 A These references came out of a search performed
19 by the staff at Sterne Kessler, who are much more
20 efficient and skilled at this than I. But this is not
21 to say that I would not have come up with the exact same
22 references without their assistance and skill.

23 Q Did you provide any input into the search
24 process? So for example, what the parameters might be?
25 What the field might be? Keywords? Just anything? Did

1 you provide any input at all into that search?

2 A Yes, I did.

3 Q How so?

4 A After -- well, I -- early in the process, after
5 reading the complaint and being advised by the attorneys
6 about the situation, I looked for certain elements of
7 the '565 that I then studied. And they suggested that
8 when I do my comprehensive search that I be attentive to
9 things. For instance, the key issues that -- that I'm
10 sure you are going to be bringing up today. And I --
11 I suggested certain things. I wish I could recall
12 exactly, since this is verbally. Back in January --
13 excuse me. December, it would have been, I -- I'm
14 sorry. I can't -- I can't recall exactly all of the
15 conversations I had, but I did provide, I would say,
16 significance into the search process.

17 Q At that time, during that process of providing
18 input about the prior art search, were you aware of any
19 of the legal standards regarding the appropriate scope
20 of such a search?

21 A Are you referring to the legal principles as --
22 as, say, those that I recite in the declaration in some
23 detail?

24 Q Well, I'm asking something very specific about
25 those sorts of legal principles.

1 So at the time were you aware of any legal
2 principles that were specifically directed to the
3 appropriate scope of such a prior art search?

4 A I was most certainly aware of the principle of
5 obviousness. I believe I understand that well. I --
6 from prior experience, I am also aware of anticipation
7 and the arguments necessary to establish that.

8 Q As an aside, is it correct to say that you have
9 no opinions regarding anticipation in this matter?

10 A In my declaration I don't -- I don't cite
11 anticipation that I can recall. These are all
12 obviousness arguments.

13 Q Thank you.

14 Who selected the specific references that are
15 the basis for the obviousness grounds in the
16 declaration? Was that you or the attorneys or
17 a combination?

18 A Ultimately, the selection of all of these was
19 mine. Suggestions were certainly made by the attorneys
20 as to which they suggested as most relevant; so I'm
21 going to put the key prior art patents, starting with
22 Suzuki, Scherer, and Takahashi were my selections.

23 Q You said -- again, I'm having a little trouble
24 on video, but let me just confirm.

25 You said Suzuki, Scherer, and Takahashi were

1 your selections, if I understand you?

2 A Yeah. All four. Suzuki, Scherer, Cohen, and
3 Takahashi. And I apologize for the bandwith. It will
4 drop out on the audio occasionally.

5 Q That's okay.

6 I'll note for you -- from -- on my screen your
7 video has frozen. I'm not so intent on -- on seeing
8 your video here. If you want to actively shut down the
9 video on your interface with Zoom, that might reserve
10 your bandwith for audio and make it a little smoother.
11 If you want to try that, feel free.

12 A Okay. I will do that. Stop video.

13 Q Great. Thank you.

14 A Can you hear me okay, though?

15 Q Yeah. We can hear you; so far it is about the
16 same, but we'll see; I think it is manageable, and --
17 and we'll just keep going like we are going.

18 All right. Dr. MacCarley, are you still there?
19 Can you hear us?

20 A I can hear you.

21 Q Thank you.

22 Let's go a little further back in time.

23 When were you first retained for this matter,
24 to your recollection?

25 Or let me rephrase that, actually, just so it

1 is a little more clear.

2 When were you first retained regarding any
3 matter between MMT and Volkswagen, whether it was in
4 district court or a potential IPR proceeding?

5 A Hmmm. Well, for this matter I was retained,
6 I believe, early -- early December of 2019. Possibly,
7 you know, the 1st or 2nd of December.

8 The larger question, have you ever had dealings
9 with MMT before? I -- I would want to go back and look
10 at all of the cases and all of the participants in all
11 of those to say definitively no. But I -- I have --
12 I do not recall any prior cases involving MMT for which
13 I served as an expert.

14 Q Roughly, how much total in -- in fees have you
15 either been paid or invoiced and yet to be paid? So
16 total fees billed so far in this matter, roughly.

17 A Oh, goodness. Honestly, my wife pays more
18 attention to that than I do. I would ask her, if
19 I could.

20 Q Let me try a different way.

21 A I don't have the --

22 Q Oh, sorry.

23 A I don't have the records in front of me, as
24 I am -- I am billing at \$300 an hour. And the time
25 I have spent preparing and working with the attorneys

1 has been typical -- you know, moderate for a case like
2 this.

3 Q Well, that was my next question.

4 Can you give us an estimate of the number of
5 hours? Was it more than a hundred, would you say?

6 A Would you permit me to pull up --

7 Q Yeah. You went out a little bit there, but if
8 your -- if your question was can you pull up some
9 records, feel free. Go ahead.

10 A All right. Oh, geez. Let's see.

11 Well, cumulative in September, up to this
12 point, it is twenty-eight hours.

13 Q All right. Could you say that again?

14 A In September it is twenty-eight hours.

15 Cumulative, there are -- there were no hours charged in
16 August. In July there were 12.55 hours. No charge in
17 June or May or April. Going back to February, there
18 were 20.13 hours charged. In January there were 50.77
19 charged. Of course, this was the month I was working on
20 the declaration. And December is also a period in which
21 I was preparing for and working on the declaration,
22 97.48 in that month. And it looks like I actually must
23 have been engaged slightly to November because I see an
24 entry for seven hours in November. That is the earliest
25 entry.

1 Q Thank you. That is helpful.

2 Could you turn to the legal standards section
3 of your declaration, which begins on page nine,
4 paragraph twenty-one.

5 Let me know when you are there.

6 A (Witness complies.)

7 I'm there.

8 Q Did I hear you correct previously when you said
9 you are not a lawyer?

10 A That's correct.

11 Q Are you a patent agent registered to patent --
12 registered to practice before the patent office?

13 A No. Huh-uh.

14 Q Have you ever taken any courses related to
15 patent law or any legal courses, like audited some law
16 school class, anything like that?

17 A In -- in the '80s I took a course in business
18 law at the University of Denver School of Law because
19 I was going to the University of Denver at the time.

20 Q You said a course in business law? Did I hear
21 you right?

22 A That's correct.

23 Q Well, did that course cover, in any substantive
24 detail, patent-related issues?

25 A I'm sure it must have been one of the topics,

1 but it would have been certainly one of many that you
2 would cover in a standard course of business law.

3 Q The legal standards section in your report --
4 and to be specific, it starts on that page nine, and
5 I believe it goes down to page fifteen, paragraph
6 thirty-nine, if I have that span right.

7 A That's correct.

8 Q Where did that come from, that legal standards
9 section?

10 A Well, from me. But, see, most paragraphs by
11 saying -- understanding -- I have worn that -- again,
12 not being this -- this is a section --

13 THE REPORTER: I'm sorry. I'm only getting
14 maybe every third word.

15 MR. DEVLIN: Go off the record.

16 (Short recess taken from
17 10:03 a.m. to 10:06 a.m.)

18 MR. DEVLIN: All right. Let's go back on.

19 All right. We're back on the record.

20 BY MR. DEVLIN:

21 Q And I'll tell you what. I'm just going to
22 ask -- I'm going to kind of go back into this legal
23 standard stuff and -- and re-ask some of the same
24 questions just to make sure, now that we have a cleaner
25 connection, that the court reporter got your answers.

1 And I think it will be easier just redoing some of this
2 than trying to figure out, you know, the details of what
3 you were saying a few minutes ago. And to be clear, I'm
4 not revisiting everything that we've talked about since
5 the start of this deposition, just when we started
6 talking about your legal standards section and we have
7 confirmed that goes up to paragraph thirty-nine.

8 Do you remember that?

9 A Page fifteen, end of thirty-nine; that's
10 correct.

11 Q Okay. Great.

12 So my question was where did this legal
13 standards section come from?

14 A Well, it came from me, but it was significantly
15 informed by the attorneys that I am working with who
16 have greater expertise in this area.

17 Q And the legal standards set forth here in your
18 expert report, that -- that section that is labeled
19 legal standards, those were the standards that you
20 applied in conducting your analysis and comparing your
21 declaration?

22 A Yes.

23 Q I would like to talk about the Scherer
24 reference a little bit.

25 A Okay.

1 Q Why don't you take a moment and pull that up on
2 your screen so you have it.

3 MR. DEVLIN: And, for the record, that is
4 Exhibit 1007 in the IPR proceeding.

5 THE WITNESS: Okay. I have it now.
6 BY MR. DEVLIN:

7 Q Okay. Is it fair to say that Scherer describes
8 four separate embodiments generally?

9 A Four? I -- I'd like to go to the specification
10 of it to confirm that.

11 Q Of course. Take your time. Go ahead and --
12 and review the specification, and when you have
13 satisfied yourself that you have refreshed your
14 recollection, go ahead and answer.

15 A (Witness complies.)
16 I believe it only refers to two embodiments.

17 Q And -- okay. How would you correlate those
18 embodiments with the figures? In other words, which
19 figures relate to each of the embodiments?

20 A That is a pretty broad question.
21 Could I ask you to narrow the question?

22 Q Sure. No problem. Let me try a little
23 differently.

24 Why don't you describe for us which two
25 embodiments you are thinking of? In other words, use

1 your own words or lingo to describe the first embodiment
2 and the second embodiment and delineating between the
3 two.

4 A Well, beginning at column three, roughly around
5 line six, where it says:

6 "In a preferred embodiment of the
7 invention, the dynamic desired torque component
8 is determined by high-pass filtering of the
9 demanded desired engine torque with the decay
10 time constant, which is selected as a function
11 of the engine operating point."

12 Most of my argument is based upon that
13 preferred embodiment.

14 Q Thank you.

15 And what is the other preferred embodiment?

16 A Immediately, continuing from there, it says:

17 "In another preferred embodiment,
18 a model-based estimation is made of the
19 quasi-static desire torque component achieved by
20 air flow rate or injection duration regulation
21 to obtain the dynamic desired torque component.
22 The estimated value is subtracted from the
23 demanded desired engine torque. In the simplest
24 case, the model can be formed by
25 a characteristic diagram of the quasi actual

1 torque component as a function of the rotational
2 engine speed, cooling water temperature. And in
3 the case of an auto cycle, the engine load,"
4 et cetera, et cetera.

5 It is very similar. The processing of the
6 signal is a bit different. The objective is the same.

7 Q Thank you.

8 And just below there -- so just to be clear,
9 you were still reading from column three in answering
10 that question; correct?

11 A Correct.

12 Q Thank you.

13 And just below there we see a brief description
14 of the drawings.

15 Do you see that heading?

16 A Yes.

17 Q And go ahead and review the description of
18 figures one through four right there in the brief
19 description. Feel free to read the description to
20 figure five or any other part of the specification.

21 But what I want to see if we agree on is that
22 figures one and two relate to the first embodiment that
23 you just described a minute ago, while figures three and
24 four relate to the second embodiment, if I have that
25 right.

1 A Okay. Well, reading from the beginning of that
2 section, it states:

3 "Figure one is a block diagram."

4 Q Well, let me -- I'm sorry. Just for -- just
5 for expediency, I'm not asking you to read anything into
6 the record. Go ahead and review that silently. I'm
7 sorry I wasn't clear. Read those descriptions and
8 anything else you need, and let me know if you can
9 answer that question that figures one and two relate to
10 the first embodiment you described, and figures three
11 and four relate to the second embodiment.

12 MR. CONKLIN: Objection. Form.

13 THE WITNESS: Let's see. The operation.

14 That --

15 BY MR. DEVLIN:

16 Q I'll just note for the record that -- sorry,
17 Doctor.

18 MR. DEVLIN: I'll just note for the record that
19 in the past thirty seconds or so the transcript may
20 reflect a little bit of kind of reading out loud that
21 the doctor was doing but not really answering the
22 question.

23 BY MR. DEVLIN:

24 Q I'm just saying that for the record so the
25 transcript is a little clearer, not to stop you from

1 answering.

2 So Dr. MacCarley, go ahead and answer, if you
3 are able to.

4 A Your -- your suggestion that figure one and two
5 pertain primarily to the preferred embodiment and figure
6 three and four to the -- what is called another
7 preferred embodiment seems fair. And then figure five,
8 the last figure, pertains to all of them.

9 Q Thank you.

10 Let's talk about the -- the first preferred
11 embodiment.

12 That is described as using a high-pass filter;
13 correct?

14 A Correct.

15 Q What is filtered? What -- what signal is
16 filtered in that first embodiment?

17 A It is a torque demand signal that referring to
18 either figures one or two, is marked as M, subscript,
19 SOLL.

20 Q Thank you.

21 So in both those figures it is the signal that
22 is coming out of the box labeled one on the left-hand
23 side.

24 Do I have that right?

25 A That's correct.

1 Q In figures three and four there is no high-pass
2 filter that is utilized -- or let me say that again.

3 In the -- the second preferred embodiment, the
4 one that is shown in figures three and four, there is no
5 high-pass filter utilized?

6 A There is a different mechanism for generating
7 a transient torque component that could be said to
8 approximate the behavior of a high-pass filter, but in
9 the description it makes it clear that it has more
10 flexibility than the fixed structure of a high-pass
11 filter.

12 Q So do I have it right that in the embodiment of
13 figures three and four, instead of the high-pass filter
14 a model-based estimate is used?

15 A Yes.

16 Q Okay. Thank you.

17 MR. DEVLIN: I'll tell you what. It is
18 actually a convenient time to take a ten-minute break.
19 That will make us a little more efficient. Why don't we
20 go off the record, and I will see you all in about ten
21 minutes.

22 MR. CONKLIN: Okay.

23 THE WITNESS: Okay.

24 (Short recess taken from
25 10:19 a.m. to 10:28 a.m.)

1 MR. DEVLIN: We have nothing further. That is
2 it.

3 MR. CONKLIN: Tim, I would like to just take
4 a five-minute break, and then I'll be back.

5 MR. DEVLIN: No problem. Yeah. I was --
6 I thought about giving you a heads up on the last break,
7 but I wasn't sure, so....

8 MR. CONKLIN: Okay.

9 MR. DEVLIN: Okay.

10 MR. CONKLIN: We'll be right back.

11 (Short recess taken from
12 10:29 a.m. to 10:34 a.m.)

13 MR. CONKLIN: No further questions.

14 THE REPORTER: Would either of you like
15 a rough?

16 MR. DEVLIN: I think we'll take a rough, if
17 that is okay.

18 MR. CONKLIN: Yes, please.
19 (10:34 a.m.)

20 --00000--

21

22

23

24

25

B. Suzanne Hull, CSR No. 13495

1 Carl A. Macarley, Ph.D., P.E.

2 art1@loragen.com

3 October 5, 2020

4 RE: Volkswagen Group Of America, Inc. v. Michigan
5 Motor Technologies LLC

6 9/28/2020, Carl Arthur MacCarley, Ph.D., P.E. (#4236434)

7 The above-referenced transcript is available for
8 review.

9 Within the applicable timeframe, the witness should
10 read the testimony to verify its accuracy. If there are
11 any changes, the witness should note those with the
12 reason, on the attached Errata Sheet.

13 The witness should sign the Acknowledgment of
14 Deponent and Errata and return to the deposing attorney.
15 Copies should be sent to all counsel, and to Veritext at
16 <Email address for Errata Return>

17 Return completed errata within 30 days from
18 receipt of transcript.

19 If the witness fails to do so within the time
20 allotted, the transcript may be used as if signed.

21
22 Yours,

23 Veritext Legal Solutions
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MMT Exhibit 2003
IPR2020-00444

Volkswagen Group Of America, Inc. v. Michigan Motor
Technologies LLC

Carl Arthur MacCarley, Ph.D., P.E. (#4236434)

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Carl Arthur MacCarley, Ph.D., P.E.

Date

Volkswagen Group Of America, Inc. v. Michigan Motor
Technologies LLC

Carl Arthur MacCarley, Ph.D., P.E. (#4236434)

ACKNOWLEDGEMENT OF DEPONENT

I, Carl Arthur MacCarley, Ph.D., P.E., do hereby declare
that I have read the foregoing transcript, I have made any
corrections, additions, or changes I deemed necessary as
noted above to be appended hereto, and that the same is
a true, correct and complete transcript of the testimony
given by me.

Carl Arthur MacCarley, Ph.D., P.E. Date

*If notary is required

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& 2:4	5 30:3	agent 19:11	aside 15:8
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10:06 20:17	6,581,565 1:12	ahead 8:19 18:9	13:11,22
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California Code of Civil Procedure
Article 5. Transcript or Recording
Section 2025.520

(a) If the deposition testimony is stenographically recorded, the deposition officer shall send written notice to the deponent and to all parties attending the deposition when the Original transcript of the testimony for each session of the deposition is available for reading, correcting, and signing, unless the deponent and the attending parties agree on the record that the reading, correcting, and signing of the transcript of the testimony will be waived or that the reading, correcting, and signing of a transcript of the testimony will take place after the entire deposition has been concluded or at some other specific time.

(b) For 30 days following each notice under subdivision (a), unless the attending parties and the deponent agree on the record or otherwise in writing to a longer or shorter time period, the deponent may change the form or the substance of the answer to a question, and may either approve the transcript of the deposition by signing it, or

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refuse to approve the transcript by not signing it.

(c) Alternatively, within this same period, the deponent may change the form or the substance of the answer to any question and may approve or refuse to approve the transcript by means of a letter to the deposition officer signed by the deponent which is mailed by certified or registered mail with return receipt requested. A copy of that letter shall be sent by first-class mail to all parties attending the deposition.

(d) For good cause shown, the court may shorten the 30-day period for making changes, approving, or refusing to approve the transcript.

(e) The deposition officer shall indicate on the original of the transcript, if the deponent has not already done so at the office of the deposition officer, any action taken by the deponent and indicate on the original of the transcript, the deponent's approval of, or failure or refusal to approve, the transcript. The deposition officer shall also notify in writing the parties attending the deposition of any changes which the deponent timely made in person.

(f) If the deponent fails or refuses to approve the transcript within the allotted period, the

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deposition shall be given the same effect as though it had been approved, subject to any changes timely made by the deponent.

(g) Notwithstanding subdivision (f), on a seasonable motion to suppress the deposition, accompanied by a meet and confer declaration under Section 2016.040, the court may determine that the reasons given for the failure or refusal to approve the transcript require rejection of the deposition in whole or in part.

(h) The court shall impose a monetary sanction under Chapter 7 (commencing with Section 2023.010) against any party, person, or attorney who unsuccessfully makes or opposes a motion to suppress a deposition under this section, unless the court finds that the one subject to the sanction acted with substantial justification or that other circumstances make the imposition of the sanction unjust.

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Veritext Legal Solutions represents that the foregoing transcript is a true, correct and complete transcript of the colloquies, questions and answers as submitted by the court reporter. Veritext Legal Solutions further represents that the attached exhibits, if any, are true, correct and complete documents as submitted by the court reporter and/or attorneys in relation to this deposition and that the documents were processed in accordance with our litigation support and production standards.

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Volkswagen Group of America, Inc.,
Petitioner

v.

Michigan Motor Technologies LLC,
Patent Owner

Case IPR2020-00444
Patent No. 6,581,565

PATENT OWNER'S RESPONSE

Under 35 U.S.C. § 42.120

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Table of Contents

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Table of Exhibits

Exhibit	Description
2001	Expert Declaration of Dr. Russell Leonard
2002	Affidavit of Robyn T. Williams
2003	Transcript of 09/28/2020 Deposition of MacCarley
2004	Second Expert Declaration of Dr. Russell Leonard

Petitioner Volkswagen Group of America, Inc. (“VWoA” or “Petitioner”)

filed a Petition for *Inter Partes* Review of U.S. Patent No. 6,581,565 (“the ’565 patent”) on January 31, 2020 (IPR2020-00444, Paper No. 2 (“Petition” or “Pet.”), which was granted by the Board (Paper 12.) Through the undersigned Counsel, Patent Owner, Michigan Motor Technologies LLC (“MMT”), submits the following Patent Owner’s Response pursuant to 35 U.S.C. § 42.120.

I. INTRODUCTION

Generally, the ’565 patent is directed to an engine torque controller for a spark ignition internal combustion engine, specifically, for a Direct Injection Spark Ignition (DISI) engine. (Exhibit 1001 at Abstract, 1:5-8, 1:62-63, Fig. 1.) The ’565 patent discloses and claims a torque controller and a method for controlling torque for an engine in which torque is controlled in dependence upon a high-pass filtered difference signal that represents the difference between a desired torque signal and a signal representing an estimate of the current torque. (Ex. 1001 at Abstract.)

II. APPLICABLE LEGAL PRINCIPLES

The petitioner has the burden to clearly set forth the basis for its challenges in the petition. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) as “requiring IPR petitions to identify ‘with particularity . . . the evidence that supports the grounds for the challenge to each

claim’’). A petitioner may not rely on the Board to substitute its own reasoning to remedy the deficiencies in a petition. *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1355 (2018) (“Congress chose to structure a process in which it’s the petitioner, not the Director, who gets to define the contours of the proceeding.”); *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016) (rejecting the Board’s reliance on obviousness arguments that “could have been included” in the petition but were not, and holding that the Board may not “raise, address, and decide unpatentability theories never presented by the petitioner and not supported by the record evidence”); *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1367 (Fed. Cir. 2015) (holding that “a challenge can fail even if different evidence and arguments might have led to success”); *Wasica Finance GMBH v. Continental Auto. Sys.*, 853 F.3d 1272, 1286 (Fed. Cir. 2017) (holding that new arguments in a reply brief are “foreclosed by statute, our precedent, and Board guidelines”).

To the extent that the petition relies on an expert declaration, it must be more than conclusory and disclose the facts underlying the opinion. *See* 37 C.F.R. § 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”); *Edmund Optics, Inc. v. Semrock, Inc.*, IPR2014-00583, Paper 50 at 8 (PTAB, Sep. 9, 2015) (affording little or no weight to “experts’ testimony that does little more than repeat, without

citation to additional evidence, the conclusory arguments of their respective counsel.”). Nor may the petition rely on the expert declaration to remedy any gaps in the petition itself. 37 C.F.R. § 42.6(a)(3) (“Arguments must not be incorporated by reference from one document into another document”); see *Cisco Sys., Inc. v. C-Cation Techs., LLC*, IPR2014-00454, Paper 12 at 9 (PTAB, Aug. 29, 2014) also (“This practice of citing the Declaration to support conclusory statements that are not otherwise supported in the Petition also amounts to incorporation by reference.”).

For rejections under 35 U.S.C. § 102, each and every claim element must be found in a single reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987) “[U]nless a reference discloses within the four corners of the document not only all of the limitations claimed but also all of the limitations arranged or combined in the same way as recited in the claim, it cannot be said to prove prior invention . . . and, thus, cannot anticipate under 35 U.S.C. § 102.” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008). Further, the prior art reference must disclose the claimed invention “or direct those skilled in the art to the [invention] without any need for picking, choosing, and combining various disclosures not directly related to each other by the teachings of the cited reference.” *Id.* (quoting *In re Arkley*, 455 F.2d 586, 587 (C.C.P.A. 1972)).

