

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BMW OF NORTH AMERICA, LLC, Inc,
Petitioner

v.

Michigan Motor Technologies LLC,
Patent Owner

Case IPR2023-01233
Patent No. 6,581,574

PATENT OWNER'S PRELIMINARY RESPONSE

Under 35 U.S.C. § 42.107

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Through the undersigned Counsel, Patent Owner, Michigan Motor Technologies LLC (“MMT”), submits the following Patent Owner Preliminary Response pursuant to 37 C.F.R. § 42.107(a). *See also* 37 C.F.R. § 42.107(b).

I. INTRODUCTION

Petitioners Mercedes-Benz USA, LLC¹ and BMW of North America, LLC. (“Petitioners”) filed a Petition for Inter Partes Review of U.S. Patent No. 6,581,574 (“the ’574 patent”) on July 21, 2023. (IPR2023-01233 Paper No. 3 (“Petition” or “Pet.”).) Through the undersigned Counsel, Patent Owner, Michigan Motor Technologies LLC (“MMT”), submits the following Patent Owner’s Preliminary Response pursuant to 37 C.F.R. § 42.107 (a). *See also* 37 C.F.R. § 42.107 (b).

Patent Owner MMT respectfully requests that the Board deny the Petition because Petitioner BMW failed to show that there is a reasonable likelihood that it would prevail with respect to at least one of the claims challenged in the Petition. Petitioner has not demonstrated a reasonable likelihood that any claim of the ’574 patent would be obvious in view of the cited *Otterman* (Ex. 1004 – U.S. Patent No. 5,505,180), *Hosoya* (Ex. 1005 - U.S. Patent No. 5,806,497), *Greiner* (Ex. 1006 – U.S. Patent No. 4,426,981) or *Buckland* (Ex. 1007 – U.S. Patent No. 6,349,700) references.

¹ Mercedes-Benz USA, LLC has moved to withdraw from the IPR after a settlement with MMT. (Paper 7)

In addition, Patent Owner MMT respectfully requests that the Board deny the Petition under 35 U.S.C. § 325(d) because Petitioner presents references that were either previously presented in a prior IPR, the patent prosecution of the ‘574 Patent or are cumulative of the previously presented prior art references raised in this Petition.

The ‘574 patent was previously the subject of an IPR petition in 2019, filed by Volkswagen Group of America, Inc. (IPR2019-01286 or the “Volkswagen IPR”), using the same *Otterman* reference (U.S. Patent No. 5,505,180) as a tertiary reference, along with Japanese Patent Pub. No. 2000-008926 to *Heiko*, U.S. Patent No. 5,579,738 to *Frischmuth*, and U.S. Patent No. 6,223,731 to *Yoshiume* references. Petitioners here exchange the primary reference in the Volkswagen IPR, *Heiko*, with the *Otterman* reference and add *Hosoya*, *Greiner* and *Buckland* (a reference already considered in the prosecution of the ‘574 Patent) in combinations to assert that that the ‘574 Patent is rendered obvious, but still do not demonstrate a reasonable likelihood of obviousness. Indeed, the Board in the Volkswagen IPR *denied* institution of trial (Paper 13) when the ‘574 Patent was first challenged with *Otterman* as a reference. Nothing has changed in the intervening years to improve the instant Petitioners’ grounds to challenge the ‘574 Patent this time².

² Hyundai Motor Co. filed an IPR proceeding relying on the *Otterman*, *Hosoya*, and *Greiner* references, which Petitioner