To make a prima facie showing of obviousness under 35 U.S.C. § 103, the Petition must, among other requirements, fulfill the requirements set forth in *Graham v. John Deere Co.*, 383 U.S. 1 (1966), including demonstrating that the cited references disclose each element of a challenged claim. *In re Magnum Oil Tools Int'l.*, 829 F.3d 1364, 1376 (Fed. Cir. 2016); *see also Apple Inc. v. Contentguard Holdings, Inc.*, IPR2015-00442, Paper 9 at 12-13 (PTAB July 13, 2015).

For an obviousness challenge based on a single reference in view of the knowledge and skill of a POSITA, there must be a motivation to make the combination and a reasonable expectation that such a combination would be successful, otherwise a skilled artisan would not arrive at the claimed combination. *In re Stepan Co.*, 868 F.3d 1342, 1345-46 (Fed. Cir. 2017). In other words, when a gap in a single prior art reference requires filling with, for example, the knowledge of one of ordinary skill, there must be a further showing that the skilled artisan would have arrived at the claimed invention.

Hindsight analysis is inappropriate; obviousness must be measured “*at the time the invention was made.*” *Ortho-McNeil Pharm. v. Mylan Labs*, 520 F.3d 1358, 1364 (Fed. Cir. 2008) (emphasis in original). A petition must demonstrate a rationale to combine prior art references without relying on the patent disclosure itself. *Apple Inc. v. Contentguard*, Paper 9 at 15, 17; *see also P&G v. Teva*

Pharms. USA, Inc., 566 F.3d 989, 995 (Fed. Cir. 2009). The Petitioner must not use the patent as a roadmap. *In re NTP, Inc.*, 654 F.3d 1279, 1299 (Fed. Cir. 2011) (internal citation omitted); *see also KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007).

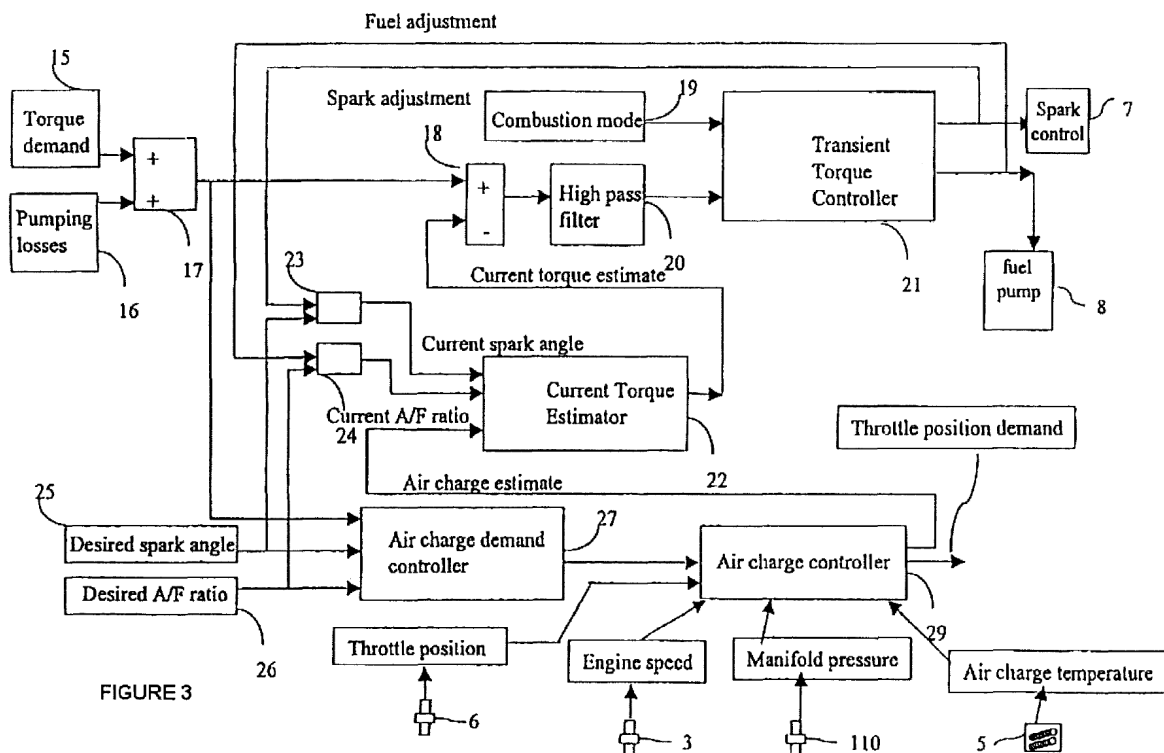
III. LEVEL OF ORDINARY SKILL IN THE ART

The level of ordinary skill in the art applicable to the '565 patent around the time of the invention in 2002 is a person with (1) a B.S. in mechanical engineering or equivalent with three or more years of experience in either engine systems or engine control systems or (2) at least a M.S. in mechanical engineering. (Leonard Decl. Ex. 2004 at ¶ 14.)

IV. THE '565 PATENT

The '565 patent generally relates to an engine torque controller for spark ignition internal combustion engine and more specifically for direct injection engines. (Ex. 1001 at Abstract.)

The '565 patent addresses the problem which occurs in stratified mode or homogenous mode where there is a steady state error between the torque demanded and the estimate of the torque produced. (Ex. 1001 at 1:46-49.) This problem is overcome by producing a difference signal that represents the difference between a desired torque signal and a signal representing an estimate of the current torque and high-pass filtering the difference signal to eliminate low



The estimated air charge may be different from the air charge demanded by the air charge demand controller 27 due to delays in the engine 100, such as the time taken for the throttle 9 to move, the time taken for the pressure in the air intake manifold 152 to rise or fall, or any errors in position of the

throttle. The air charge estimate signal is sent to a current torque estimator 22.

The estimate of the current torque is compared to the desired torque signal by a comparator 18 to generate an error signal 35 which is then filtered by a high pass filter 20. The resulting high-pass filtered error signal is used by a transient torque controller 21 to generate a control signal for temporarily adjusting the torque produced by the engine 100.

A combustion mode signal 19 indicates whether the engine 100 is operating in a stratified mode or in a homogenous mode. If the engine 100 is operating in the stratified mode then a fuel adjustment signal is generated and sent to the fuel pump 8 in order to adjust the amount of fuel which is injected into the combustion chamber 108 by the fuel injector 130. If the engine 100 is operating in the homogenous mode then a spark adjustment signal is generated and sent to the spark control unit 7 to adjust the timing of the ignition spark generated by the spark plug 106.

A signal representing the current spark angle is calculated by a calculator 23 using the desired spark angle and the spark adjustment signal received from the transient torque controller 21. A signal representing the current air/fuel ratio is calculated by a calculator 24 using the desired air/fuel ratio and the fuel adjustment signal received from the transient torque controller 21. When the engine 100 is operating in stratified mode the current spark angle will be equal to the desired spark angle 25. When the engine 100 is operating in homogenous mode the current air/fuel ratio will be equal to the desired air/fuel ratio 26.

(Ex. 1001 at 3:6-60)

The basic inventive concept disclosed and claimed in the subject '565 patent is, in the context of a spark ignition direct injection internal combustion engine, a method in which engine torque is controlled dependent upon a high-pass filtered difference signal representative of the difference between desired torque and current torque estimate signals. (Ex. 2004 at ¶¶ 21-25.)

The method and system of the '565 patent utilizes a torque demand signal which constitutes a feedforward signal and a current torque estimate signal which constitutes a feedback signal. (*Id.* at ¶ 25; Ex. 1001 at 2:57-3:6.) These two signals are applied as inputs to a comparator 18 that generates an error signal or difference signal representative of the difference between the two inputs to the comparator. (Ex. 2004 at ¶ 25; Ex. 1001 at 2:57-3:6.) The error or difference signal is generated by subtracting the current torque estimate from the torque demand signal. (Ex. 2004 at ¶ 25.) This error signal indicates instances where torque demand is less than torque produced and instances where torque demand is greater than torque produced. (*Id.*) The high-pass filter receives the error signal and blocks (filters out) smaller differences from the comparator and only allows larger differences to pass through to the transient torque controller. Indeed, the '565 invention does not expend energy with smaller, less significant errors by only acting upon larger errors. (*Id.*) This design minimizes hunting, where the system is continuously chasing changes back and forth. (*Id.*)

A high-pass filter is used to filter the difference signal of desired torque and current torque estimate signals and it is this high-pass filtering of the difference of these two signals that makes the '565 patent unique. It is the high-pass filtered difference signal that controls engine torque. (*Id.*)

The '565 patent discloses what was well known in the prior art, namely, that “[i]n engine torque controllers for DISI engines, when the engine is operated in stratified mode, spark angle has little influence on the torque produced. (Ex. 1001 at 1:19-30.) The torque producer modifies the air/fuel in order to control the torque produced. (*Id.* at 1:37-45.) Conversely, when the engine is operating in homogenous mode... [t]he torque producer modifies the timing of the spark ignition in order to control the torque produce.” (Ex. 1001 at 1:36-45.) This disclosure constitutes the “admitted prior art” of the '565 patent. *See* Ex. 1001.

The main difference between the prior art and the '565 patent is the method of correction for a steady state error by high-pass filtering the difference between the torque demanded signal and the estimate of the torque produced signal. (Ex. 1002 at 44.)

A. **Challenged Claims**

Petitioner challenges claims 1-7 of the '565 patent.

Independent claim 1 recites:

1. A device for controlling a torque output of an engine, the device comprising:

a torque demand controller for generating a torque demand signal; and
a torque producer which receives the torque demand signal, the torque producer includes:

an estimator which receives as inputs a current spark angle signal, a current air/fuel ratio signal and an estimated air charge signal and outputs an estimated torque signal;

a comparator which receives as inputs the estimated torque signal and a desired torque signal and outputs a difference signal;

a high pass filter which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent; and

a transient torque controller which receives as an input the filtered difference signal and outputs a fuel adjustment signal and a spark adjustment signal.

Dependent claims 2-6 recite additional features. (Ex. 1001 at 4:1-4:52.)

Independent claim 7 recites:

7. A method for controlling a torque output of an engine, the method comprising:

estimating a current torque signal from a received current spark angle signal, a received current air/fuel ratio signal and a received estimated air charge signal;

comparing the estimated current torque signal with a desired torque signal to output a difference signal;

filtering out a plurality of low frequency components from the difference signal; and

controlling a fuel adjustment signal and a spark adjustment signal in dependence upon a filtered difference signal.

(Ex. 1001 at 4:53-1:65.)

V. CLAIM CONSTRUCTION

In an *inter partes* review proceeding, “a claim of a patent . . . shall be construed using the same claim construction standard that would be used to

construe the claim in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b).

Only terms that are in controversy need to be construed and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

None of the claim terms require specific construction and should receive their plain and ordinary meaning, in the context of the ’565 patent specification.

Patent owner reserves the right to construe other terms of the ’565 patent throughout this proceeding, if the petition is granted, and in pending district court litigation pending against Petitioner and its parent company.

VI. OVERVIEW OF CITED PRIOR ART

Cited References

U.S. Patent No. 6,006,717, Suzuki *et al.*, titled “Direct-Injection Spark-Ignition Type Engine Control Apparatus,” issued December 28, 1999 (“*Suzuki*”).

U.S. Patent No. 5,241,855, Cullen *et al.*, titled "Method and Apparatus for Inferring Engine Torque," issued September 7, 1993 ("*Cullen*").

U.S. Patent No. 6,07,68, Scherer *et al.*, titled "Process and Apparatus for Adjusting the Torque of an Internal-Combustion Engine," issued April 11, 2000 ("*Scherer*").

U.S. Patent No. 5,282,449, Takahashi *et al.*, titled "Method and System for Engine Control," issued February 1, 1994 ("*Takahashi*").

A. Suzuki

Suzuki discloses a method of torque control of a direct injection spark ignition engine. (Ex. 1005 at 1:39-64.) The torque control method covers the engine combustion operation of both stratified and homogeneous modes. (*Id.*) Torque correction is realized by controlling spark timing in homogeneous combustion operation and air/fuel ratio during stratified combustion operation. (*Id.*)

Like *Suzuki*, the '565 patent discloses what was well known in the prior art that "[i]n engine torque controllers for DISI engines, when the engine is operated in stratified mode, spark angle has little influence on the torque produced. The torque producer modifies the air/fuel in order to control the torque produced. Conversely, when the engine is operating in homogenous mode... [t]he torque producer modifies the timing of the spark ignition in order to control the torque

produce.” (Ex. 1001 at 1:36-45.) Thus, *Suzuki* is merely cumulative of the admitted prior art of the '565 patent.

B. Cullen

Cullen, one of the secondary references relied upon by the Petitioner, discloses a method of control for an automatic transmission that relies on predicting the torque produced by the engine, which is coupled to the transmission. (Ex. 1006 at 2:32-43; 3:18-68.)

C. Scherer

Scherer is directed to a system and method for controlling engine torque by regulating the ignition point and air flow rate on an Otto (gasoline) engine, or by regulating the start and duration of fuel injection in a diesel engine. (Ex. 1007 at 1:8-41.) *Scherer* claims to improve adjustment of engine torque to a desired value with minimal deviations in both steady-state (quasi-static) and transient (dynamic) operation, with a claimed shorter reaction time. (*Id.*)

Scherer uses the high-pass filter with an adjustable decay time constant (t), which is a function of engine speed and load, to generate a filtered dynamic desired torque (M_d) signal. (Ex. 1007 at 4:31-4; Fig. 1.)

D. Takahashi

Takahashi discloses controlling the throttle valve and fuel injection in a manner that ensures the engine output torque and air/fuel ratio match target values.

(Ex. 1008 at 1:43-65.) *Takahashi* employs a method that calculates target air mass flow rate as the air mass flow rate at the inlet port which achieves target torque.

(*Id.*) The target torque is used to control the fuel injection and electronic throttle control. (*Id.*)

VII. THE PRIOR ART REFERENCES DO NOT INDIVIDUALLY OR IN COMBINATION DISCLOSE ALL ELEMENTS OF CHALLENGED CLAIMS OF THE '565 PATENT

As will be clearly demonstrated herein, the Board and the Petitioner have made the same fundamental error in two separate, simultaneously filed Petitions for *inter partes* review to find the challenged claims of the '565 patent unpatentable over various combinations of prior art that all rely upon *Scherer* as a key secondary reference, because, as will be shown, *Scherer* clearly contradicts the Board's and the Petitioner's articulated reasoning for combining *Scherer* with a primary reference – *Scherer* discourages and, in fact, directly “teaches away from” the claimed invention as set forth in the challenged claims of the '565 patent.

In this case, Patent Owner has argued that since none of the prior art references relied upon by Petitioner and the Board disclose a required claim element of the challenged claims (in fact, the key, patentability-imparting feature of the challenged claims), then no combination thereof can render the challenged claims unpatentable. In response, the Petitioner and the Board have criticized Patent Owner for attacking the references individually, rather than their combination or combined teachings. In

this regard, the Petitioner and the Board have taken the position that a hypothetical person of ordinary skill in the art (“POSITA”) would have extracted certain teachings from one prior art reference (namely, *Scherer*) and used that extracted teaching from *Scherer* to modify another reference, *Suzuki*, to add the claim element that is admittedly missing from all prior art references the Petitioner and the Board are relying upon.

More particularly, the challenged claims of the ’565 patent all require high-pass filtering the output of a comparator whose inputs are a desired torque signal and an estimated torque signal. The Board’s Decision to grant institution of *inter partes* review states, “Petitioner provides a reasoned explanation of an allegedly obvious combination of the references that would high pass filter a torque difference signal, regardless of whether any of the references individually teaches high pass filtering a torque difference signal.” (Paper 12 at 37.) Patent Owner contends that this reasoning constitutes the exercise of impermissible hindsight in violation of well-settled law, as developed below.

It is not often the case that a particular challenged claim would be found obvious over a combination of references if none of those prior art references disclose a particular limitation or element recited in that particular challenged claim, such as in the instant case. In other words, if a first reference discloses elements A and B, and a second reference discloses elements B and C, but the particular

challenged claims require elements A, B, C and D, then the combination of those two references cannot render that particular challenged claim obvious or unpatentable since neither of those references disclose element D, unless “ordinary knowledge” of the POSITA or “common sense” is relied upon to modify the combined teachings of the references in such a manner as to add the missing element.

“[T]here are at least three caveats to note in applying “common sense” in an obviousness analysis.” *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016). “First, common sense is typically invoked to provide a known motivation to combine, not to supply a missing claim limitation.” *Id.* Second, the limitation in question that is missing from the prior art must be unusually simple and the technology relatively straightforward. *Id.* Third, “common sense” cannot be used as a “wholesale substitute for reasoned analysis and evidentiary support.” *Id.* Such “obvious to modify to supply the missing element” reasoning is fraught with “hindsight bias.” *See Id.* “Absent some additional reasoning, the Board’s finding that a skilled artisan would have arrived at the claimed invention through routine optimization is insufficient to support a conclusion of obviousness.” *In re Stepan Co.*, 868 F.3d 1342, 1346 (Fed. Cir. 2017).

Further, the MPEP instructs the examiner to step back in time and into the shoes of the hypothetical person of ordinary skill in the art “when the invention was

unknown and just ***before it was made.***¹ Under AIA §103, the key time would be just before the effective filing date. MPEP §2142.7.

Patent Owner respectfully submits that if all the guidelines set forth in the foregoing discussion are followed in the present case, then the Board will be compelled to find that all challenged claims of the '565 patent are patentable.

A. None of the Prior Art References Disclose “A High Pass Filter Which Receives As an Input the Difference Signal and Outputs a Filtered Difference Signal In Which Low Frequency Components Are Absent”

In the present case, none of the prior art references disclose “a high pass filter which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent,” where the “difference signal” is outputted by “a comparator which receives as inputs the estimated torque signal and a desired torque signal.”

Dr. McCarley, Petitioner's expert, admitted that he did not render any opinion regarding “inherency” (Ex. 2003 at 11:13-24), that all of his arguments are “obviousness arguments,” (*Id.* at 15:8-12) and that he rendered no opinion regarding anticipation. (*Id.* 15:8-12).

Although the Petitioner admits that the primary reference it relies upon, *Suzuki*, does not explicitly disclose using a high-pass filter, the Petitioner goes on to assert that “[b]ut Suzuki's spark and fuel correction factor curves in Figures 12-15

¹ Unless otherwise noted, emphasis added.

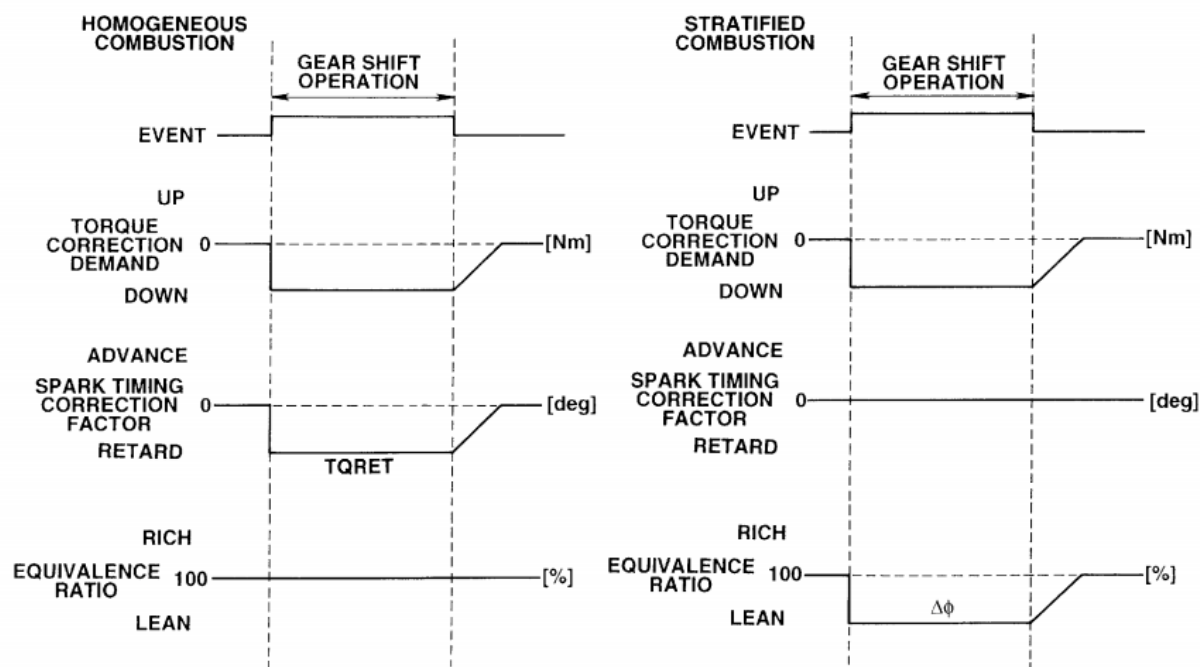
suggest that a high-pass filter is, in fact, being used. *Id.* To a POSA, the shape of these curves suggests that the torque correction demand signal is filtered with a high-pass filter.” (Paper 2 at 33).” (Ex. 2004 at ¶ 30).

1. *Suzuki*

A person of ordinary skill in the art reading the disclosure of Suzuki would not have been taught by Suzuki to high pass filter the output of a comparator which outputs the difference between an estimated torque signal and a desired torque signal. (Ex. 2004 at ¶ 32.) Figure 12, shown below, in *Suzuki* represents the lowering of torque during a gear shift, where torque is momentarily reduced, and then ramped back up after the shift. (*Id.*) Suzuki does not disclose or suggest that the signals represented in Figure 12 were produced by utilizing a high pass filter.

(Id.)

FIG.12

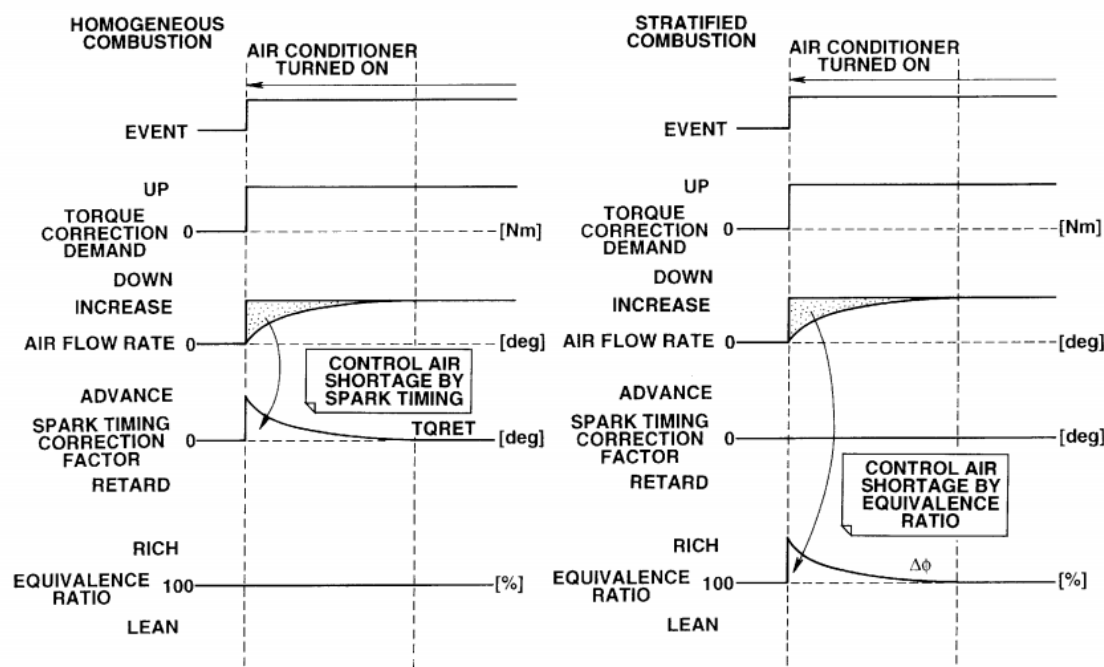


A person of ordinary skill in the art reading the disclosure of *Suzuki* would not have been taught by *Suzuki* to high pass filter the output of a comparator which outputs the difference between an estimated torque signal and a desired torque signal. (Id.) And there is no way for the person of ordinary skill in the art to infer that a high pass filter was used to produce the signals represented in Figure 12 of *Suzuki*. (Id.)

Figure 13 in *Suzuki* (included below) shows the effects of the air conditioning compressor cycling on and off. (Id. at ¶ 33.) When the air conditioning compressor turns on, it increases the torque load on the engine,

slowing it down. (*Id.*) The system response for homogeneous combustion is to initially increase spark advance, which quickly increases torque output. (*Id.*) After the initial spike in spark advance, spark timing is gradually retarded while at the same time, air flow rate is increased. (*Id.*) The different response occurs when the air conditioning compressor turns on while operating in stratified combustion mode. (*Id.*) The equivalence ratio is spiked rich, to quickly compensate for the increased torque requirement of the air conditioning compressor. (*Id.*) After the initial rich spike of equivalence ratio, it is gradually reduced while at the same time air flow rate is gradually increased. (*Id.*)

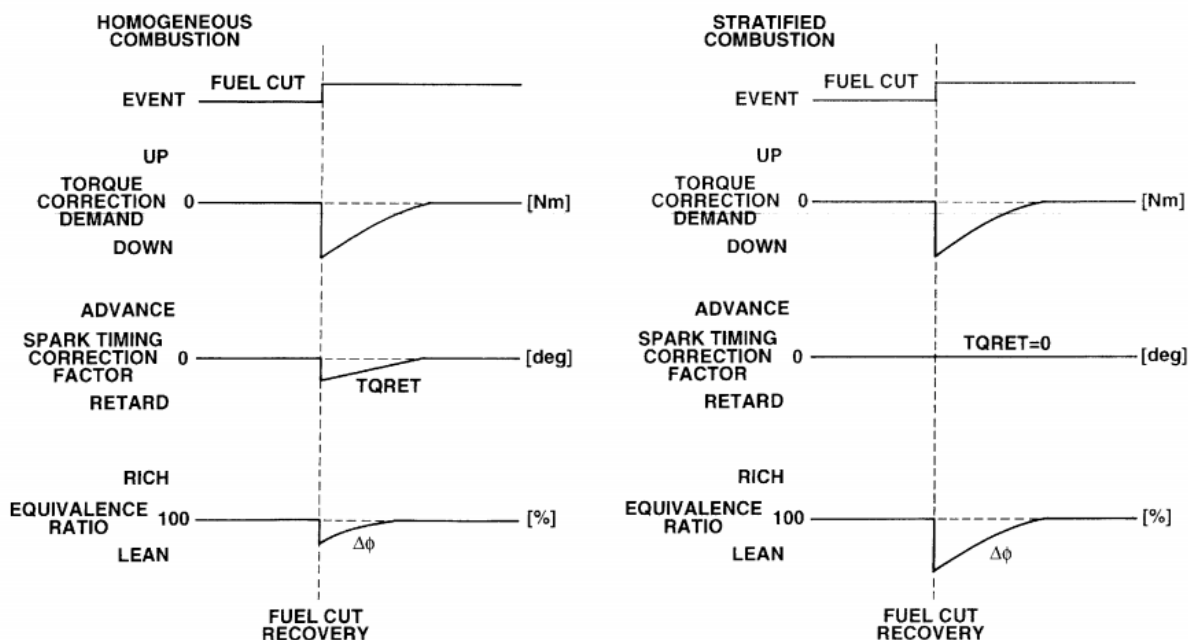
FIG.13



Suzuki does not disclose or suggest that the signals represented in Figure 13 are produced using a high pass filter. (*Id.*) A person of ordinary skill in the art reading the disclosure of *Suzuki* would not have been taught by *Suzuki* to high pass filter the output of a comparator which outputs the difference between an estimated torque signal and a desired torque signal. (*Id.*) And there is no way for the person of ordinary skill in the art to infer that a high pass filter was used to produce the signals represented in Figure 13 of *Suzuki*. (*Id.*)

Figure 14 in *Suzuki* (included below) shows the response for both homogeneous and stratified combustion for a torque correction demand in the presence of a fuel cut. (*Id.* at 34; Ex. 1005 at 10:13-20.) For homogeneous operation, the spark timing shifts to retarded and the equivalence ratio also shifts lean, then spark timing is gradually advanced while at the same time, equivalence ratio is gradually increased to rich. (*Id.*) For stratified combustion operation, equivalence ratio shifts lean and is gradually increased, but the spark timing correction factor is left unchanged. (*Id.*)

FIG.14

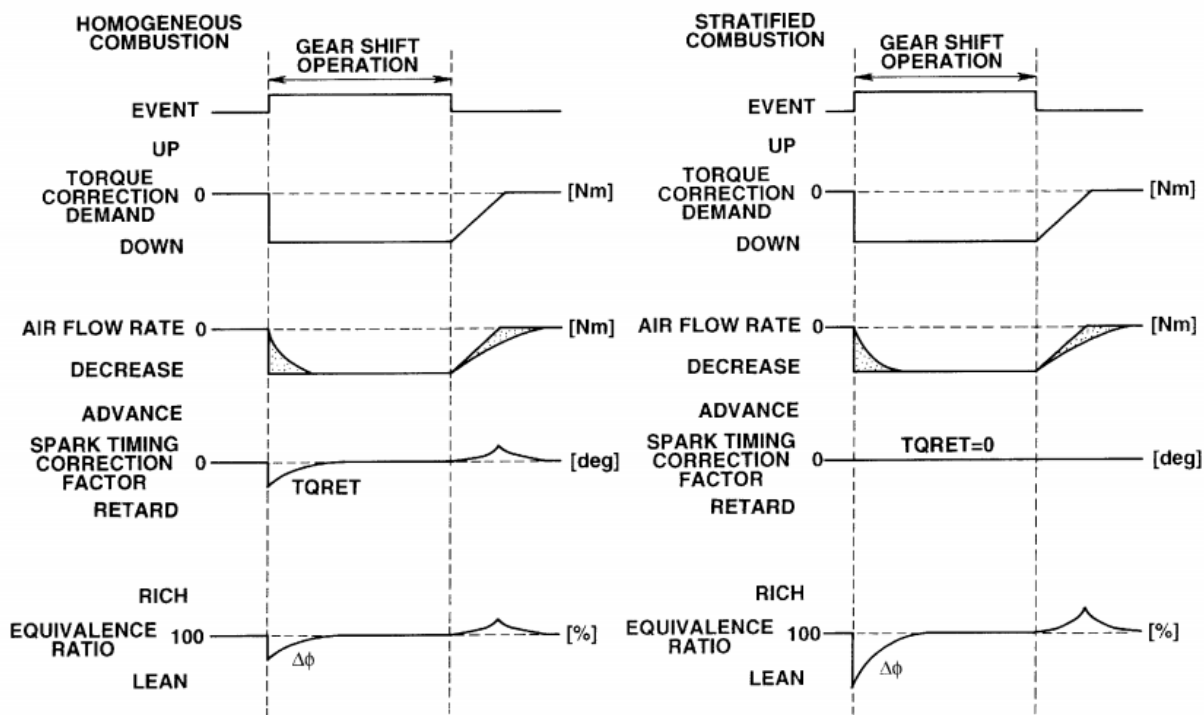


Suzuki does not disclose or suggest that the signals represented in Figure 14 are produced using a high pass filter. (*Id.*) A person of ordinary skill in the art reading the disclosure of *Suzuki* would not have been taught by *Suzuki* to high pass filter the output of a comparator which outputs the difference between an estimated torque signal and a desired torque signal. (*Id.*) And there is no way for the person of ordinary skill in the art to infer that a high pass filter was used to produce the signals represented in Figure 14 of *Suzuki*. (*Id.*)

Figure 15 in *Suzuki* (included below) shows a fourth embodiment with a torque correction demand for a torque reduction during a gear shift operation. Again, both homogeneous and stratified combustion operation are shown. (*Id.* at ¶

35; Ex 1005 at 11:22-32.) During homogeneous combustion operation, air flow rate is decreased, but since the response is slow, torque is quickly reduced by retarding the spark timing correction factor along with leaning out the equivalence ratio. (*Id.*) Air flow gradually decreases, while the spark timing correction factor is advanced and equivalence ratio is richened up. (*Id.*) For stratified combustion operation, the equivalence ratio is spiked lean. (*Id.*) As the air flow rate is decreasing gradually, the equivalence ratio is increased rich. (*Id.*) The spark timing correction factor is not changed. (*Id.*)

FIG.15



Suzuki does not disclose or suggest that the signals represented in Figure 15 are produced using a high pass filter. (*Id.*) A person of ordinary skill in the art

reading the disclosure of *Suzuki* would not have been taught by *Suzuki* to high pass filter the output of a comparator which outputs the difference between an estimated torque signal and a desired torque signal. (*Id.*) And there is no way for the person of ordinary skill in the art to infer that a high pass filter was used to produce the signals represented in Figure 15 of *Suzuki*. (*Id.*)

Throughout the entire patent, *Suzuki* does not disclose a key element of the challenged claims of the '565 patent, namely, “a high pass filter which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent” (claim 1) or “filtering out a plurality of low frequency components from the difference signal” (claim 7). (*Id.* at ¶ 36). *Suzuki* does not disclose using a high pass filter, period. (*Id.*) This admitted by Petitioner. (Paper 2 at 33.) Let us suppose for a moment that *Suzuki* did use a high pass filter as implied by the petitioner. Accordingly, *Suzuki* would only high pass filter the “torque correction demand signal.” That method, even if it were true, which it is not, does not entail high pass filtering of the “difference signal.” (Ex. 2004 at ¶ 64).

Although the prior art discloses high-pass filtering either an “estimated torque signal” or a “desired torque signal,” no prior art reference relied upon by the Petitioner or the Board discloses producing a “difference signal” by comparing an “estimated torque signal” and a “desired torque signal” and then high-pass filtering such “difference signal.” In fact, the key secondary reference (*Scherer*) which is the

linchpin of the Board's and the Petitioner's obviousness positions, clearly discourages and teaches away from the Board's and Petitioner's hindsight modification to the combined teachings of the relied-upon prior art references. At a bare minimum, the Board and the Petitioner (and its expert) failed to consider *Scherer* in its entirety, ignoring portions of the reference (specifically, the embodiment depicted in Figs. 3 and 4 of *Scherer*) that clearly lead away from obviousness. *See In re Wesslau*, 353 F.2d 238, 241 (CCPA 1965); *see also Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 449-49 (Fed. Cir. 1986) (holding that the district court, by failing to consider a prior art reference in its entirety, ignored portions of the reference that led away from obviousness).

It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one skilled in the art.

Bausch & Lomb, Inc., 796 F.2d 443 at 448.

2. *Scherer*

Scherer discloses a process and apparatus for adjusting the torque of an internal combustion engine which has as an object “ . . . to provide a process and apparatus of the initially mentioned type which adjusts the engine torque to a desired value with the least possible expenditures in both steady-state and transient engine operation with a comparatively short reaction time.” (Ex. 1007 at 2:39-43.) *Scherer* produces a demanded desired engine torque signal that “is split into a dynamic

component and a remaining quasi-static component. (Ex. 1007 at 2:47-59.) The dynamic component is used to determine corresponding adjustment of the ignition point in the case of an Otto engine or of the injection start in the case of a diesel engine. . . . while the quasi-static desired torque component is regulated by means of a corresponding adjustment of the air flow rate (for an Otto engine) or of the injection duration (a diesel engine).” (Ex. 1007 at 2:47-59.) “In a preferred embodiment of the invention, the dynamic desired torque component is determined by high-pass filtering the demanded desired engine torque with a decay time constant which is selected as a function of the engine operating point.” (Ex. 1007 at 3:6-10.)

There are two such preferred embodiments of *Scherer* depicted in Figures 1 and 2 of *Scherer*. “In another preferred embodiment, a model-based estimation is made of the quasi-static desired torque component achieved by air flow rate or injection duration regulation. (Ex. 1007 at 3:11-16.) To obtain the dynamic desired torque component, the estimated value is subtracted from the demanded desired engine torque.” (Ex. 1007 at 3:11-16.) There are two such preferred embodiments depicted in Figures 3 and 4 of *Scherer*.

In the preferred embodiments depicted in Figures 1 and 2 of *Scherer*, only the desired torque signal is high-pass filtered and no comparator is used to compare an “estimated torque signal” to the “desired torque signal.” In the preferred embodiments depicted in Figures 3 and 4 of *Scherer*, a comparator 15 is used to

produce a “difference signal” (M_d) by subtracting an “estimated torque signal” (M_{IS}) from the “desired torque signal” (M_{des}). (Ex. 2004 at ¶ 54). In these Figure 3 and 4 embodiments, *Scherer explicitly eliminates the high-pass filter* used in the Figures 1 and 2 embodiments, and, in place thereof, uses the “estimated value stage.” (*Id.*)

In this regard, *Scherer* states:

“FIG. 3 again shows a device which is suitable for torque adjustment of an Otto engine. This embodiment corresponds to that of FIG. 1 except that, ***instead of the high pass filter stage, a model-based estimated value stage is provided*** to determine the dynamic desired engine torque component (M_{des}) that cannot be regulated by the air flow rate regulation, by estimating the quasi-static engine torque part (M_{IS}) which can be adjusted by the air flow rate regulation.”

(Ex. 1007 at 6:3-12.)

Scherer further states:

“[t]he embodiment of FIG. 4, which is adapted for a diesel engine, is identical with that of FIG. 2 except that, ***instead of a high pass filter stage, (analogously to the modification of FIG. 3 in comparison to that of FIG. 1), an estimated value stage is provided***. This estimated value stage corresponds essentially to that of FIG. 3. The estimated value (M_{IS}) is then subtracted in the subtractor device 15 from the demanded desired engine torque (M_{des}), and the resulting difference signal is treated as the dynamic desired engine torque part (M_d) which is to be regulated by the injection start adjusting branch and is supplied to the dead zone unit 6.”

(Ex. 1007 at 6:44-64.)

Thus, it is clear that in embodiments in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “desired torque signal,” the high-pass filter used in the other embodiments that do not employ such a comparator is eliminated, and the “difference signal” output by the comparator is not high-pass filtered. (Ex. 2002 at ¶ 55.) Thus, *Scherer discourages*

a POSA from and, in fact, directly teaches away from using a high-pass filter in embodiments in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “desired torque signal.” (Id.)

The Board states the following:

“ . . . Petitioner asserts that Suzuki and Scherer render obvious claim 1’s ‘high pass filter which receives as an input the difference signal in which low frequency components are absent.’”

(Paper 12 at 32.)

“Petitioner argues that it would have been obvious to a person of ordinary skill in the art to add Scherer’s high pass filter 4 to Suzuki’s system.”

(Id.)

“Patent Owner concludes that ‘[c]ombining the teachings of Scherer and those of any one or more of the secondary references relied upon by Petitioner, even in hindsight, would result in a desired engine torque signal which is high-pass filtered, and a ‘difference signal’ which is not high-pass filtered.’”

(Id. at 34.)

“ . . . Patent Owner suggests that the only possible obvious location and use of a high pass filter is downstream of an engine torque coordination unit to filter a desired torque signal. . . . This argument takes a myopic view of Scherer, overlooking a significant aspect identified by Petitioner, and attacking the references individually. Patent Owner’s argument overlooks that Scherer’s high pass filter 4 sits immediately upstream of the provisions for adjusting torque, such as the provisions for controlling spark to adjust torque, in the case of Figure 1. . . . Recognizing this aspect of Scherer’s disclosure, Petitioner argues that it would have been obvious to add high pass filter 4 to Suzuki immediately upstream of the provisions for adjusting torque, which would place high pass filter 4 downstream of Suzuki’s comparator. . . . Situated immediately upstream of the torque-adjusting provisions and immediately downstream of the comparator in Suzuki’s system, high pass filter 4 would filter the difference signal generated by Suzuki’s comparator. ***Thus, Petitioner provides a reasoned explanation of an allegedly obvious combination of references that would high pass filter a torque difference***

signal, regardless of whether any of the references individually teaches high pass filtering a torque difference signal.”

(*Id.* at 36-37.)

As an initial matter, Patent Owner strongly disagrees that Petitioner provided a “reasoned explanation of an allegedly obvious combination of references that would high pass filter a torque difference signal...”. Rather, ***Patent Owner contends that what the Board characterizes as a “reasoned explanation” actually constitutes convoluted, hindsight reasoning.*** Additionally, Patent Owner disagrees that it has taken a “myopic view” of *Scherer*, or that it only attacked *Suzuki* and *Scherer* individually, and did not fully consider the “combination of *Suzuki* and *Scherer*.”

Scherer discourages and, in fact, directly teaches away from using a high-pass filter in embodiments in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “desired torque signal.” The Board and the Petitioner have overlooked Scherer’s explicit teaching of eliminating the high-pass filter altogether in embodiments in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “desired torque signal.” Certainly, a person of ordinary skill in the art would have been taught by *Scherer* to high-pass filter the “desired torque signal” in embodiments in which a comparator is not used, and to eliminate the high-pass filter in embodiments in which the comparator is used. (Ex. 2004 at ¶ 55.)

B. *Suzuki* and *Scherer* In Combination Do Not Render Any of the Challenged Claims of the '565 Patent Obvious

Any attempt to reconstruct the claimed invention of the '565 patent by combining the teachings of *Scherer* and *Suzuki* and/or any other prior art reference being relied upon by Petitioner (much less then modifying such combined teachings to supply a critical, patentability-imparting claim limitation that goes to the heart of the '565 invention that is lacking in all references) contravenes the well-settled law set forth above, and constitutes clearly impermissible hindsight, and, furthermore, is contrary to the fairly considered teachings of these prior art references. As demonstrated hereinabove, such attempts are based upon using the challenged claims as a blueprint or roadmap to pick and choose isolated teachings of these prior art references that support a particular thesis while ignoring and selectively discarding other teachings of these prior art references that undermine that particular thesis, which clearly constitutes the exercise of legally impermissible hindsight.

Dr. McCarley, Petitioner's expert, testified during his deposition in this matter that *his expert declaration submitted in this case "was a collaborative effort between us [between him and Petitioner's attorneys]"* (Ex. 2003 at 8:12-9:7), as further revealed by his following testimony during his aforementioned deposition:

Q Who prepared the initial draft of the declaration?

A Hmmm. I believe the initial framework was drafted by the attorneys, lacking most of the technical details that then I provided.

Q What do you mean by framework there? Describe for me what you received from the attorneys.

A Well, after certain prior art references were identified and I attempted to get the arguments out of them, I had the assistance of the attorneys on crafting the actual final language, that is correct and consistent. Again, this does not suggest that any of this is not my opinion. I'm admitting that I am not an attorney.

Q How was the prior art search conducted? Did you conduct that or the attorneys or some combination?

A ***These references came out of a search performed by the staff at Stern[e] Kessler, who are much more efficient and skilled at this than I.*** But this is not to say that I would not have come up with the exact same references without their assistance and skill.

Q Did you provide any input into the search process?

A Yes, I did.

Q How so?

A After – well, I – early in the process, after reading the complaint and being advised by the attorneys about the situation, I looked for certain elements of the '565 that I then studied. And they [Petitioner's attorneys] suggested that when I do my comprehensive search that I be attentive to things. . . . I can't recall exactly all of the conversations I had, but I did provide, I would say, significance (sic) into the search process."

(Ex. 2003 at 13:2-14:16.)

Based upon the above and other deposition testimony of Dr. McCarley, it is plain to see that what the Petitioner's attorneys and expert have done, broadly speaking, is to collaboratively prepare expert declarations and copy and paste therefrom into their briefs in this proceeding, and without the expert even starting the obviousness analysis from the proper starting point, *i.e.*, stepping into the shoes of the hypothetical POSA working at the time of the invention and devising the prior

art search strategy that the POSA would have devised without the benefit of the disclosure and claims of the subject patent.

Further, based upon the above and other deposition testimony of Dr. McCarley, and as will become more fully apparent hereinafter, it is plain to see that the Petitioner's expert in this case did not use the proper obviousness analytical framework, and, as such, the Expert Declaration in this proceeding are fundamentally flawed and lack probative value. Limiting the scope of prior art review, such as the limited prior art provided by Petitioner, facilitates hindsight bias in expert witnesses. *See Novartis Pharm. Corp. v. W.-Ward Pharm. Int'l Ltd.*, 923 F.3d 1051, 1058 (Fed. Cir. 2019).

The case law and other authorities cited herein dictate that the *Graham v. John Deere* requirement of determining the scope and content of the prior art requires that the starting point of an obviousness analysis is a careful consideration of what prior art references a hypothetical person of ordinary skill in the art at the time the invention was made, without the benefit of the disclosure or claims of the subject patent, tasked with solving the problem and/or meeting the objectives that the inventor had in mind at the time of the invention, would have selected and combined during the normal course of research and development.

The scope and content of the prior art that is relevant to the obviousness analysis should be limited to the scope and content of the prior art that the

hypothetical person of ordinary skill in the art attempting to solve the problem and/or meet the objectives that the inventor had in mind at the time of the invention would have found during the normal course of research and development. In cases in which the retained expert is handed or spoon fed the prior art references to consider by the petitioner's attorneys, such as the instant case, it becomes impossible for the Patent Owner's attorney to meaningfully and properly cross-examine the petitioner's expert about how he/she formulated the prior art search and what criteria he/she used in devising the search strategy and in ultimately selecting relevant prior art references, and then, combining the teachings of those relevant prior art references that are selected and considered.

The overall approach and methodology of a law firm supplying the prior art references to a retained expert is fundamentally flawed and inherently unreliable, since the expert in this instance necessarily has an improper starting point. The proper starting point is for the expert to “***step back in time and into the shoes of the hypothetical person of ordinary skill in the art “when the invention was unknown and just before it was made”***” (MPEP §2142.7) and determine what prior art the POSA would have searched for and found in the normal course of research and development, assuming the POSA was attempting to solve the problem and/or meet the objectives the inventor had in mind at the time the invention was made. To reach a conclusion of obviousness requires more than a mere showing that the prior art

includes separate references covering each separate limitation in a claim under examination. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). Rather, obviousness requires the additional showing that a person of ordinary skill in the art at the time of the invention would have **selected** and **combined** those prior art elements **in the normal course of research and development** to yield the claimed invention. *Id.*

Additionally, Petitioner's attorneys and expert have collaborated to use hindsight reasoning to analyze the challenged claims part-by-part, and collaborated to devise an after-the-fact explanation of how as POSA could have theoretically combined various prior art elements without any showing as to how "a person of ordinary skill in the art at the time of the invention would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention." *Unigene Labs* at 1360.

"The 'as a whole' instruction in title 35 prevents evaluation of the invention part by part. . . . This form of hindsight reasoning, using the invention as a roadmap to find its prior art components, would discount the value of combining various existing features or principles in a new way to achieve a new result - often the very definition of invention."

Princeton Biochemicals, Inc. v. Coulter, Inc., 411 F.3d 1332, 1337 (Fed. Cir. 2005); *see also Allergan, Inc. v. Apotex, Inc.*, 754 F.3d 952 (Fed. Cir. 2014).

Dr. McCarley's deposition testimony clearly indicates that he failed to follow the "as a whole" instruction in 35 U.S.C. § 103. ("After – well, I – early in the process, after reading the complaint and being **advised by the attorneys about the**

situation, I looked for certain elements of the '565 that I then studied." (Ex. 2003 at McCarley, 14:3-16.)

Based upon the foregoing, Patent Owner respectfully submits that Dr. McCarley's expert declaration in this case is fundamentally flawed, inherently unreliable, and, ultimately, lacks probative value and should not be relied upon by the Board in finding that a claim limitation that is admittedly not disclosed in any of the prior art references Petitioner and the Board are relying upon ("missing claim limitation") would nevertheless have been implemented by a POSA at the time of the invention, without the benefit of the disclosure and claims of the '565 patent.

VIII. CONCLUSION

For the foregoing reasons, the Board should find that all claims of the '565 patent are valid.

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that there are 7,916 words in this paper, excluding any table of contents, table of authorities, mandatory notices under 37 C.F.R. § 42.8, certificate of word count, certificate of service, or appendix of exhibits. This certification relies on the word count of the word-processing system used to prepare this paper.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on October 29, 2020, I caused a true and correct copy of the foregoing materials to be served via the Patent Office electronic filing system, and electronic service via email to the following attorneys of record pursuant to Petitioner's consent.

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Volkswagen Group of America, Inc.,
Petitioner

v.

Michigan Motor Technologies LLC,
Patent Owner

Case IPR2020-00444
Patent No. 6,581,565

SECOND DECLARATION OF DR. RUSSELL LEONARD

MMT 2004

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1. I, Dr. Russell Leonard, declare as follows:

I. INTRODUCTION

2. I have been retained as an expert in this proceeding by counsel for Michigan Motor Technologies (MMT). I have been asked for my expert conclusions.

II. BACKGROUND

3. I obtained my Bachelor's degree in Industrial Arts Education with an automotive emphasis from Central Michigan University in 1991. Next, I earned a Master of Education from Wayne State University in 1997, and a Ph.D. in Higher Educational Leadership from Western Michigan University in 2016.

4. I am currently a Professor at Ferris State University in the Automotive Department of the School of Automotive and Heavy Equipment where I teach in both the Automotive Engineering Technology and Automotive Service programs.

5. I began my automotive career working as a mechanic on civilian automobiles and military vehicles. After transitioning to building prototype vehicles at Roush, I started a new position as a contractor to Ford Motor Company teaching engineers on the topic of Ford powertrain electronic controls. I learned an incredible amount of detail that augmented my technician viewpoint with an understanding

from a design and manufacturing perspective. While earning my master's degree, a classmate suggested that I should apply to Hughes Aircraft.

6. At Hughes, I worked as a Systems Engineer designing and developing training for General Motors. The last assignment I performed at Hughes Aircraft was integrating advanced military technologies with civilian applications. It was during this project with Hughes that I was encouraged to apply for a position at General Motors as a Service Engineer for Cadillac.

7. While at Cadillac, I assisted field technicians with repairs over the phone, tracked trends and created engineering bulletins and campaigns as required. The next position in my General Motors career was a release engineer of diagnostic scan tool software after an internal transfer. In this position, I wrote code for the Tech 2 scan tool to request and receive data from various computer control modules for numerous GM vehicles to not only comply with OBD II, but to be a useful tool to the repair technician.

8. After the September 11th terrorist attack, I decided to share my experiences and enjoyment of automobiles with future generations, so I became an automotive professor at Ferris State University. I earned my Ph.D. during this time while teaching many automotive subjects in the automotive service program for technicians and in the automotive engineering technology program for engineering technologists.

9. I am a continuing member of multiple professional organizations, including SAE International, where I am the faculty advisor at Ferris State University for the student chapter of the collegiate design series, Baja SAE. At ASTM International, I am a voting member of Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants, and Committee D15 on Engine Coolants and Related Fluids. Additionally, I am a task group member of four work items within D15.

10. My career thus far includes 17 years teaching automotive engineering technology and servicing at a university, 7 years as an engineer for major automotive and technology corporations, 3 years as a trainer of powertrain electronic controls for an automobile manufacturer, 19 years of service in the United States military, 7 years of which I was a mechanic, and 4 years as a civilian automobile mechanic.

11. A copy of my curriculum vitae is attached as Appendix A, which contains further details regarding my experience, education, and other qualifications to render an expert opinion in connection with this proceeding.

12. I am being compensated at my normal consulting rate of \$240/hour for my work, but my opinions are based on my own views of the patented technology and the prior art. My compensation is not dependent on the outcome of this

proceeding and in no way influences the substance of my statements in this declaration.

13. I have no financial interests in the patent owner. Similarly, I have no financial interest in the '565 patent.

III. LEVEL OF ORDINARY SKILL IN THE ART

14. The level of ordinary skill in the art applicable to the '565 patent around the time of the invention in 2002 is a person with (1) a B.S. in mechanical engineering or equivalent with three or more years of experience in either engine systems or engine control systems or (2) at least a M.S. in mechanical engineering.

IV. UNDERSTANDING OF THE LAW

15. I am not an attorney. For the purposes of this declaration, the patent owner's counsel has informed me about certain aspects of the law that are relevant to my opinions. I have applied those legal principles in arriving at my conclusions expressed in this Declaration.

a. Claim construction

16. I understand that "a claim of a patent . . . shall be construed using the same claim construction standard that would be used to construe the claim including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent."

17. I understand that claim terms that are not construed by the Board should be given their ordinary and customary meaning as would have been understood by a person of ordinary skill in the art at the time of the claimed invention.

18. I also understand that a “means-plus-function” claim term is a term that recites a certain function but does not recite sufficient structure for performing that function. I understand that means-plus-function terms are limited to the function recited in the claim term and the specific structure that is disclosed in the patent’s specification for performing that function and structures that are equivalent to the disclosed structures. Thus, I have been informed and understand that construing a means-plus-function claim term is a two-step process. First, the claimed function of the term must be identified. Second, the structure or structures described in the specification for performing that function must be identified.

b. Obviousness

19. I also understand that a showing of obviousness must include demonstrating that the cited references disclose each element of a challenged claim.

20. Additionally, the focus when determining obviousness should be on what a person of ordinary skill in the pertinent art would have known at the time of the invention, and on what such a person would have reasonably expected to have been able to do in view of that knowledge.

V. OVERVIEW OF THE ‘565 PATENT

21. The basic inventive concept disclosed and claimed in the subject ‘565 patent is to, in the controlling of engine torque of a spark ignition direct injection internal combustion engine, teach a method in which torque is controlled dependent upon a filtered difference signal of desired torque and current torque estimate signals.

22. A high pass filter is used to filter the difference signal of desired torque and current torque estimate signals and it is this high pass filtering of the difference of two signals that makes the ‘565 patent unique. It is the filtered difference signal that controls engine torque.

23. The ‘565 patent discloses what was well known in the prior art that “[i]n engine torque controllers for DISI engines, when the engine is operated in stratified mode, spark angle has little influence on the torque produced. The torque producer modifies the air/fuel in order to control the torque produced. Conversely, when the engine is operating in homogenous mode... [t]he torque producer modifies the timing of the spark ignition in order to control the torque produce.” (EX 1001, ‘565 at 1:36-45.)

24. The main difference between the prior art and the ‘565 patent is the method of correction for a steady state error by using a high pass filtered output of

the difference of the torque demanded signal and the estimate of the torque produced signal.

25. A better description of the uniqueness of the '565 patent's method is to say that the torque demand signal represents a feedforward signal and that the torque produced signal represents a feedback signal. These two signals are run through a comparator 18 that generates an error signal. The error signal is generated by subtracting the current torque estimate from the torque demand signal. EX 1001 at 3:34-39 and Figure 3. This error signal indicates instances where torque demand is less than torque produced and instances where torque demand is greater than torque produced. The high pass filter receives the error signal and blocks (filters out) smaller differences from the comparator 18 and only allows larger differences to pass through to the transient torque controller. Indeed, the '565 invention does not expend energy with smaller, less significant errors by only acting upon larger errors. This design minimizes hunting, where the system is continuously chasing changes back and forth.

VI. OVERVIEW OF THE PRIOR ART

a. Suzuki

26. The Suzuki invention discloses a method of torque control of a direct injection spark ignition engine. The torque control method covers the engine combustion operation of both stratified and homogeneous modes. Torque correction

is realized by controlling at minimum, spark timing for torque correction in homogeneous combustion and air/fuel ratio during stratified combustion operation. Suzuki is a simple solution to engine torque control at the time of invention.

27. Like Suzuki, the ‘565 patent discloses what was well known in the prior art that “[i]n engine torque controllers for DISI engines, when the engine is operated in stratified mode, spark angle has little influence on the torque produced. The torque producer modifies the air/fuel in order to control the torque produced. Conversely, when the engine is operating in homogenous mode... [t]he torque producer modifies the timing of the spark ignition in order to control the torque produce.” (EX 1001, ‘565 at 1:36-45.)

28. In addition, a POSA would know that in homogeneous mode, air/fuel ratio manipulation has a much less correcting effect when compared to spark timing. Again, Suzuki reiterates what was already known at the time of the ‘565 invention.

29. The fatal flaw of Suzuki is the lack of disclosure of the usage of a high pass filter. In the Petition, it is admitted that “Suzuki does not expressly disclose using a high-pass filter to receive the torque difference signal as an input and to output a filtered difference signal in which low frequency components are removed.” (Paper No. 1 at 33).

30. The Petitioner goes on to assert that “[b]ut Suzuki’s spark and fuel correction factor curves in Figures 12-15 suggest that a high-pass filter is, in fact,

being used. Id. To a POSA, the shape of these curves suggests that the torque correction demand signal is filtered with a high-pass filter.” (Paper No. 1 at 33).

31. In review of Figures 12-15 of Suzuki, I state the following:

32. Figure 12 represents the lowering of torque during a gear shift, where torque is momentarily reduced, and then ramped back up after the shift. Suzuki does not disclose or suggest that the signals represented in Figure 12 were produced by utilizing a high pass filter. A person of ordinary skill in the art reading the disclosure of Suzuki would not have been taught by Suzuki to high pass filter the output of a comparator which outputs the difference between an estimated torque signal and a desired torque signal. And there is no way for the person of ordinary skill in the art to infer that a high pass filter was used to produce the signals represented in Figure 12 of Suzuki.

33. Figure 13 shows the effects of the air conditioning compressor cycling on and off. When the air conditioning compressor turns on, it increases the torque load on the engine, slowing it down. The system response for homogeneous combustion is to initially increase spark advance, which quickly increases torque output. After the initial spike in spark advance, spark timing is gradually retarded while at the same time, air flow rate is increased. The different response occurs when the air conditioning compressor turns on while operating in stratified combustion mode. The equivalence ratio is spiked rich, to quickly compensate for

the increased torque requirement of the air conditioning compressor. After the initial rich spike of equivalence ratio, it is gradually reduced while at the same time air flow rate is gradually increased. Suzuki does not disclose or suggest that the signals represented in Figure 13 are produced using a high pass filter. A person of ordinary skill in the art reading the disclosure of Suzuki would not have been taught by Suzuki to high pass filter the output of a comparator which outputs the difference between an estimated torque signal and a desired torque signal. And there is no way for the person of ordinary skill in the art to infer that a high pass filter was used to produce the signals represented in Figure 13 of Suzuki.

34. Figure 14 shows the response for both homogeneous and stratified combustion for a torque correction demand in the presence of a fuel cut EX 1005 at 10:13-20. For homogeneous operation, the spark timing shifts to retarded and the equivalence ratio also shifts lean, then spark timing is gradually advanced while at the same time, equivalence ratio is gradually increased to rich. For stratified combustion operation, equivalence ratio shifts lean and is gradually increased, but the spark timing correction factor is left unchanged. Suzuki does not disclose or suggest that the signals represented in Figure 14 are produced using a high pass filter. A person of ordinary skill in the art reading the disclosure of Suzuki would not have been taught by Suzuki to high pass filter the output of a comparator which outputs the difference between an estimated torque signal and a desired torque

signal. And there is no way for the person of ordinary skill in the art to infer that a high pass filter was used to produce the signals represented in Figure 14 of Suzuki.

35. Figure 15 shows a fourth embodiment with a torque correction demand for a torque reduction during a gear shift operation. Again, both homogeneous and stratified combustion operation are shown. EX 1005 at 11:22-32. During homogeneous combustion operation, air flow rate is decreased, but since the response is slow, torque is quickly reduced by retarding the spark timing correction factor along with leaning out the equivalence ratio. Air flow gradually decreases, while the spark timing correction factor is advanced and equivalence ratio is richened up. For stratified combustion operation, the equivalence ratio is spiked lean. As the air flow rate is decreasing gradually, the equivalence ratio is increased rich. The spark timing correction factor is not changed. Suzuki does not disclose or suggest that the signals represented in Figure 15 are produced using a high pass filter. A person of ordinary skill in the art reading the disclosure of Suzuki would not have been taught by Suzuki to high pass filter the output of a comparator which outputs the difference between an estimated torque signal and a desired torque signal. And there is no way for the person of ordinary skill in the art to infer that a high pass filter was used to produce the signals represented in Figure 15 of Suzuki.

36. Throughout the entire patent, Suzuki does not disclose or suggest a key element of the challenged claims of the '565 patent, namely, "a high pass filter

which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent” (claim 1) or “filtering out a plurality of low frequency components from the difference signal” (claim 7).

b. Cullen

37. Cullen is a secondary reference relied upon by the Petitioner.

38. The Cullen invention is a method of control for an automatic transmission that relies on predicting the torque produced by the engine, which is coupled to the transmission. The automatic transmission is a device that receives engine torque and is designed to use that torque via a plurality of gear ratio choices. The logic to control an automatic transmission is a balancing act to best achieve the desired vehicle dynamics based upon the operator’s commands, while containing the torque in a manner that protects the drivetrain hardware.

39. Cullen improves the accuracy of the calculation for engine torque prediction by including factors in the calculation that affect torque such as: air conditioning operation, power steering operation, cold engine friction, green (new) engine friction, non-gasoline fuel usage and cylinder deactivation.

40. While Cullen may be a good method for controlling an automatic transmission, the disclosure of engine torque prediction in Cullen does not address the special methodology required for precisely controlling engine torque during

stratified combustion operation. Additionally, Cullen does not disclose the use of a high pass filter. Both of these disclosures are key elements of the ‘565 patent.

41. A POSA would not have been motivated to combine Cullen with Suzuki or Scherer because the field of invention of Cullen is “for a control system governing operation of an automatic transmission[.]” EX. 1006 at 1:11-12. That makes Cullen farther afield, making it a stretch for a POSA to even consider Cullen’s teachings.

c. Scherer

42. Scherer is the key secondary reference relied upon by the Petitioner.

43. Scherer is primarily directed to a system and method for controlling engine torque regulating the ignition point and air flow rate on an Otto (gasoline) engine, or by regulating the start and duration of fuel injection in a diesel engine. The Scherer invention claims to improve adjustment of engine torque to a desired value with minimal deviations in both steady-state (quasi-static) and transient (dynamic) operation, with a claimed shorter reaction time.

44. One issue with Scherer is that there is no consideration of a stratified charge operation mode for a DISI engine as the ‘565 teaches. Scherer teaches diesel engine control, which the ‘565 does not teach. In this light, Scherer “teaches away” from the ‘565 patent with technology relating to diesel engines and not teaching to Direct Injection Spark Ignition (DISI) engine’s unique operational characteristics.

45. A POSA would know that diesel engines operate differently than a spark ignition engine in that a diesel engine does not have spark plugs. A diesel engine relies upon the heat of compression to ignite the air/fuel mixture.

46. Scherer does disclose homogeneous operation of a spark ignition engine, but fails to consider the stratified charge operation of a DISI engine.

47. Another fundamental flaw of Scherer is that even though there is a high pass filter disclosed, it is not employed in the unique manner of the teachings of the '565. Scherer uses the high pass filter with an adjustable decay time constant (t), which is a function of engine speed and load to generate the filtered output of dynamic desired torque (M_d). EX 1007 at 4:31-45 and Figure 1.

48. In the '565 patent, a "current torque estimator 22 uses the air charge estimate signal, together with a signal representing the current spark angle and a signal representing the current air/fuel ratio to generate a signal representing an estimate of current torque." EX 1001 at 3:29-39.

49. It is this signal, "[t]he estimate of the current torque, [which] is compared to the desired torque signal by a comparator 18 to generate an error signal, which is then filtered by the high pass filter 20."

50. Indeed, this is a markedly different approach than what Scherer teaches. Indeed, the petitioner's expert admits that "[t]he processing of the signal is a bit different. EX. 2003 Pg. 24, 5-6.

51. Scherer discloses that “In a preferred embodiment of the invention, the dynamic desired torque component is determined by high-pass filtering the demanded desired engine torque with a decay time constant which is selected as a function of the engine operating point.” (Ex. 1007 at 3:6-10).

52. There are two such preferred embodiments of Scherer depicted in FIGs. 1 and 2 of Scherer.

53. “In another preferred embodiment, a model-based estimation is made of the quasi-static desired torque component achieved by air flow rate or injection duration regulation. To obtain the dynamic desired torque component, the estimated value is subtracted from the demanded desired engine torque.” (Ex. 1007 at 3:11-16). There are two such preferred embodiments depicted in FIGs. 3 and 4 of Scherer.

54. In the preferred embodiments depicted in FIGs. 1 and 2 of Scherer, only the desired torque signal is high-pass filtered and no comparator is used to compare an “estimated torque signal” to the “desired torque signal.” In the preferred embodiments depicted in FIGs. 3 and 4 of Scherer, a comparator 15 is used to produce a “difference signal” (M_d) by subtracting an “estimated torque signal” (M_{IS}) from the “desired torque signal” (M_{des}). In these FIG. 3 and 4 embodiments, **Scherer explicitly eliminates the high-pass filter** used in the FIGs. 1 and 2

embodiments, and, in place thereof, uses the “estimated value stage.” In this regard,

Scherer states that:

“FIG. 3 again shows a device which is suitable for torque adjustment of an Otto engine. This embodiment corresponds to that of FIG. 1 except that, **instead of the high pass filter stage, a model-based estimated value stage is provided** to determine the dynamic desired engine torque component (M_{des}) that cannot be regulated by the air flow rate regulation, by estimating the quasi-static engine torque part (M_{IS}) which can be adjusted by the air flow rate regulation.” (Ex. 1007 at 6:3-12) (emphasis added).

Scherer further states that:

“[t]he embodiment of FIG. 4, which is adapted for a diesel engine, is identical with that of FIG. 2 except that, **instead of a high pass filter stage, (analogously to the modification of FIG. 3 in comparison to that of FIG. 1), an estimated value stage is provided**. This estimated value stage corresponds essentially to that of FIG. 3. The estimated value (M_{IS}) is then subtracted in the subtractor device 15 from the demanded desired engine torque (M_{des}), and the resulting difference signal is treated as the dynamic desired engine torque part (M_d) which is to be regulated by the injection start adjusting branch and is supplied to the dead zone unit 6.” (Ex. 1007 at 6:44-64) (emphasis added).

55. Thus, it is clear that in embodiments of Scherer in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “torque demand signal,” the high-pass filter used in the other embodiments that do not employ such a comparator is eliminated, and the “difference signal” output by the comparator is not high-pass filtered. Thus, **Scherer discourages a POSA from and, in fact, directly teaches away from using a high-pass filter in embodiments in which a comparator is used to**

produce a “difference signal” by subtracting an “estimated torque signal” from a “desired torque signal.”

56. For these reasons, I do not believe a POSA would consider combining Scherer with Suzuki or any other teaching because they teach away from each other and the ‘565 patent.

d. Takahashi

57. Takahashi is the fourth reference asserted by the petitioner. Takahashi controls the throttle valve and fuel injection in a manner that ensures the engine output torque and air/fuel ratio matches target values. It achieves this goal with a method that calculates target air mass flow rate as “the air mass flow rate at the inlet port which achieves target torque.” The target torque is used to control the fuel injection and electronic throttle control.

58. Petitioner claims that Takahashi “discloses that the air-mass-flow-rate deciding block 11 receives a target torque signal T_o (“desired torque signal”), a target air/fuel ratio signal A/F_o (“desired air/fuel”), **and a spark advance signal θ_{adv} (“desired spark angle signal”)** to determine the target mass flow rate Q_{map0} (“air charge demand signal”).” Paper at pgs.74-75. EX. 1008 at 3:28-51

59. In reference to the “spark advance signal θ_{adv} (“desired spark angle signal”) to determine the target mass flow rate Q_{map0} (“air charge demand signal”).”, it is obvious to a POSA that spark advance signal θ_{adv} (“desired spark angle signal”)

is a small part, as in a denominator of a quotient of the equation Q_{map0} . Whereas the '565 patent teaches a desired spark angle as a direct input to the "Air Charge Demand Controller" in EX 1001 at 3:6-12 and Figure 3. Neither figure 2 nor figure 14 of Takahashi indicate a desired spark angle as a discrete input to the "Throttle Controller" nor the "Target Air Mass Flow Rate Deciding Block."

60. The Petitioner claims that "Takahashi's target air-mass-flow-rate deciding block 11 is an "air charge demand controller," as recited in claims 3 and 6. EX1003, ¶181. The target air-mass-flow-rate deciding block 11 determines a demand air charge value for the throttle controller 144 based on receiving a desired torque signal, a desired spark angle signal, and a desired air/fuel ratio. Id. Indeed, Takahashi's target air-mass- flow-rate deciding block 11 operates in the same manner as the air charge demand controller 27 disclosed by the '565 patent, which receives a desired torque signal, a desired spark angle signal, and a desired air/fuel ratio and outputs a demand air charge signal to the air charge controller 29. Paper at pgs. 86-87.

61. This statement is not exactly true because the air charge demand controller 27 disclosed by the '565 patent, which receives a desired torque signal, a **discrete input** of a desired spark angle signal, and a desired air/fuel ratio and outputs a demand air charge signal to the air charge controller 29. This differs from the Takahashi patent in that the spark advance signal θ_{adv} ("desired spark angle signal")

is a small part, as in a denominator of a quotient of the equation Q_{map0} and not a discrete input.

VII. NO MOTIVATION TO COMBINE THE PRIMARY REFERENCES

62. The Petitioner and the Board have taken the position that a hypothetical POSA would have extracted certain teachings from one prior art reference (namely, Scherer) and used that extracted teaching from Scherer to modify another reference, Suzuki, to add the claim element that is admittedly missing from all the prior art references the Petitioner and the Board rely upon. In particular, the challenged claims of the '565 patent all require high-pass filtering of the output of a comparator whose inputs are a desired torque signal and an estimated torque signal. The Board concludes that "[t]hus, Petitioner provides a reasoned explanation of an allegedly obvious combination of the references that would high pass filter a torque difference signal, regardless of whether any of the references individually teaches high pass filtering a torque difference signal." (DI, 37). This is clearly a conclusion made in error as it does not honor the uniqueness of that specific unique teaching of the '565 patent.

63. A POSA would not consider combining Suzuki with Cullen, Scherer Takahashi or any other teaching because Cullen teaches away from the others by being focused on automatic transmission controls.

64. Suzuki does not disclose using a high pass filter, period. Interestingly, the Petitioner admits this to be true. (Paper No. 1 at 33). Let us suppose for a moment that Suzuki did use a high pass filter as implied by the petitioner. Accordingly, Suzuki would only high pass filter the “torque correction demand signal.” That method, even if it were true, which it is not, does not disclose a high pass filtering of the “difference signal.”

65. Again, Suzuki does not disclose a key element of the challenged claims of the ‘565 patent, namely, “a high pass filter which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent” (claim 1) or “filtering out a plurality of low frequency components from the difference signal” (claim 7).

66. Cullen is directed toward controlling an automatic transmission. The disclosure of engine torque prediction in Cullen does not address the special considerations required for controlling torque during stratified combustion engine operation nor does Cullen disclose the use of a high pass filter. Both of these disclosures are key elements of the ‘565 patent.

67. A POSA would not have been motivated to combine Cullen with Suzuki, Scherer nor Takahashi because the field of invention of Cullen is “for a control system governing operation of an automatic transmission[.]” EX. 1006 at

1:11-12. That makes Cullen far afield, making it a stretch for a POSA to even consider Cullen's teachings.

68. The issues with Scherer are that there is no consideration of a stratified charge operation mode for a DISI engine as the '565 teaches and Scherer teaches diesel engine control, which the '565 does not apply to that technology field. In this light, Scherer "teaches away" from the '565 patent with technology relating to diesel engines and not teaching to a Direct Injection Spark Ignition (DISI) engine's unique operational characteristics as they relate to engine torque control.

69. Indeed, a POSA would know that diesel engines operate differently than a spark ignition engine in that a diesel engine does not have spark plugs as it is a Compression Ignition (CI) engine and not a Spark Ignition (SI) engine. Spark ignition is a key component in a Direct Injection Spark Ignition (DISI) engine. A diesel engine relies upon the heat of compression to ignite the air/fuel mixture making the teachings of Scherer move away from the teachings of the '565 patent.

70. Scherer does disclose homogeneous operation of a spark ignition engine, but fails to reveal the stratified charge operation of a DISI engine which is another key element of the '565 patent.

71. Another fundamental flaw of Scherer is that even though a high pass filter is disclosed, it is not employed in the unique manner of the teachings of the '565. Scherer uses the high pass filter with an adjustable decay time constant (t),

which is a function of engine speed and load to generate the filtered output of dynamic desired torque (M_d). EX 1007 at 4:31-45 and Figure 1.

72. In the '565 patent, a “current torque estimator 22 uses the air charge estimate signal, together with a signal representing the current spark angle and a signal representing the current air/fuel ratio to generate a signal representing an estimate of current torque.” EX 1001 at 3:29-39.

73. It is this signal, “[t]he estimate of the current torque, [which] is compared to the desired torque signal by a comparator 18 to generate an error signal, which is then filtered by the high pass filter 20.”

74. Scherer discloses a process and apparatus for adjusting the torque of an internal combustion engine which has as an object “... to provide a process and apparatus of the initially mentioned type which adjusts the engine torque to a desired value with the least possible expenditures in both steady-state and transient engine operation with a comparatively short reaction time.” (Ex. 1007 at 2:39-43). Scherer produces a demanded desired engine torque signal that “is split into a dynamic component and a remaining quasi-static component. The dynamic component is used to determine corresponding adjustment of the ignition point in the case of an Otto engine or of the injection start in the case of a diesel engine. ... while the quasi-static desired torque component is regulated by means of a corresponding adjustment of the air flow rate (for an Otto engine) or of the injection

duration (a diesel engine).” (Ex. 1007 at 2:47-59). “In a preferred embodiment of the invention, the dynamic desired torque component is determined by high-pass filtering the demanded desired engine torque with a decay time constant which is selected as a function of the engine operating point.” (Ex. 1007 at 3:6-10).

There are two such preferred embodiments of Scherer depicted in FIGs. 1 and 2 of Scherer. “In another preferred embodiment, a model-based estimation is made of the quasi-static desired torque component achieved by air flow rate or injection duration regulation. To obtain the dynamic desired torque component, the estimated value is subtracted from the demanded desired engine torque.” (Ex. 1007 at 3:11-16). There are two such preferred embodiments depicted in FIGs. 3 and 4 of Scherer.

In the preferred embodiments depicted in FIGs. 1 and 2 of Scherer, only the desired torque signal is high-pass filtered and no comparator is used to compare an “estimated torque signal” to the “desired torque signal.” In the preferred embodiments depicted in FIGs. 3 and 4 of Scherer, a comparator 15 is used to produce a “difference signal” (M_d) by subtracting an “estimated torque signal” (M_{IS}) from the “desired torque signal” (M_{des}). In these FIG. 3 and 4 embodiments, **Scherer explicitly eliminates the high-pass filter** used in the FIGs. 1 and 2 embodiments, and, in place thereof, uses the “estimated value stage.” In this regard, Scherer states that:

“FIG. 3 again shows a device which is suitable for torque adjustment of an Otto engine. This embodiment corresponds to that of FIG. 1 except that, **instead of the high pass filter stage, a model-based estimated value stage is provided** to determine the dynamic desired engine torque component (M_{des}) that cannot be regulated by the air flow rate regulation, by estimating the quasi-static engine torque part (M_{IS}) which can be adjusted by the air flow rate regulation.” (Ex. 1007 at 6:3-12) (emphasis added).

Scherer further states that:

“[t]he embodiment of FIG. 4, which is adapted for a diesel engine, is identical with that of FIG. 2 except that, **instead of a high pass filter stage, (analogously to the modification of FIG. 3 in comparison to that of FIG. 1), an estimated value stage is provided**. This estimated value stage corresponds essentially to that of FIG. 3. The estimated value (M_{IS}) is then subtracted in the subtractor device 15 from the demanded desired engine torque (M_{des}), and the resulting difference signal is treated as the dynamic desired engine torque part (M_d) which is to be regulated by the injection start adjusting branch and is supplied to the dead zone unit 6.” (Ex. 1007 at 6:44-64) (emphasis added).

Thus, it is clear that in embodiments in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “torque demand signal,” the high-pass filter used in the other embodiments that do not employ such a comparator is eliminated, and the “difference signal” output by the comparator is not high-pass filtered. Thus, Scherer discourages a POSA from and, in fact, directly teaches away from using a high-pass filter in embodiments in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “desired torque signal.”

75. It is therefore obvious that the Board and the Petitioner, including its expert, failed to consider Scherer in its entirety, ignoring portions of the reference

(specifically, the embodiment depicted in Figs. 3 and 4 of Scherer) that clearly teach away from the '565 patent.

76. Takahashi does not disclose the usage of a ***discrete input*** of a desired spark angle signal directly into its “target air mass flow rate deciding block.” This means it uses a different methodology for throttle control than the '565 patent.

77. As noted earlier, the prior art does disclose high-pass filtering of either an “estimated torque signal” or a “desired torque signal.” However, no prior art reference relied upon by the Petitioner or the Board discloses producing a “difference signal” by comparing an “estimated torque signal” and a “desired torque signal” and then high-pass filtering such “difference signal.”

78. To even remotely consider that a POSA, using this plethora of disparate teachings seriously minimizes the likelihood of combining the references to arrive at anything close to the '565 patent. It is extremely unfair that the Petitioner, armed with the roadmap of the '565 patent, a team of internet searchers and an unlimited budget, is allowed to piece together tiny bits and pieces of teachings in an attempt to undermine the creativity of an American inventor by invalidating a patent.

VIII. AVAILABILITY FOR CROSS-EXAMINATION

79. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject

to cross examination in the case and that cross examination will take place within the United States. If cross examination is required of me, I will appear for cross examination within the United States during the time allotted for cross examination.

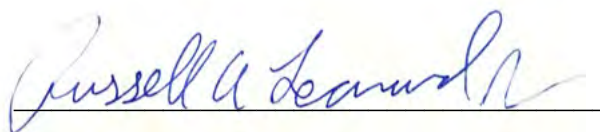
IX. RIGHT TO SUPPLEMENT

80. I reserve the right to supplement my opinions in the future to respond to any arguments that the Petitioner raises and to consider new information as it becomes available to me.

X. JURAT

81. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: October 29, 2020



Dr. Russell Leonard

Appendix A

Russell A. Leonard, Jr., PhD

Work: 231-591-2357

E-mail: leonardr@ferris.edu

EDUCATION

Doctor of Philosophy, Higher Educational Leadership, June 2016
Western Michigan University, Kalamazoo, Michigan

Master of Education, December 1997, magna cum laude
Wayne State University, Detroit, Michigan
Curriculum: Instructional Systems Design & Adult Education

Bachelor of Science in Secondary Education, June 1991
Central Michigan University, Mount Pleasant, Michigan
Major: K-12 Industrial Engineering & Technology Education, Automotive Focus

WORK EXPERIENCE: FERRIS STATE UNIVERSITY

- August 2018 - **Professor, Ferris State University.** College of Engineering Technology, School of Automotive and Heavy Equipment
Present Currently instructing in both the Automotive Service and Automotive Engineering Technology programs
- August 2017 - **Chair, University Curriculum Committee.**
Present This position oversees curriculum changes at the university level, creates, enforces and instructs on university policy, reports to the Academic Senate and works closely with the Academic Affairs office and faculty
- August 2015 - **Faculty Advisor, SAE Baja Racing Club.**
Present SAE Baja is a student led team that designs, builds, tests and races an off-road buggy. The team competes against other universities from around the world
- August 2008 - **Associate Professor, Ferris State University.** College of Engineering Technology,
August 2018 School of Automotive and Heavy Equipment
Instructed in both the Automotive Service and Automotive Engineering Technology programs
- August 2008 - **Motorcycle Safety Foundation (MSF) Ridercoach.** Corporate and Professional
August 2015 Development Center
Instructed the Basic Rider Course for the Motorcycle Safety Foundation Program
- August 2010 - **Coordinator, Automotive Engineering Technology Program, Ferris State University.**
August 2012 College of Engineering Technology, School of Automotive and Heavy Equipment
Part-time administrator with teaching duties for the Automotive Engineering Technology program

August 2002 - **Assistant Professor, Ferris State University.** College of Technology, Automotive
August 2008 Department
Instructed in both the Automotive Service and Automotive Engineering Technology
programs

WORK EXPERIENCE: GENERAL MOTORS

June 1998 - **Release Engineer,** Service Operations
August 2002 Developed and validated diagnostic tool software for various vehicle Electronic Control
Modules

August 1997- **Service Engineer,** Cadillac Motor Car Division
June 1998 Assisted technicians in diagnosis and repair of Cadillac vehicles, maintained an
information database, identified and tracked trends, performed root-cause analysis, and
recommended solutions

OTHER WORK EXPERIENCE

August 2008 - **Harley-Davidson Riding Academy Motorcycle Safety instructor,** Grand Rapids
Present Harley-Davidson
Instruct motorcycle rider safety course for Grand Rapids Harley-Davidson’s Riding
Academy program

June 1995 - **Systems Engineer, Hughes Training Inc. (Hughes Aircraft Co.)**
August 1997 Designed and developed engineering courses for various General Motors' advanced
engineering projects

July 1986 - **Sergeant E-5, United States Army Reserve (retired)**
July 2005 Certified military instructor in three areas of expertise: Light-Wheeled Vehicle Mechanics,
Crane Operation, and Battlefield Communication

October 1992 - **Engineering Instructor, Ford Motor Co. (via Bartech)**
June 1995 Delivered stand-up instruction in a company-sponsored engineering university; created
lesson plans and wrote textbooks; developed subject-matter expertise in powertrain
controls, from microprocessor strategy to OBD-II systems

June - **Prototype Technician, Roush Industries**
October 1992 Prepared prototype vehicles for engineering testing

July 1991 - **Technician, Lakeside Toyota-Lexus**
June 1992 Performed light through heavy repairs, warranty diagnosis, and vehicle maintenance
programs

January - **Student Teacher, Midland Dow High School**
May 1991 Instructed Automotive Technology and Advanced Drafting

January - May 1990	Teaching Assistant, Central Michigan University Assisted Professor in automotive maintenance course by delivering course material and developing lab activities
1988-1991	Automotive Technician, Souder's Amoco Performed light repairs specializing in no-starts

SPECIAL SKILLS

Canvas and Blackboard Learning Management System (LMS)
Instructional Systems Design
Microsoft Word, Excel, Project, and PowerPoint
Benchmark stand-up instruction
Subject-matter expertise:
 Vehicle ECM communication
 Keyword protocol 82 and 2000, Class 2, CAN, GM LAN, J1979 (CARB) and J2190
 Powertrain controls
 Automotive transmissions (electrical and mechanical)
 Engine design and performance
 Spark ignition
 Compression Ignition
 Emission controls
 Braking systems
 HVAC
 Suspension and steering systems
 Military vehicle design and performance
 Military communication networks and systems
 Satellite communication hardware and software

PROFESSIONAL ASSOCIATIONS / CERTIFICATIONS / HONORS

ASE Master Recertified Automobile Technician
ASE Recertified, Advanced Engine Performance (L-1)
ASE Certified Truck Technician
Ferris Foundation Grant recipient, 2009, 2010 & 2011
Registered Student Organization Advisor of the Year, 2019 (SAE Baja)
Society of Automotive Engineers (SAE) member
Automotive Transmission Rebuilders Association (ATRA) member
ASTM International Voting Member, D02 & D15
Faculty Advisor, SAE Baja Racing Club
Former Faculty Advisor, Sigma Chi Fraternity
Former Faculty Advisor, Lambda Chi Alpha Fraternity
Former Faculty Advisor, High Performance Motorsports Student Organization (HPMSO)
Former Ferris State University Academic Senate Diversity Committee member

GM President's Council Honors
Ford Powertrain Customer Service Award
Security Clearance: SECRET (expired)

PUBLICATIONS

Leonard, Russell A. Jr., "Females in Automotive Careers: Career Decision-Making Influences and Experiences During University Preparation and Beyond" (2016). *Dissertations*. Paper 1608.
<http://scholarworks.wmich.edu/dissertations/1608>

I have reviewed the Manual Drivetrains and Axles book by Halderman/Birch multiple times including the latest edition (7th) dated 2015, Prentice Hall, 978-0-13-351504-6.

PRESENTATIONS

"How to Make Biodiesel" for the Energy Summer Youth Camp on July 12-16, 2010. The students made biodiesel fuel out of waste vegetable oil from the University's dining facility, and then used it to fuel the test diesel engine.

Biodiesel Processing, Michigan Energy conference, April 7-8, 2009.

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EDUCATION

Doctor of Philosophy, Higher Educational Leadership, June 2016
Western Michigan University, Kalamazoo, Michigan

Master of Education, December 1997, magna cum laude
Wayne State University, Detroit, Michigan
Curriculum: Instructional Systems Design & Adult Education

Bachelor of Science in Secondary Education, June 1991
Central Michigan University, Mount Pleasant, Michigan
Major: K-12 Industrial Engineering & Technology Education, automotive focus

WORK EXPERIENCE: FERRIS STATE UNIVERSITY

August 2018 - Present	Professor, Ferris State University. College of Engineering Technology, Present School of Automotive and Heavy Equipment Currently instructing in both the Automotive Service and Automotive Engineering Technology programs
August 2017 - Present	Chair, University Curriculum Committee. This position oversees curriculum changes at the university level, creates, enforces and instructs on university policy, reports to the Academic Senate and works closely with the Academic Affairs office and faculty
August 2015 – Present	Faculty Advisor, SAE Baja Racing Club SAE Baja is a student led team that designs, builds, tests and races an off-road buggy. The team competes against other universities
August 2010 - August 2012	Coordinator, Automotive Engineering Technology, Ferris State University. College of Engineering Technology, School of Automotive and Heavy Equipment Part-time administrator with teaching duties for the Automotive Engineering Technology program
August 2008 - August 2018	Associate Professor, Ferris State University. College of Engineering Technology, School of Automotive and Heavy Equipment Instructed in both the Automotive Service and Automotive Engineering Technology

programs

August 2008 -
2017 **Ridercoach, Motorcycle Safety Foundation (MSF)**
Ferris State University Corporate and Professional Development Center
Instructed the Basic Rider Course for the Motorcycle Safety Foundation Program

August 2002 -
August 2008 **Assistant Professor, Ferris State University.** College of Technology, Automotive
Department
Instructed in both the Automotive Service and Automotive Engineering Technology
programs

WORK EXPERIENCE: GENERAL MOTORS

June 1998 -
August 2002 **Release Engineer,** Service Operations
Develop and validate diagnostic tool software for various vehicle Electronic Control
Modules

August 1997-
June 1998 **Service Engineer,** Cadillac Motor Car Division
Assisted technicians in diagnosis and repair of Cadillac vehicles, maintained an
information database, identified and tracked trends, performed root-cause analysis, and
recommended solutions

OTHER WORK EXPERIENCE

August 2008-
Present **Harley-Davidson Riding Academy Instructor,** Grand Rapids Harley-Davidson
Instruct basic motorcycle rider safety course for the Harley-Davidson Riding Academy
program

June 1995-
August 1997 **Systems Engineer, Hughes Training Inc. (Hughes Aircraft Co.)**
Designed and developed engineering courses for various General Motors' projects

July 1986 -
July 2005 **Sergeant E-5, United States Army Reserve (retired)**
Certified military instructor in three areas of expertise: Light-Wheeled Vehicle
Mechanics, Crane Operation, and Battlefield Communication with a Secret Security
Clearance

October 1992
-June 1995 **Engineering Instructor, Ford Motor Co. (via Bartech)**
Delivered stand-up instruction in a company-sponsored engineering university; created
lesson plans and co-wrote textbooks; developed subject-matter expertise in powertrain
controls, from microprocessor strategy to OBD-II systems

June –
October 1992 **Prototype Technician, Roush Industries**
Prepared prototype vehicles for engineering testing

July 1991 – **Technician, Lakeside Toyota-Lexus**

June 1992	Performed light through heavy repairs, warranty diagnosis, and vehicle maintenance programs
January – May 1991	Student Teacher, Midland Dow High School Instructed Automotive Technology and Advanced Drafting
January – May 1990	Teaching Assistant, Central Michigan University Assisted Professor in automotive maintenance course by delivering course material and developing lab activities
1988-1991	Automotive Technician, Souder's Amoco Performed light repairs specializing in no-starts

COURSES TAUGHT AT FERRIS STATE UNIVERSITY

AUTO 111 Manual Transmissions and Drivelines
AUTO 112 Automotive Brake Systems
AUTO 113 Automotive Electricity and Electronics
AUTO 116 Engine Electrical Systems
AUTO 117 Electronic Fuel Management Systems
AUTO 200 Service Area
AUTO 211 Automatic Transmission
AUTO 214 Automotive HVAC
AUTO 291 Auto Service Internship
AUTO 450 Automotive Fuels and Lubes
AUTO 460 Emissions Systems
AUTO 493 Automotive Engineering Technology Internship
AMGT 300 Automotive Materials
AMGT 493 Automotive Management Internship
FSUS 100 Freshman Seminar
HEQT 230 Diesel Fuel Systems Technology
HEQT 193 Industry Internship
HSET 393 Industry Internship.

SPECIAL SKILLS

Canvas and Blackboard Learning Management Systems (LMS)
Instructional Systems Design
Subject-matter expertise:
Automotive Fuels and Lubricants
Automotive Coolants and other Liquids
Vehicle ECM and Scan Tool Communication
Powertrain Controls, both Hardware and Software
Automotive Transmissions, Electrical, Mechanical, and Software Calibration
Engine Design, Performance and Calibration
Spark Ignition
Compression Ignition

Gasoline and Diesel Emission Controls
Braking Systems
HVAC
Suspension and Steering Systems
Military Vehicle Design and Performance
Military Communication Networks and Systems
Satellite Communication Hardware and Software
Lift and Load (Crane Operation) Specialist

PROFESSIONAL ASSOCIATIONS / CERTIFICATIONS / HONORS

ASE Master Recertified Automobile Technician
ASE Recertified, Advanced Engine Performance (L-1)
ASE Certified Truck Technician
Ferris Foundation Grant recipient, 2009, 2010 & 2011
Society of Automotive Engineers (SAE) member
Automotive Transmission Rebuilders Association (ATRA) member
Faculty Advisor, SAE Baja Racing Club
Former Faculty Advisor, Sigma Chi Fraternity
Former Faculty Advisor, Lambda Chi Alpha Fraternity
Former Faculty Advisor, High Performance Motorsports Student Organization (HPMSO)
Former Ferris State University Academic Senate Diversity Committee member
GM President's Council Honors
Ford Powertrain Customer Service Award
Ferris State University Registered Student Organization Advisor of the Year 2018-2019 for Baja SAE

PUBLICATIONS

Leonard, Russell A. Jr., "Females in Automotive Careers: Career Decision-Making Influences and Experiences During University Preparation and Beyond" (2016). *Dissertations*. Paper 1608.
<http://scholarworks.wmich.edu/dissertations/1608>

I have reviewed the Manual Drivetrains and Axles book by Halderman/Birch multiple times including the latest edition (7th) dated 2015, Prentice Hall, 978-0-13-351504-6.

PRESENTATIONS

"How to Make Biodiesel" for the Energy Summer Youth Camp on July 12-16, 2010. The students made biodiesel fuel out of waste vegetable oil from the University's dining facility, and then used it to fuel the test diesel engine.

Biodiesel Processing, Michigan Energy conference, April 7-8, 2009.

PROFESSIONAL ORGANIZATIONS

ASTM International (2014-present)

I am a voting member of ASTM International’s Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and Committee D15 on Engine Coolants and Related Fluids. ASTM International is an international, not-for-profit organization, based in the USA, for the development, collection, standardization and dissemination of technical knowledge in a wide range of disciplines and is a voluntary, consensus standards organization.

In this capacity, I review; changes to current specifications, new specifications, and the deletion of obsolete specifications. The changes typically come out at multiple times each month. It requires, on average, 5 to 10 hours per month to review all the new changes and determine if there is benefit to the automotive industry. Each main committee in ASTM International is composed of subcommittees that address specific segments within the general subject area covered by the technical committee. Along with the general subject area of D02 and D15, I am a member of the following subcommittees:

- D02.01 Combustion Characteristics
- D02.06 Analysis of Liquid Fuels and Lubricants
- D02.08 Volatility
- D02.09 Oxidation of Lubricants
- D02.14 Stability and Cleanliness of Liquid Fuels
- D02.A0 Gasoline and Oxygenated Fuels
- D02.B0 Automotive Lubricants
- D02.E0 Burner, Diesel, Non-Aviation Gas Turbine, and Marine Fuels
- D02.G0 Lubricating Grease
- D02.L0 Industrial Lubricants and Engineering Sciences of High Performance Fluids and Solids
- D02.N0 Hydraulic Fluids
- D02.P0 Recycled Products
- D15.03 Physical Properties
- D15.04 Chemical Properties
- D15.07 Specifications
- D15.11 Heavy Duty Coolants
- D15.15 Recycled Engine Coolant
- D15.21 Long Life Engine Coolant
- D15.21.01 TG on Glycerin/Glycol Blend Base Fluids
- D15.22 Non-Aqueous Coolants
- D15.25 Diesel Exhaust Fluid
- D15.97 World Coolant Standards

ASTM Task Groups

WK51908 – Standard Test Method for Freezing Point of Aqueous Engine Coolants

WK58499 - Standard Specification for Fully-Formulated Glycol Base Engine Coolant for Heavy-Duty Engines
WK43678 – Standard Specification for Aqueous Engine Coolant Grade Glycol (53% Nominal)
WK59630 – Standard Specification for Engine Coolant Grade 1,3-Propanediol (PDO)
WK68375 - ASTM Reference Fluid for Carboxylate-Inhibited Coolant Tests

SAE Member since 2011

Fall 2015 – **Faculty Advisor, Ferris State University SAE Baja student race team**
present Consult with the team during regular meetings regarding vehicle design, oversee the purchase of parts and materials for the team and expense them through the university accounting process. Assist in the planning of the team’s travel including three competitions per year with many competitions located out-of-state.

National Science Foundation (NSF) Grant			Contact	Credit	Semester
Hours	Rate	Hours			

06/2010	Selected Topics in Energy Education: Biofuels			Sem. Hrs.	1.0
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Professional Development Grants

02/2009	Performance Development of IC Engines	18	CEU	1.8
09/2009	Fuels & the Future for IC Engines	18	CEU	1.8
05/2014	ASTM Gasoline Specs, Testing,& Technology	21	CEU	2.1
09/2014	ASTM Diesel Specs, Testing & Technology	21	CEU	2.1
09/2016	ASTM Petroleum Lab Technician Series: Biodiesel	18	CEU	1.8
06/2019	Center for Advanced Automotive Technology (CAAT)	16	CEU	1.6
Electric Drive Vehicles Technology				

Non-credit coursework:

10/2008	Toyota TIS2	8		0.5
02/2009	Toyota Engine Management Systems Diagnosis	4		0.25
02/2009	Tech Expo: OBD II, Duramax Diesel, 5 gas	8		0.5
02/2010	Tech Expo: Alignment, Mitchel mgt., ABS	8		0.5
02/2011	Tech Expo: VW Drive By Wire & 6.7L Ford Diesel 8			0.5

03/2012	Powerstroke Diesel Fundamentals Seminar	4	0.25
08/2013	Automotive Networks and Fuel Trim issues	4	0.25
03/2019	National Alternative Fuels Training Consortium Electric Drive Vehicle Technician Training	32	2

PTS On-Demand: Professional Technician’s Seminars

12/22/2015	Diagnosing Catalytic Converter Efficiency Codes	1	PDH
12/22/2015	HVAC Update 2015	1	PDH
12/19/2015	Variable Valve Timing Tips &Tricks	1	PDH
12/23/2015	Guerilla Diagnostics	1	PDH
12/23/2015	ABS and Vehicle Stability Control	1	PDH
01/01/2016	No-scope Diagnosis	1	PDH
01/01/2016	Hybrid HV Battery Diagnosis	1	PDH
01/01/2016	Ford 6.0 Powerstroke Misfire Tips	1	PDH
01/01/2016	Sensor Diagnosis	1	PDH
01/01/2016	Hyundai/Kia Tips &Tricks	1	PDH
01/01/2016	Voltage Drop Testing	1	PDH
01/01/2016	Chrysler EVAP Tips &Tricks	1	PDH
01/01/2016	OE Scan Tool Update	1	PDH
01/01/2016	Brain Teasers: Diagnostic Puzzles	1	PDH
01/01/2016	More Duramax Diesel Tips &Tricks	1	PDH
01/01/2016	Diesel No-Start Diagnosis	1	PDH
01/01/2016	GM Idle Stop and Light Hybrid	1	PDH

01/01/2016	Electronic Transmission Controls Part II	1	PDH
01/01/2016	Chrysler/Jeep Tips &Tricks	1	PDH
01/01/2016	Understanding Wiring Schematics Part II	1	PDH

ASTM Petroleum Lab Technician Series: Biodiesel

05/30/2017	ASTM Standard D2622-16 Standard Test Method for Sulfur in Petroleum Products	1	CEU	0.1
05/30/2017	ASTM Standard D1298-12b Standard Test Method for Density, Relative Density or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method	1	CEU	0.1
06/19/2017	ASTM Standard D1319-15 Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption	1	CEU	0.1
06/20/2017	ASTM Standard D4530-15 Standard Test Method for Determination of Carbon Residue (Micro Method)	1	CEU	0.1
06/20/2017	ASTM Standard D445-15a Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)	1	CEU	0.1
06/20/2017	ASTM Standard D4294-16e1 Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry	1	CEU	0.1
06/21/2017	ASTM Standard D5453-16 Standard Test Method for Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence	1	CEU	0.1
06/21/2017	ASTM Standard D524-15 Standard Test Method for Ramsbottom Carbon Residue of Petroleum Products	1	CEU	0.1
06/21/2017	ASTM Standard D482-13 Standard Test Method for Ash from Petroleum Products	1	CEU	0.1
06/22/2017	ASTM Standard D97-17 Standard Test Method for Pour Point of Petroleum Products	1	CEU	0.1

06/21/2017 ASTM Standard D93-15a Standard Test Method for Flash Point by Pensky-Martens Closed Cup Tester	1	CEU	0.1
06/22/2017 ASTM Standard D86-16a Standard Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure	1	CEU	0.1
06/22/2017 ASTM Standard D664-11a Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration	1	CEU	0.1
06/25/2017 ASTM Standard D974-14e2 Standard Test Method for Acid and Base Number by Color-Indicator Titration	1	CEU	0.1
06/25/2017 ASTM Standard D1319-14 Standard Test Method for Hydrocarbon Types inLiquid Petroleum Products by Fluorescent Indicator Adsorption	1	CEU	0.1
06/25/2017 ASTM Standard D2622-10 Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry	1	CEU	0.1
06/25/2017 ASTM Standard D4294-10 Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry	1	CEU	0.1
06/25/2017 ASTM Standard D5453-12 Standard Test Method for Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence	1	CEU	0.1

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Volkswagen Group of America, Inc.,
Petitioner

v.

Michigan Motor Technologies LLC,
Patent Owner

Case IPR2020-00445
Patent No. 6,581,565

SECOND DECLARATION OF DR. RUSSELL LEONARD

MMT 2004

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1. I, Dr. Russell Leonard, declare as follows:

I. INTRODUCTION

2. I have been retained as an expert in this proceeding by counsel for Michigan Motor Technologies (MMT). I have been asked for my expert conclusions.

II. BACKGROUND

3. I obtained my Bachelor's degree in Industrial Arts Education with an automotive emphasis from Central Michigan University in 1991. Next, I earned a Master of Education from Wayne State University in 1997, and a Ph.D. in Higher Educational Leadership from Western Michigan University in 2016.

4. I am currently a Professor at Ferris State University in the Automotive Department of the School of Automotive and Heavy Equipment where I teach in both the Automotive Engineering Technology and Automotive Service programs.

5. I began my automotive career working as a mechanic on civilian automobiles and military vehicles. After transitioning to building prototype vehicles at Roush, I started a new position as a contractor to Ford Motor Company teaching engineers on the topic of Ford powertrain electronic controls. I learned an incredible amount of detail that augmented my technician viewpoint with an understanding

from a design and manufacturing perspective. While earning my master's degree, a classmate suggested that I should apply to Hughes Aircraft.

6. At Hughes, I worked as a Systems Engineer designing and developing training for General Motors. The last assignment I performed at Hughes Aircraft was integrating advanced military technologies with civilian applications. It was during this project with Hughes that I was encouraged to apply for a position at General Motors as a Service Engineer for Cadillac.

7. While at Cadillac, I assisted field technicians with repairs over the phone, tracked trends and created engineering bulletins and campaigns as required. The next position in my General Motors career was a release engineer of diagnostic scan tool software after an internal transfer. In this position, I wrote code for the Tech 2 scan tool to request and receive data from various computer control modules for numerous GM vehicles to not only comply with OBD II, but to be a useful tool to the repair technician.

8. After the September 11th terrorist attack, I decided to share my experiences and enjoyment of automobiles with future generations, so I became an automotive professor at Ferris State University. I earned my Ph.D. during this time while teaching many automotive subjects in the automotive service program for technicians and in the automotive engineering technology program for engineering technologists.

9. I am a continuing member of multiple professional organizations, including SAE International, where I am the faculty advisor at Ferris State University for the student chapter of the collegiate design series, Baja SAE. At ASTM International, I am a voting member of Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants, and Committee D15 on Engine Coolants and Related Fluids. Additionally, I am a task group member of four work items within D15.

10. My career thus far includes 17 years teaching automotive engineering technology and servicing at a university, 7 years as an engineer for major automotive and technology corporations, 3 years as a trainer of powertrain electronic controls for an automobile manufacturer, 19 years of service in the United States military, 7 years of which I was a mechanic, and 4 years as a civilian automobile mechanic.

11. A copy of my curriculum vitae is attached as Appendix A, which contains further details regarding my experience, education, and other qualifications to render an expert opinion in connection with this proceeding.

12. I am being compensated at my normal consulting rate of \$240/hour for my work, but my opinions are based on my own views of the patented technology and the prior art. My compensation is not dependent on the outcome of this

proceeding and in no way influences the substance of my statements in this declaration.

13. I have no financial interests in the patent owner. Similarly, I have no financial interest in the '565 patent.

III. LEVEL OF ORDINARY SKILL IN THE ART

14. The level of ordinary skill in the art applicable to the '565 patent around the time of the invention in 2002 is a person with (1) a B.S. in mechanical engineering or equivalent with three or more years of experience in either engine systems or engine control systems or (2) at least a M.S. in mechanical engineering.

IV. UNDERSTANDING OF THE LAW

15. I am not an attorney. For the purposes of this declaration, the patent owner's counsel has informed me about certain aspects of the law that are relevant to my opinions. I have applied those legal principles in arriving at my conclusions expressed in this Declaration.

a. Claim construction

16. I understand that "a claim of a patent . . . shall be construed using the same claim construction standard that would be used to construe the claim including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent."

17. I understand that claim terms that are not construed by the Board should be given their ordinary and customary meaning as would have been understood by a person of ordinary skill in the art at the time of the claimed invention.

18. I also understand that a “means-plus-function” claim term is a term that recites a certain function but does not recite sufficient structure for performing that function. I understand that means-plus-function terms are limited to the function recited in the claim term and the specific structure that is disclosed in the patent’s specification for performing that function and structures that are equivalent to the disclosed structures. Thus, I have been informed and understand that construing a means-plus-function claim term is a two-step process. First, the claimed function of the term must be identified. Second, the structure or structures described in the specification for performing that function must be identified.

b. Obviousness

19. I also understand that a showing of obviousness must include demonstrating that the cited references disclose each element of a challenged claim.

20. Additionally, the focus when determining obviousness should be on what a person of ordinary skill in the pertinent art would have known at the time of the invention, and on what such a person would have reasonably expected to have been able to do in view of that knowledge.

V. OVERVIEW OF THE ‘565 PATENT

21. The basic inventive concept disclosed and claimed in the subject ‘565 patent is to, in the controlling of engine torque of a spark ignition direct injection internal combustion engine, teach a method in which torque is controlled dependent upon a filtered difference signal of desired torque and current torque estimate signals.

22. A high pass filter is used to filter the difference signal of desired torque and current torque estimate signals and it is this high pass filtering of the difference of two signals that makes the ‘565 patent unique. It is the filtered difference signal that controls engine torque.

23. The ‘565 patent discloses what was well known in the prior art that “[i]n engine torque controllers for DISI engines, when the engine is operated in stratified mode, spark angle has little influence on the torque produced. The torque producer modifies the air/fuel in order to control the torque produced. Conversely, when the engine is operating in homogenous mode... [t]he torque producer modifies the timing of the spark ignition in order to control the torque produced.” (EX 1001, ‘565 at 1:36-45.)

24. The main difference between the prior art and the ‘565 patent is the method of correction for a steady state error by using a high pass filtered output of

the difference of the torque demanded signal and the estimate of the torque produced signal.

25. A better description of the uniqueness of the ‘565 patent’s method is to say that the torque demand signal represents a feedforward signal and that the torque produced signal represents a feedback signal. These two signals are run through a comparator 18 that generates an error signal. The error signal is generated by subtracting the current torque estimate from the torque demand signal. EX 1001 at 3:34-39 and Figure 3. This error signal indicates instances where torque demand is less than torque produced and instances where torque demand is greater than torque produced. The high pass filter receives the error signal and blocks (filters out) smaller differences from the comparator 18 and only allows larger differences to pass through to the transient torque controller. Indeed, the ‘565 invention does not expend energy with smaller, less significant errors by only acting upon larger errors. This design minimizes hunting, where the system is continuously chasing changes back and forth.

VI. OVERVIEW OF THE PRIOR ART

a. Robichaux

26. Robichaux is the primary reference relied upon by Petitioner against all challenged claims. Robichaux’s is primarily directed to a system and method for controlling engine torque using feedback and feed forward control.

27. The engine controller in Robichaux modifies desired engine brake torque based current engine operating conditions to determine a requested engine brake torque which it then uses to modify engine control parameters such as air flow, spark, exhaust gas recirculation (EGR) and fuel. (EX. 1020 pg.4 at 25-29 and figure 3.)

28. Robichaux teaches three levels of arbitration to determine requested engine brake torque utilizing feedback and feedforward methods. Robichaux at discloses a conventional (admitted prior art) system that produces a “difference signal” TQ_ERROR, which is not high-pass filtered. EX1020 at 0030.

29. The Robichaux invention does not utilize nor suggest a method of correction for a steady state error by using a high pass filtered output of the difference of the desired torque signal and the estimate of the torque produced signal as the ‘565 patent teaches.

30. In other words, there is no disclosure in Robichaux of “a high pass filter which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent” (claim 1) or “filtering out a plurality of low frequency components from the difference signal” (claim 7) as disclosed in the ‘565 patent.

31. Robichaux’s alleged indication of a “need for transient torque control in lieu of PID controller 220 during transient conditions” stems from the following

single statement in Robichaux: “Robichaux’s proportional-integral-derivative (PID) controller 220 processes the torque error signal during steady-state conditions. Robichaux’s PID controller ‘is not active during certain transient torque limiting control modes.’” (DI, 33).

32. I disagree that a statement that the PID controller “is not active during certain transient torque limiting control modes” constitutes a statement of “a need for transient torque control in lieu of PID controller 220 during transient conditions.” First, Robichaux’s PID controller is only not active during “certain” transient torque limiting control modes, which implies that it is active during other than those “certain transient torque limiting control modes.”

33. Second, a “transient torque limiting control mode” is a mode in which transient torque is purposely limited as part and parcel of the basic design intent of Robichaux. Rather than indicating “a need for transient torque control in lieu of PID controller 220 during transient conditions,” Robichaux discourages a POSA from and teaches away from doing so because Robichaux purposely causes the PID controller 220 to be not active during “*certain transient torque limiting control modes.*”

34. It is a clear error by the Petitioner and the Board to extrapolate from the above isolated teaching of Robichaux that rather than purposely not activate the PID controller during “certain transient torque limiting control modes” that

Robichaux indicates “a need for transient torque control in lieu of PID controller 220 during transient conditions.”

b. Scherer

35. Scherer is the secondary reference relied upon by Petitioner against all challenged claims.

36. Scherer discloses a process and apparatus for adjusting the torque of an internal combustion engine which has as an object “... to provide a process and apparatus of the initially mentioned type which adjusts the engine torque to a desired value with the least possible expenditures in both steady-state and transient engine operation with a comparatively short reaction time.” (Ex. 1007, 2:39-43).

37. Scherer produces a demanded desired engine torque signal that “is split into a dynamic component and a remaining quasi-static component. The dynamic component is used to determine corresponding adjustment of the ignition point in the case of an Otto engine or of the injection start in the case of a diesel engine. ... while the quasi-static desired torque component is regulated by means of a corresponding adjustment of the air flow rate (for an Otto engine) or of the injection duration (a diesel engine).” (Ex. 1007, 2:47-59).

38. Scherer discloses that “In a preferred embodiment of the invention, the dynamic desired torque component is determined by high-pass filtering the demanded desired engine torque with a decay time constant which is selected as a

function of the engine operating point.” (Ex. 1007, 3:6-10). There are two such preferred embodiments of Scherer depicted in FIGs. 1 and 2 of Scherer.

39. “In another preferred embodiment, a model-based estimation is made of the quasi-static desired torque component achieved by air flow rate or injection duration regulation. To obtain the dynamic desired torque component, the estimated value is subtracted from the demanded desired engine torque.” (Ex. 1007, 3:11-16). There are two such preferred embodiments depicted in FIGs. 3 and 4 of Scherer.

40. In the preferred embodiments depicted in FIGs. 1 and 2 of Scherer, only the dynamic component of the desired engine torque is high-pass filtered and no comparator is used to compare an “estimated torque signal” to the “desired torque signal.” In the preferred embodiment depicted in FIGs. 3 and 4 of Scherer, a comparator 15 is used to produce a “difference signal” (M_d) by subtracting an “estimated torque signal” (M_{IS}) from the “desired torque signal” (M_{des}).

41. In these FIG. 3 and 4 embodiments, Scherer explicitly eliminates the high-pass filter used in the FIGs. 1 and 2 embodiments, and, in place thereof, uses the “estimated value stage.” In this regard, Scherer states that “FIG. 3 again shows a device which is suitable for torque adjustment of an Otto engine. This embodiment corresponds to that of FIG. 1 except that, **instead of the high pass filter stage**, a model-based estimated value stage is provided to determine the dynamic desired

engine torque component (M_{des}) that cannot be regulated by the air flow rate regulation, by estimating the quasi-static engine torque part (M_{IS}) which can be adjusted by the air flow rate regulation.” (Ex. 1007, 6:3-12) (emphasis added).

42. Scherer further states that “[t]he embodiment of FIG. 4, which is adapted for a diesel engine, is identical with that of FIG. 2 except that, **instead of a high pass filter stage**, (analogously to the modification of FIG. 3 in comparison to that of FIG. 1), an estimated value stage is provided. This estimated value stage corresponds essentially to that of FIG. 3. The estimated value (M_{IS}) is then subtracted in the subtractor device 15 from the demanded desired engine torque (M_{des}), and the resulting difference signal is treated as the dynamic desired engine torque part (M_d) which is to be regulated by the injection start adjusting branch and is supplied to the dead zone unit 6.” (Ex. 1007, 6:44-64).

43. Thus, it is clear that in embodiments in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “torque demand signal,” the high-pass filter used in the other embodiments that do not employ such a comparator is eliminated, and the “difference signal” output by the comparator is not high-pass filtered. Thus, Scherer discourages a POSA from and, in fact, directly teaches away from using a high-pass filter in embodiments in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “torque demand signal.”

44. In the '565 patent, a "current torque estimator 22 uses the air charge estimate signal, together with a signal representing the current spark angle and a signal representing the current air/fuel ratio to generate a signal representing an estimate of current torque." EX 1001 at 3:29-39.

45. It is this signal, "[t]he estimate of the current torque, [which] is compared to the desired torque signal by a comparator 18 to generate an error signal, which is then filtered by the high pass filter 20."

46. Indeed, this is a markedly different approach than what Scherer teaches.

47. For these reasons, I do not believe a POSA would consider combining Scherer with Robichaux or any other teaching because they teach away from each other and the '565 patent.

c. Takahashi

48. Takhashi is a tertiary reference that controls the throttle valve and fuel injection in a manner that ensures the engine output torque and air/fuel ratio matches target values. It achieves this goal with a method that calculates target air mass flow rate as "the air mass flow rate at the inlet port which achieves target torque." The target torque is used to control the fuel injection and electronic throttle control.

49. Takahashi is only concerned with a homogeneous combustion method. Takahashi does not disclose spark timing control nor is it directed to DISI engines that operate in a stratified combustion mode. Figure 1 of Takahashi discloses a port

fuel injection engine, not a direct injection spark ignition engine (DISI) EX 1008

Figure 1.

d. Suzuki

50. Suzuki is the fourth reference asserted by the petitioner.

51. The Suzuki invention discloses a method of torque control of a direct injection spark ignition (DISI) engine. The torque control method covers the engine combustion operation of both stratified and homogeneous modes. Torque correction is realized by controlling at minimum, spark timing for torque correction in homogeneous combustion and air/fuel ratio during stratified combustion operation.

52. Like Suzuki, the '565 patent discloses what was well known in the prior art at the time of invention that "[i]n engine torque controllers for DISI engines, when the engine is operated in stratified mode, spark angle has little influence on the torque produced. The torque producer modifies the air/fuel in order to control the torque produced. Conversely, when the engine is operating in homogenous mode... [t]he torque producer modifies the timing of the spark ignition in order to control the torque produce." (EX 1001, '565 at 1:36-45.)

53. In addition, a POSA would know that in homogeneous mode, air/fuel ratio manipulation has a much less correcting effect when compared to spark timing. Again, Suzuki reiterates what was already known at the time of the '565 invention.

54. Suzuki lacks the disclosure of the usage of a high pass filter.

VII. NO MOTIVATION TO COMBINE THE PRIMARY REFERENCES

55. A POSA would not consider combining Scherer with Robichaux or any other teaching because they teach away from each other and the '565 patent as shown below.

56. One issue with Scherer is that there is no consideration of a stratified charge operation mode for a DISI engine as the '565 teaches. Scherer teaches diesel engine control, which the '565 does not teach. In this light, Scherer "teaches away" from the '565 patent with technology relating to diesel engines and not teaching to Direct Injection Spark Ignition (DISI) engine's unique operational characteristics.

57. A POSA would know that diesel engines operate differently than a spark ignition engine in that a diesel engine does not have spark plugs. A diesel engine relies upon the heat of compression to ignite the air/fuel mixture.

58. Scherer does disclose homogeneous operation of a spark ignition engine, but fails to consider the stratified charge operation of a DISI engine.

59. Another fundamental flaw of Scherer is that even though there is a high pass filter disclosed, it is not employed in the unique manner of the teachings of the '565. Scherer uses the high pass filter with an adjustable decay time constant (t), which is a function of engine speed and load to generate the filtered output of dynamic desired torque (M_d). EX 1007 at 4:31-45 and Figure 1.

60. In the '565 patent, a "current torque estimator 22 uses the air charge estimate signal, together with a signal representing the current spark angle and a signal representing the current air/fuel ratio to generate a signal representing an estimate of current torque." EX 1001 at 3:29-39.

61. It is this signal, "[t]he estimate of the current torque, [which] is compared to the desired torque signal by a comparator 18 to generate an error signal, which is then filtered by the high pass filter 20."

62. Additionally, Scherer discourages and directly teaches away from using a high-pass filter in embodiments in which a comparator is used to produce a "difference signal" by subtracting an "estimated torque signal" from a "desired torque signal," as depicted in Figs. 3 and 4 of Scherer. The Board and the Petitioner have "overlooked" or selectively ignored the Scherer's explicit teaching of eliminating the high-pass filter altogether in embodiments in which a comparator is used to produce a "difference signal" by subtracting an "estimated torque signal" from a "desired torque signal."

63. Both Robichaux and Scherer disclose an embodiment using a comparator to compare an estimated torque signal and a desired torque signal and to output a difference signal based upon this comparison.

64. Scherer specifically eliminates the high-pass filter in this embodiment (shown in Figs. 3 and 4 of Scherer) and clearly does not high-pass filter this

“difference signal,” and Robichaux also does not disclose high-pass filtering the difference signal output by the comparator. Indeed, these two references disclose a comparator that outputs a “difference signal” based upon a comparison of an estimated torque signal and a desired torque signal but do not disclose that this “difference signal” is high-pass filtered, is a strong indication of non-obviousness of the claimed invention of the ’565 patent.

65. For these reasons, I do not believe a POSA would consider combining Scherer with Robichaux or any other teaching because they teach away from each other and the ’565 patent.

VIII. AVAILABILITY FOR CROSS-EXAMINATION

66. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross examination in the case and that cross examination will take place within the United States. If cross examination is required of me, I will appear for cross examination within the United States during the time allotted for cross examination.

IX. RIGHT TO SUPPLEMENT

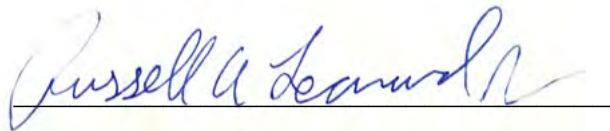
67. I reserve the right to supplement my opinions in the future to respond to any arguments that the Petitioner raises and to consider new information as it becomes available to me.

X. JURAT

68. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

IPR2020-00445
Ex. 2004
Declaration of Dr. Russell Leonard

Dated: October 29, 2020

A handwritten signature in blue ink, reading "Russell A. Leonard", is written over a horizontal line. The signature is cursive and stylized.

Dr. Russell Leonard

Appendix A

Russell A. Leonard, Jr., PhD

Work: 231-591-2357

E-mail: leonardr@ferris.edu

EDUCATION

Doctor of Philosophy, Higher Educational Leadership, June 2016
Western Michigan University, Kalamazoo, Michigan

Master of Education, December 1997, magna cum laude
Wayne State University, Detroit, Michigan
Curriculum: Instructional Systems Design & Adult Education

Bachelor of Science in Secondary Education, June 1991
Central Michigan University, Mount Pleasant, Michigan
Major: K-12 Industrial Engineering & Technology Education, Automotive Focus

WORK EXPERIENCE: FERRIS STATE UNIVERSITY

August 2018 - **Professor, Ferris State University**. College of Engineering Technology, School of
Present Automotive and Heavy Equipment
Currently instructing in both the Automotive Service and Automotive Engineering
Technology programs

August 2017 - **Chair, University Curriculum Committee**.
Present This position oversees curriculum changes at the university level, creates, enforces and
instructs on university policy, reports to the Academic Senate and works closely with the
Academic Affairs office and faculty

August 2015 - **Faculty Advisor, SAE Baja Racing Club**.
Present SAE Baja is a student led team that designs, builds, tests and races an off-road buggy.
The team competes against other universities from around the world

August 2008 - **Associate Professor, Ferris State University**. College of Engineering Technology,
August 2018 School of Automotive and Heavy Equipment
Instructed in both the Automotive Service and Automotive Engineering Technology
programs

August 2008 - **Motorcycle Safety Foundation (MSF) Ridercoach**. Corporate and Professional
August 2015 Development Center
Instructed the Basic Rider Course for the Motorcycle Safety Foundation Program

August 2010 - **Coordinator, Automotive Engineering Technology Program, Ferris State University**.
August 2012 College of Engineering Technology, School of Automotive and Heavy Equipment
Part-time administrator with teaching duties for the Automotive Engineering Technology
program

August 2002 - **Assistant Professor, Ferris State University.** College of Technology, Automotive
August 2008 Department
Instructed in both the Automotive Service and Automotive Engineering Technology
programs

WORK EXPERIENCE: GENERAL MOTORS

June 1998 - **Release Engineer,** Service Operations
August 2002 Developed and validated diagnostic tool software for various vehicle Electronic Control
Modules

August 1997- **Service Engineer,** Cadillac Motor Car Division
June 1998 Assisted technicians in diagnosis and repair of Cadillac vehicles, maintained an
information database, identified and tracked trends, performed root-cause analysis, and
recommended solutions

OTHER WORK EXPERIENCE

August 2008 - **Harley-Davidson Riding Academy Motorcycle Safety instructor,** Grand Rapids
Present Harley-Davidson
Instruct motorcycle rider safety course for Grand Rapids Harley-Davidson’s Riding
Academy program

June 1995 - **Systems Engineer, Hughes Training Inc. (Hughes Aircraft Co.)**
August 1997 Designed and developed engineering courses for various General Motors' advanced
engineering projects

July 1986 - **Sergeant E-5, United States Army Reserve (retired)**
July 2005 Certified military instructor in three areas of expertise: Light-Wheeled Vehicle Mechanics,
Crane Operation, and Battlefield Communication

October 1992 - **Engineering Instructor, Ford Motor Co. (via Bartech)**
June 1995 Delivered stand-up instruction in a company-sponsored engineering university; created
lesson plans and wrote textbooks; developed subject-matter expertise in powertrain
controls, from microprocessor strategy to OBD-II systems

June - **Prototype Technician, Roush Industries**
October 1992 Prepared prototype vehicles for engineering testing

July 1991 - **Technician, Lakeside Toyota-Lexus**
June 1992 Performed light through heavy repairs, warranty diagnosis, and vehicle maintenance
programs

January - **Student Teacher, Midland Dow High School**
May 1991 Instructed Automotive Technology and Advanced Drafting

January - May 1990	Teaching Assistant, Central Michigan University Assisted Professor in automotive maintenance course by delivering course material and developing lab activities
1988-1991	Automotive Technician, Souder's Amoco Performed light repairs specializing in no-starts

SPECIAL SKILLS

Canvas and Blackboard Learning Management System (LMS)
Instructional Systems Design
Microsoft Word, Excel, Project, and PowerPoint
Benchmark stand-up instruction
Subject-matter expertise:
 Vehicle ECM communication
 Keyword protocol 82 and 2000, Class 2, CAN, GM LAN, J1979 (CARB) and J2190
 Powertrain controls
 Automotive transmissions (electrical and mechanical)
 Engine design and performance
 Spark ignition
 Compression Ignition
 Emission controls
 Braking systems
 HVAC
 Suspension and steering systems
 Military vehicle design and performance
 Military communication networks and systems
 Satellite communication hardware and software

PROFESSIONAL ASSOCIATIONS / CERTIFICATIONS / HONORS

ASE Master Recertified Automobile Technician
ASE Recertified, Advanced Engine Performance (L-1)
ASE Certified Truck Technician
Ferris Foundation Grant recipient, 2009, 2010 & 2011
Registered Student Organization Advisor of the Year, 2019 (SAE Baja)
Society of Automotive Engineers (SAE) member
Automotive Transmission Rebuilders Association (ATRA) member
ASTM International Voting Member, D02 & D15
Faculty Advisor, SAE Baja Racing Club
Former Faculty Advisor, Sigma Chi Fraternity
Former Faculty Advisor, Lambda Chi Alpha Fraternity
Former Faculty Advisor, High Performance Motorsports Student Organization (HPMSO)
Former Ferris State University Academic Senate Diversity Committee member

GM President's Council Honors
Ford Powertrain Customer Service Award
Security Clearance: SECRET (expired)

PUBLICATIONS

Leonard, Russell A. Jr., "Females in Automotive Careers: Career Decision-Making Influences and Experiences During University Preparation and Beyond" (2016). *Dissertations*. Paper 1608.
<http://scholarworks.wmich.edu/dissertations/1608>

I have reviewed the Manual Drivetrains and Axles book by Halderman/Birch multiple times including the latest edition (7th) dated 2015, Prentice Hall, 978-0-13-351504-6.

PRESENTATIONS

"How to Make Biodiesel" for the Energy Summer Youth Camp on July 12-16, 2010. The students made biodiesel fuel out of waste vegetable oil from the University's dining facility, and then used it to fuel the test diesel engine.

Biodiesel Processing, Michigan Energy conference, April 7-8, 2009.

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EDUCATION

Doctor of Philosophy, Higher Educational Leadership, June 2016
Western Michigan University, Kalamazoo, Michigan

Master of Education, December 1997, magna cum laude
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SAE Baja is a student led team that designs, builds, tests and races an off-road buggy. The team competes against other universities

August 2010 - August 2012 **Coordinator, Automotive Engineering Technology, Ferris State University.**
College of Engineering Technology, School of Automotive and Heavy Equipment
Part-time administrator with teaching duties for the Automotive Engineering Technology program

August 2008 - August 2018 **Associate Professor, Ferris State University.** College of Engineering Technology, School of Automotive and Heavy Equipment
Instructed in both the Automotive Service and Automotive Engineering Technology

programs

August 2008 -
2017 **Ridercoach, Motorcycle Safety Foundation (MSF)**
Ferris State University Corporate and Professional Development Center
Instructed the Basic Rider Course for the Motorcycle Safety Foundation Program

August 2002 -
August 2008 **Assistant Professor, Ferris State University.** College of Technology, Automotive
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Instructed in both the Automotive Service and Automotive Engineering Technology
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August 2008-
Present **Harley-Davidson Riding Academy Instructor,** Grand Rapids Harley-Davidson
Instruct basic motorcycle rider safety course for the Harley-Davidson Riding Academy
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October 1992
-June 1995 **Engineering Instructor, Ford Motor Co. (via Bartech)**
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January – May 1990	Teaching Assistant, Central Michigan University Assisted Professor in automotive maintenance course by delivering course material and developing lab activities
1988-1991	Automotive Technician, Souder's Amoco Performed light repairs specializing in no-starts

COURSES TAUGHT AT FERRIS STATE UNIVERSITY

AUTO 111 Manual Transmissions and Drivelines
AUTO 112 Automotive Brake Systems
AUTO 113 Automotive Electricity and Electronics
AUTO 116 Engine Electrical Systems
AUTO 117 Electronic Fuel Management Systems
AUTO 200 Service Area
AUTO 211 Automatic Transmission
AUTO 214 Automotive HVAC
AUTO 291 Auto Service Internship
AUTO 450 Automotive Fuels and Lubes
AUTO 460 Emissions Systems
AUTO 493 Automotive Engineering Technology Internship
AMGT 300 Automotive Materials
AMGT 493 Automotive Management Internship
FSUS 100 Freshman Seminar
HEQT 230 Diesel Fuel Systems Technology
HEQT 193 Industry Internship
HSET 393 Industry Internship.

SPECIAL SKILLS

Canvas and Blackboard Learning Management Systems (LMS)
Instructional Systems Design
Subject-matter expertise:
Automotive Fuels and Lubricants
Automotive Coolants and other Liquids
Vehicle ECM and Scan Tool Communication
Powertrain Controls, both Hardware and Software
Automotive Transmissions, Electrical, Mechanical, and Software Calibration
Engine Design, Performance and Calibration
Spark Ignition
Compression Ignition

Gasoline and Diesel Emission Controls
Braking Systems
HVAC
Suspension and Steering Systems
Military Vehicle Design and Performance
Military Communication Networks and Systems
Satellite Communication Hardware and Software
Lift and Load (Crane Operation) Specialist

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Former Faculty Advisor, Lambda Chi Alpha Fraternity
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Ferris State University Registered Student Organization Advisor of the Year 2018-2019 for Baja SAE

PUBLICATIONS

Leonard, Russell A. Jr., "Females in Automotive Careers: Career Decision-Making Influences and Experiences During University Preparation and Beyond" (2016). *Dissertations*. Paper 1608.
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Biodiesel Processing, Michigan Energy conference, April 7-8, 2009.

PROFESSIONAL ORGANIZATIONS

ASTM International (2014-present)

I am a voting member of ASTM International’s Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and Committee D15 on Engine Coolants and Related Fluids. ASTM International is an international, not-for-profit organization, based in the USA, for the development, collection, standardization and dissemination of technical knowledge in a wide range of disciplines and is a voluntary, consensus standards organization.

In this capacity, I review; changes to current specifications, new specifications, and the deletion of obsolete specifications. The changes typically come out at multiple times each month. It requires, on average, 5 to 10 hours per month to review all the new changes and determine if there is benefit to the automotive industry. Each main committee in ASTM International is composed of subcommittees that address specific segments within the general subject area covered by the technical committee. Along with the general subject area of D02 and D15, I am a member of the following subcommittees:

- D02.01 Combustion Characteristics
- D02.06 Analysis of Liquid Fuels and Lubricants
- D02.08 Volatility
- D02.09 Oxidation of Lubricants
- D02.14 Stability and Cleanliness of Liquid Fuels
- D02.A0 Gasoline and Oxygenated Fuels
- D02.B0 Automotive Lubricants
- D02.E0 Burner, Diesel, Non-Aviation Gas Turbine, and Marine Fuels
- D02.G0 Lubricating Grease
- D02.L0 Industrial Lubricants and Engineering Sciences of High Performance Fluids and Solids
- D02.N0 Hydraulic Fluids
- D02.P0 Recycled Products
- D15.03 Physical Properties
- D15.04 Chemical Properties
- D15.07 Specifications
- D15.11 Heavy Duty Coolants
- D15.15 Recycled Engine Coolant
- D15.21 Long Life Engine Coolant
- D15.21.01 TG on Glycerin/Glycol Blend Base Fluids
- D15.22 Non-Aqueous Coolants
- D15.25 Diesel Exhaust Fluid
- D15.97 World Coolant Standards

ASTM Task Groups

WK51908 – Standard Test Method for Freezing Point of Aqueous Engine Coolants

WK58499 - Standard Specification for Fully-Formulated Glycol Base Engine Coolant for Heavy-Duty Engines
WK43678 – Standard Specification for Aqueous Engine Coolant Grade Glycol (53% Nominal)
WK59630 – Standard Specification for Engine Coolant Grade 1,3-Propanediol (PDO)
WK68375 - ASTM Reference Fluid for Carboxylate-Inhibited Coolant Tests

SAE Member since 2011

Fall 2015 – **Faculty Advisor, Ferris State University SAE Baja student race team**
present Consult with the team during regular meetings regarding vehicle design, oversee the purchase of parts and materials for the team and expense them through the university accounting process. Assist in the planning of the team’s travel including three competitions per year with many competitions located out-of-state.

National Science Foundation (NSF) Grant			Contact	Credit	Semester
Hours	Rate	Hours			

06/2010	Selected Topics in Energy Education: Biofuels			Sem. Hrs.	1.0
---------	---	--	--	-----------	-----

Professional Development Grants

02/2009	Performance Development of IC Engines	18	CEU	1.8
09/2009	Fuels & the Future for IC Engines	18	CEU	1.8
05/2014	ASTM Gasoline Specs, Testing,& Technology	21	CEU	2.1
09/2014	ASTM Diesel Specs, Testing & Technology	21	CEU	2.1
09/2016	ASTM Petroleum Lab Technician Series: Biodiesel	18	CEU	1.8
06/2019	Center for Advanced Automotive Technology (CAAT)	16	CEU	1.6
	Electric Drive Vehicles Technology			

Non-credit coursework:

10/2008	Toyota TIS2	8		0.5
02/2009	Toyota Engine Management Systems Diagnosis	4		0.25
02/2009	Tech Expo: OBD II, Duramax Diesel, 5 gas	8		0.5
02/2010	Tech Expo: Alignment, Mitchel mgt., ABS	8		0.5
02/2011	Tech Expo: VW Drive By Wire & 6.7L Ford Diesel 8			0.5

03/2012	Powerstroke Diesel Fundamentals Seminar	4	0.25
08/2013	Automotive Networks and Fuel Trim issues	4	0.25
03/2019	National Alternative Fuels Training Consortium Electric Drive Vehicle Technician Training	32	2

PTS On-Demand: Professional Technician’s Seminars

12/22/2015	Diagnosing Catalytic Converter Efficiency Codes	1	PDH
12/22/2015	HVAC Update 2015	1	PDH
12/19/2015	Variable Valve Timing Tips &Tricks	1	PDH
12/23/2015	Guerilla Diagnostics	1	PDH
12/23/2015	ABS and Vehicle Stability Control	1	PDH
01/01/2016	No-scope Diagnosis	1	PDH
01/01/2016	Hybrid HV Battery Diagnosis	1	PDH
01/01/2016	Ford 6.0 Powerstroke Misfire Tips	1	PDH
01/01/2016	Sensor Diagnosis	1	PDH
01/01/2016	Hyundai/Kia Tips &Tricks	1	PDH
01/01/2016	Voltage Drop Testing	1	PDH
01/01/2016	Chrysler EVAP Tips &Tricks	1	PDH
01/01/2016	OE Scan Tool Update	1	PDH
01/01/2016	Brain Teasers: Diagnostic Puzzles	1	PDH
01/01/2016	More Duramax Diesel Tips &Tricks	1	PDH
01/01/2016	Diesel No-Start Diagnosis	1	PDH
01/01/2016	GM Idle Stop and Light Hybrid	1	PDH

01/01/2016	Electronic Transmission Controls Part II	1	PDH
01/01/2016	Chrysler/Jeep Tips &Tricks	1	PDH
01/01/2016	Understanding Wiring Schematics Part II	1	PDH

ASTM Petroleum Lab Technician Series: Biodiesel

05/30/2017	ASTM Standard D2622-16 Standard Test Method for Sulfur in Petroleum Products	1	CEU	0.1
05/30/2017	ASTM Standard D1298-12b Standard Test Method for Density, Relative Density or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method	1	CEU	0.1
06/19/2017	ASTM Standard D1319-15 Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption	1	CEU	0.1
06/20/2017	ASTM Standard D4530-15 Standard Test Method for Determination of Carbon Residue (Micro Method)	1	CEU	0.1
06/20/2017	ASTM Standard D445-15a Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)	1	CEU	0.1
06/20/2017	ASTM Standard D4294-16e1 Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry	1	CEU	0.1
06/21/2017	ASTM Standard D5453-16 Standard Test Method for Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence	1	CEU	0.1
06/21/2017	ASTM Standard D524-15 Standard Test Method for Ramsbottom Carbon Residue of Petroleum Products	1	CEU	0.1
06/21/2017	ASTM Standard D482-13 Standard Test Method for Ash from Petroleum Products	1	CEU	0.1
06/22/2017	ASTM Standard D97-17 Standard Test Method for Pour Point of Petroleum Products	1	CEU	0.1

06/21/2017 ASTM Standard D93-15a Standard Test Method for Flash Point by Pensky-Martens Closed Cup Tester	1	CEU	0.1
06/22/2017 ASTM Standard D86-16a Standard Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure	1	CEU	0.1
06/22/2017 ASTM Standard D664-11a Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration	1	CEU	0.1
06/25/2017 ASTM Standard D974-14e2 Standard Test Method for Acid and Base Number by Color-Indicator Titration	1	CEU	0.1
06/25/2017 ASTM Standard D1319-14 Standard Test Method for Hydrocarbon Types inLiquid Petroleum Products by Fluorescent Indicator Adsorption	1	CEU	0.1
06/25/2017 ASTM Standard D2622-10 Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry	1	CEU	0.1
06/25/2017 ASTM Standard D4294-10 Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry	1	CEU	0.1
06/25/2017 ASTM Standard D5453-12 Standard Test Method for Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence	1	CEU	0.1

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Volkswagen Group of America, Inc.,
Petitioner

v.

Michigan Motor Technologies LLC,
Patent Owner

Case IPR2020-00445
Patent No. 6,581,565

PATENT OWNER'S RESPONSE

Under 35 U.S.C. § 42.120

Mail Stop PATENT BOARD
Patent Trial and Appeal Board
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
Submitted Electronically via PTAB E2E

Table of Contents

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VI. CLAIM CONSTRUCTION 11

VII. THE PRIOR ART REFERENCES DO NOT INDIVIDUALLY OR IN COMBINATION DISCLOSE ALL ELEMENTS OF CHALLENGED CLAIMS OF THE ’565 PATENT 12

 A. None of the Prior Art References Disclose “A High Pass Filter Which Receives As an Input the Difference Signal and Outputs a Filtered Difference Signal In Which Low Frequency Components Are Absent,” Where the “Difference Signal” Is Outputted By “A Comparator Which Receives As Inputs the Estimated Torque Signal And A Desired Torque Signal” 15

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B. *Scherer and Robichaux In Combination Do Not Render Any of the
Challenged Claims of the '565 Patent Obvious* 20

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Table of Authorities

Cases

Arendi S.A.R.L. v. Apple Inc.,
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829 F.3d 1364 (Fed. Cir. 2016) 4

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Wasica Finance GMBH v. Continental Auto. Sys.,
853 F.3d 1272, 1286 (Fed. Cir. 2017) 2

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35 U.S.C. § 103 9

35 U.S.C. 282 19

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Table of Exhibits

Exhibit	Description
2001	Expert Declaration of Dr. Russell Leonard
2004	Affidavit of Robyn T. Williams
2003	Deposition transcript of C. Arthur MacCarley, Ph.D. dated October 5, 2020
2004	Second Expert Declaration of Dr. Russell Leonard

Petitioner Volkswagen Group of America, Inc. ("VWoA" or "Petitioner")

filed a Petition for *Inter Partes* Review of U.S. Patent No. 6,581,565 ("the '565 patent") on January 31, 2020. (IPR2020-00445, Paper No. 3 ("Petition" or "Pet."), which was granted by the Board (Paper 12.) Through the undersigned Counsel, Patent Owner, Michigan Motor Technologies LLC ("MMT"), submits the following Patent Owner's Response pursuant to 35 U.S.C. § 42.120.

I. INTRODUCTION

Generally, the '565 patent is directed to an engine torque controller for a spark ignition internal combustion engine, specifically, for a Direct Injection Spark Ignition (DISI) engine. (Exhibit 1001 at Abstract, 1:5-8, 1:62-63, Fig. 1.) The '565 patent discloses and claims a torque controller and a method for controlling torque for an engine in which torque is controlled in dependence upon a high-pass filtered difference signal that represents the difference between a desired torque signal and a signal representing an estimate of the current torque. (Ex. 1001 at Abstract.)

II. APPLICABLE LEGAL PRINCIPLES

The petitioner has the burden to clearly set forth the basis for its challenges in the petition. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) as "requiring IPR petitions to identify 'with particularity . . . the evidence that supports the grounds for the challenge to each

claim’’). A petitioner may not rely on the Board to substitute its own reasoning to remedy the deficiencies in a petition. *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1355 (2018) (“Congress chose to structure a process in which it’s the petitioner, not the Director, who gets to define the contours of the proceeding.”); *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016) (rejecting the Board’s reliance on obviousness arguments that “could have been included” in the petition but were not, and holding that the Board may not “raise, address, and decide unpatentability theories never presented by the petitioner and not supported by the record evidence”); *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1367 (Fed. Cir. 2015) (holding that “a challenge can fail even if different evidence and arguments might have led to success”); *Wasica Finance GMBH v. Continental Auto. Sys.*, 853 F.3d 1272, 1286 (Fed. Cir. 2017) (holding that new arguments in a reply brief are “foreclosed by statute, our precedent, and Board guidelines”).

To the extent that the petition relies on an expert declaration, it must be more than conclusory and disclose the facts underlying the opinion. *See* 37 C.F.R. § 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”); *Edmund Optics, Inc. v. Semrock, Inc.*, IPR2014-00583, Paper 50 at 8 (PTAB, Sep. 9, 2015) (affording little or no weight to “experts’ testimony that does little more than repeat, without

citation to additional evidence, the conclusory arguments of their respective counsel.”). Nor may the petition rely on the expert declaration to remedy any gaps in the petition itself. 37 C.F.R. § 42.6(a)(3) (“Arguments must not be incorporated by reference from one document into another document”); see also *Cisco Sys., Inc. v. C-Cation Techs., LLC*, IPR2014-00454, Paper 12 at 9 (PTAB, Aug. 29, 2014) (“This practice of citing the Declaration to support conclusory statements that are not otherwise supported in the Petition also amounts to incorporation by reference.”).

For rejections under 35 U.S.C. § 102, each and every claim element must be found in a single reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987) “[U]nless a reference discloses within the four corners of the document not only all of the limitations claimed but also all of the limitations arranged or combined in the same way as recited in the claim, it cannot be said to prove prior invention . . . and, thus, cannot anticipate under 35 U.S.C. § 102.” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008). Further, the prior art reference must disclose the claimed invention “or direct those skilled in the art to the [invention] without any need for picking, choosing, and combining various disclosures not directly related to each other by the teachings of the cited reference.” *Id.* (quoting *In re Arkley*, 455 F.2d 586, 587 (C.C.P.A. 1972)).

To make a prima facie showing of obviousness under 35 U.S.C. § 103, the Petition must, among other requirements, fulfill the requirements set forth in *Graham v. John Deere Co.*, 383 U.S. 1 (1966), including demonstrating that the cited references disclose each element of a challenged claim. *In re Magnum Oil Tools Int'l.*, 829 F.3d 1364, 1376 (Fed. Cir. 2016); *see also Apple Inc. v. Contentguard Holdings, Inc.*, IPR2015-00442, Paper 9 at 12-13 (PTAB July 13, 2015).

For an obviousness challenge based on a single reference in view of the knowledge and skill of a POSITA, there must be a motivation to make the combination and a reasonable expectation that such a combination would be successful, otherwise a skilled artisan would not arrive at the claimed combination. *In re Stepan Co.*, 868 F.3d 1342, 1345-46 (Fed. Cir. 2017). In other words, when a gap in a single prior art reference requires filling with, for example, the knowledge of one of ordinary skill, there must be a further showing that the skilled artisan would have arrived at the claimed invention.

Hindsight analysis is inappropriate; obviousness must be measured “*at the time the invention was made.*” *Ortho-McNeil Pharm. v. Mylan Labs*, 520 F.3d 1358, 1364 (Fed. Cir. 2008) (emphasis in original). A petition must demonstrate a rationale to combine prior art references without relying on the patent disclosure itself. *Apple Inc. v. Contentguard*, Paper 9 at 15, 17; *see also P&G v. Teva*

Pharms. USA, Inc., 566 F.3d 989, 995 (Fed. Cir. 2009). The Petitioner must not use the patent as a roadmap. *In re NTP, Inc.*, 654 F.3d 1279, 1299 (Fed. Cir. 2011) (internal citation omitted); *see also KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007).

III. LEVEL OF ORDINARY SKILL IN THE ART

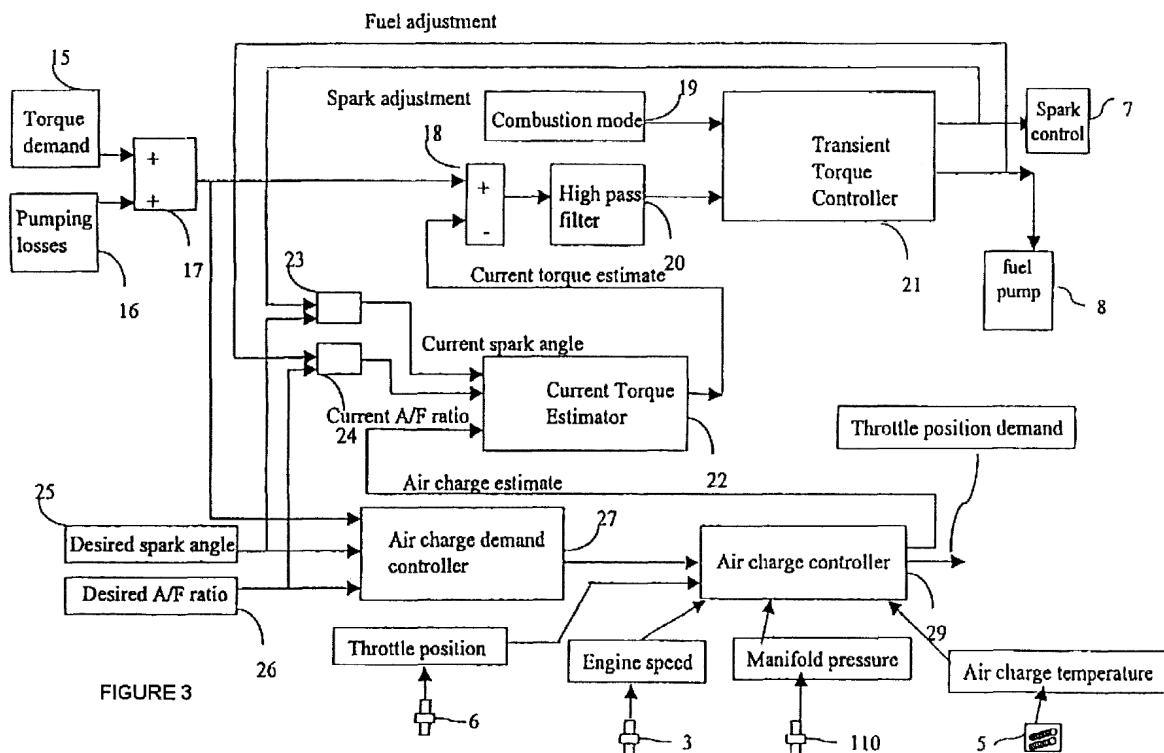
The level of ordinary skill in the art applicable to the '565 patent around the time of the invention in 2004 is a person with (1) a B.S. in mechanical engineering or equivalent with three or more years of experience in either engine systems or engine control systems or (2) at least a M.S. in mechanical engineering. (Leonard Decl. Ex. 2004 at ¶ 14.)

IV. THE '565 PATENT

The '565 patent generally relates to an engine torque controller for spark ignition internal combustion engine and more specifically for direct injection engines. (Ex. 1001 at Abstract.)

The '565 patent addresses the problem which occurs in stratified mode or homogenous mode where there is a steady state error between the torque demanded and the estimate of the torque produced. (Ex. 1001 at 1:46-49.) This problem is overcome by producing a difference signal that represents the difference between a desired torque signal and a signal representing an estimate of the current torque and high-pass filtering the difference signal to eliminate low

frequency components, among other things. Figure 3 describes a block diagram of a torque producer, in accordance with the '565 patent:



he air charge demand controller 27 generates an air charge demand signal that is received by an air charge controller 29. The air charge controller 29 also receives as inputs a signal indicating throttle position that is received from the throttle position indicator 6 (FIG. 1), and signals from the engine speed sensor 3, the manifold absolute pressure sensor 110 and the air charge temperature meter 5. The air charge controller 29 generates a signal indicating desired throttle position that is sent to throttle 9 (FIG. 1) and a signal representing an estimate of the air charge.

The estimated air charge may be different from the air charge demanded by the air charge demand controller 27 due to delays in the engine 100, such as the time taken for the throttle 9 to move, the time taken for the pressure in the air intake manifold 152 to rise or fall, or any errors in position of the

throttle. The air charge estimate signal is sent to a current torque estimator 22.

The estimate of the current torque is compared to the desired torque signal by a comparator 18 to generate an error signal 35 which is then filtered by a high pass filter 20. The resulting high-pass filtered error signal is used by a transient torque controller 21 to generate a control signal for temporarily adjusting the torque produced by the engine 100.

A combustion mode signal 19 indicates whether the engine 100 is operating in a stratified mode or in a homogenous mode. If the engine 100 is operating in the stratified mode then a fuel adjustment signal is generated and sent to the fuel pump 8 in order to adjust the amount of fuel which is injected into the combustion chamber 108 by the fuel injector 130. If the engine 100 is operating in the homogenous mode then a spark adjustment signal is generated and sent to the spark control unit 7 to adjust the timing of the ignition spark generated by the spark plug 106.

A signal representing the current spark angle is calculated by a calculator 23 using the desired spark angle and the spark adjustment signal received from the transient torque controller 21. A signal representing the current air/fuel ratio is calculated by a calculator 24 using the desired air/fuel ratio and the fuel adjustment signal received from the transient torque controller 21. When the engine 100 is operating in stratified mode the current spark angle will be equal to the desired spark angle 25. When the engine 100 is operating in homogenous mode the current air/fuel ratio will be equal to the desired air/fuel ratio 26.

(Ex. 1001 at 3:6-60)

The basic inventive concept disclosed and claimed in the subject '565 patent is, in the context of a spark ignition direct injection internal combustion engine, a method in which engine torque is controlled dependent upon a high-pass filtered difference signal representative of the difference between desired torque and current torque estimate signals. (Ex. 2004 at ¶¶ 21-25.)

The method and system of the '565 patent utilizes a torque demand signal which constitutes a feedforward signal and a current torque estimate signal which constitutes a feedback signal. (*Id.* at ¶ 25; Ex. 1001 at 2:57-3:6.) These two signals are applied as inputs to a comparator 18 that generates an error signal or difference signal representative of the difference between the two inputs to the comparator. (Ex. 2004 at ¶ 25; Ex. 1001 at 2:57-3:6.) The error or difference signal is generated by subtracting the current torque estimate from the torque demand signal. (Ex. 2004 at ¶ 25.) This error signal indicates instances where torque demand is less than torque produced and instances where torque demand is greater than torque produced. (*Id.*) The high-pass filter receives the error signal and blocks (filters out) smaller differences from the comparator and only allows larger differences to pass through to the transient torque controller. Indeed, the '565 invention does not expend energy with smaller, less significant errors by only acting upon larger errors. (*Id.*) This design minimizes hunting, where the system is continuously chasing changes back and forth. (*Id.*)

A high-pass filter is used to filter the difference signal of desired torque and current torque estimate signals and it is this high-pass filtering of the difference of these two signals that makes the '565 patent unique. It is the high-pass filtered difference signal that controls engine torque. (*Id.*)

The '565 patent discloses what was well known in the prior art, namely, that “[i]n engine torque controllers for DISI engines, when the engine is operated in stratified mode, spark angle has little influence on the torque produced. (Ex. 1001 at 1:19-30.) The torque producer modifies the air/fuel in order to control the torque produced. (*Id.* at 1:37-45.) Conversely, when the engine is operating in homogenous mode... [t]he torque producer modifies the timing of the spark ignition in order to control the torque produce.” (Ex. 1001 at 1:36-45.) This disclosure constitutes the “admitted prior art” of the '565 patent. *See* Ex. 1001.

The main difference between the prior art and the '565 patent is the method of correction for a steady state error by high-pass filtering the difference between the torque demanded signal and the estimate of the torque produced signal. (Ex. 1002 at 44.)

V. OVERVIEW OF CITED PRIOR ART

A. *Robichaux*

Robichaux discloses a system and method for controlling an engine including determining a desired engine brake torque and modifying the desired engine brake torque based on current engine operating conditions prior to determination of control parameters, including at least one of an airflow and a fuel quantity. (Ex. 1020 at Abstract.) *Robichaux's* system and method controls engine torque by modifying the desired engine brake torque by (1) combining the desired

engine brake torque with an idle speed torque to generate a first intermediate torque, (2) comparing the first intermediate torque to an actual engine brake torque to generate a second intermediate torque, (3) generating a feedback correction torque based on the second intermediate torque, and (4) combining (a) the first intermediate torque, (b) the feedback correction torque, and (c) a second intermediate torque to produce a third intermediate torque (4) which represents accessory load or a frictional torque loss which varies with temperature. (Ex. 1020 at ln. 18-30.)

B. Scherer

Scherer discloses a process and an apparatus for controlling the engine torque of an internal combustion engine by regulating the ignition point in an Otto engine, or by regulating the start and the duration of the fuel injection in a diesel engine. (Ex. 1007 at Abstract, 1:7-11.)

C. Takahashi

Takahashi is a tertiary reference that controls the throttle valve and fuel injection in a manner that ensures the engine output torque and air/fuel ratio match target values. (Ex. 1008 at 43-65.)

D. Suzuki

Suzuki is a tertiary reference which discloses a system comprising an engine controller capable of operating in homogenous and stratified mode with means to

determine load and correct torque and vary spark timing or ratio of air and fuel based on the determined load. (Ex. 1005 at 15:46-16:2.)

VI. CLAIM CONSTRUCTION

In an *inter partes* review proceeding, “a claim of a patent . . . shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b).

Only terms that are in controversy need to be construed and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

None of the claim terms require specific construction and should receive their plain and ordinary meaning, in the context of the ’565 patent specification.

Patent owner reserves the right to construe other terms of the ’565 patent throughout this proceeding, if the petition is granted, and in pending district court litigation pending against Petitioner and its parent company.

VII. THE PRIOR ART REFERENCES DO NOT INDIVIDUALLY OR IN COMBINATION DISCLOSE ALL ELEMENTS OF CHALLENGED CLAIMS OF THE '565 PATENT

As will be clearly demonstrated herein, the Board and the Petitioner have made the same fundamental error in two separate, simultaneously filed Petitions for *inter partes* review to find the challenged claims of the '565 patent unpatentable over various combinations of prior art that all rely upon *Scherer* as a key secondary reference, because, as will be shown, *Scherer* clearly contradicts the Board's and the Petitioner's articulated reasoning for combining *Scherer* with a primary reference, and directly "teaches away from" the claimed invention as set forth in the challenged claims of the '565 patent.

In this case, Patent Owner has argued that since none of the prior art references relied upon by Petitioner and the Board disclose a required claim element of the challenged claims (in fact, the key, patentability-imparting feature of the challenged claims), then no combination thereof can render the challenged claims unpatentable. In response, the Petitioner and the Board have criticized Patent Owner for attacking the references individually, rather than their combination or combined teachings. In this regard, the Petitioner and the Board have taken the position that a hypothetical person of ordinary skill in the art ("POSITA") would have extracted certain teachings from one prior art reference (namely, *Scherer*) and used that extracted teaching from *Scherer* to modify another reference, *Robichaux*, to add the claim

element that is admittedly missing from all prior art references the Petitioner and the Board are relying upon.

More particularly, the challenged claims of the '565 patent all require high-pass filtering the output of a comparator whose inputs are a desired torque signal and an estimated torque signal. The Board's Decision to grant institution of *inter partes* review states, "[a]t this stage, Petitioner has shown sufficiently that a person of ordinary skill in the art would have had a reason to add Scherer's transient control branch with its high-pass filter 4 to Robichaux's system." (Paper 12 at 37.) Patent Owner contends that this reasoning constitutes the exercise of impermissible hindsight in violation of well-settled law, as developed below.

It is not often the case that a particular challenged claim would be found obvious over a combination of references if none of those prior art references disclose a particular limitation or element recited in that particular challenged claim, such as in the instant case. In other words, if a first reference discloses elements A and B, and a second reference discloses elements B and C, but the particular challenged claims require elements A, B, C and D, then the combination of those two references cannot render that particular challenged claim obvious or unpatentable since neither of those references disclose element D, unless "ordinary knowledge" of the POSITA or "common sense" is relied upon to modify the combined teachings of the references in such a manner as to add the missing element.

“[T]here are at least three caveats to note in applying “common sense” in an obviousness analysis.” *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016). “First, common sense is typically invoked to provide a known motivation to combine, not to supply a missing claim limitation.” *Id.* Second, the limitation in question that is missing from the prior art must be unusually simple and the technology relatively straightforward. *Id.* Third, “common sense” cannot be used as a “wholesale substitute for reasoned analysis and evidentiary support.” *Id.* Such “obvious to modify to supply the missing element” reasoning is fraught with “hindsight bias.” *See Id.* “Absent some additional reasoning, the Board’s finding that a skilled artisan would have arrived at the claimed invention through routine optimization is insufficient to support a conclusion of obviousness.” *In re Stepan Co.*, 868 F.3d 1342, 1346 (Fed. Cir. 2017).

Further, the MPEP instructs the examiner to step back in time and into the shoes of the hypothetical person of ordinary skill in the art “when the invention was unknown and just **before it was made.**”¹ Under AIA §103, the key time would be just before the effective filing date. MPEP §2142.7.

Patent Owner respectfully submits that if all the guidelines set forth in the foregoing discussion are followed in the present case, then the Board will be compelled to find that all challenged claims of the ’565 patent are patentable.

¹ Unless otherwise noted, emphasis added.

A. None of the Prior Art References Disclose “A High Pass Filter Which Receives As an Input the Difference Signal and Outputs a Filtered Difference Signal In Which Low Frequency Components Are Absent,” Where the “Difference Signal” Is Outputted By “A Comparator Which Receives As Inputs the Estimated Torque Signal And A Desired Torque Signal”

In the present case, none of the prior art references disclose “a high pass filter which receives as an input the difference signal and outputs a filtered difference signal in which low frequency components are absent,” where the “difference signal” is outputted by “a comparator which receives as inputs the estimated torque signal and a desired torque signal.”

Although the prior art discloses high-pass filtering either an “estimated torque signal” or a “desired torque signal,” no prior art reference relied upon by the Petitioner or the Board discloses producing a “difference signal” by comparing an “estimated torque signal” and a “desired torque signal” and then high-pass filtering such “difference signal.” In fact, the key secondary reference (*Scherer*) which is the linchpin of the Board’s and the Petitioner’s obviousness positions, clearly teaches away from the Board’s and Petitioner’s hindsight modification to the combined teachings of the relied-upon prior art references. At a bare minimum, the Board and the Petitioner (and its expert) failed to consider *Scherer* in its entirety, ignoring portions of the reference that clearly lead away from obviousness. *In re Wesslau*, 353 F.2d 238, 241 (CCPA 1965); *see also Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 449-49 (Fed. Cir. 1986) (holding that the

district court, by failing to consider a prior art reference in its entirety, ignored portions of the reference that led away from obviousness).

1. *Scherer*

Scherer discloses a process and apparatus for adjusting the torque of an internal combustion engine which has as an object “ . . . to provide a process and apparatus of the initially mentioned type which adjusts the engine torque to a desired value with the least possible expenditures in both steady-state and transient engine operation with a comparatively short reaction time.” (Ex. 1007 at 2:39-43.) *Scherer* produces a demanded desired engine torque signal that “is split into a dynamic component and a remaining quasi-static component. The dynamic component is used to determine corresponding adjustment of the ignition point in the case of an Otto engine or of the injection start in the case of a diesel engine. . . . while the quasi-static desired torque component is regulated by means of a corresponding adjustment of the air flow rate (for an Otto engine) or of the injection duration (a diesel engine).” (*Id.* at 2:47-59.) “In a preferred embodiment of the invention, the dynamic desired torque component is determined by high-pass filtering the demanded desired engine torque with a decay time constant which is selected as a function of the engine operating point.” (*Id.* at 3:6-10.) There are two such preferred embodiments of *Scherer* depicted in Figures 1 and 2 of *Scherer*. “In another preferred embodiment, a model-based estimation is made of the quasi-static desired torque component

achieved by air flow rate or injection duration regulation. To obtain the dynamic desired torque component, the estimated value is subtracted from the demanded desired engine torque.” (*Id.* at 3:11-16.) There are two such preferred embodiments depicted in Figures 3 and 4 of Scherer. (Ex. 2004 at ¶ 36-40.)

In the preferred embodiments depicted in Figures 1 and 2 of *Scherer*, only the dynamic component of the desired engine torque is high-pass filtered and no comparator is used to compare an “estimated torque signal” to the “desired torque signal.” (*Id.* at ¶¶ 40-42; 62-64.) In the preferred embodiment depicted in Figures 3 and 4 of *Scherer*, a comparator 15 is used to produce a “difference signal” (M_d) by subtracting an “estimated torque signal” (M_{IS}) from the “desired torque signal” (M_{des}). In these Figure 3 and 4 embodiments, ***Scherer explicitly eliminates the high-pass filter*** used in the 1 and 2 embodiments, and, in place thereof, uses the “estimated value stage.” (*Id.*) In this regard, *Scherer* states that “FIG. 3 again shows a device which is suitable for torque adjustment of an Otto engine. This embodiment corresponds to that of FIG. 1 except that, ***instead of the high pass filter stage, a model-based estimated value stage is provided*** to determine the dynamic desired engine torque component (M_{des}) that cannot be regulated by the air flow rate regulation, by estimating the quasi-static engine torque part (M_{IS}) which can be adjusted by the air flow rate regulation.” (Ex. 1007 at 6:3-12; Ex. 2004 at ¶¶ 40-42; 62-64). *Scherer* further states that “[t]he embodiment of FIG. 4, which is adapted

for a diesel engine, is identical with that of FIG. 2 except that, ***instead of a high pass filter stage, (analogously to the modification of FIG. 3 in comparison to that of FIG. 1), an estimated value stage is provided.*** This estimated value stage corresponds essentially to that of FIG. 3. . . . The estimated value (M_{Is}) is then subtracted in the subtractor device 15 from the demanded desired engine torque (M_{des}), and the resulting difference signal is treated as the dynamic desired engine torque part (M_d) which is to be regulated by the injection start adjusting branch and is supplied to the dead zone unit 6.” (Ex. 1007 at 6:44-64; Ex. 2004 at ¶¶ 40-42; 62-64.)

Thus, it is clear that in embodiments in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “torque demand signal,” the ***high-pass filter used in the other embodiments that do not employ such a comparator is eliminated***, and the “difference signal” output by the comparator is not high-pass filtered. (Ex. 2004 at ¶ 43.) Thus, ***Scherer discourages a POSA from and, in fact, directly teaches away from using a high-pass filter in embodiments in which a comparator is used to produce a “difference signal” by subtracting an “estimated torque signal” from a “desired torque signal.”*** (*Id.* at ¶¶ 40-43; 62-64.)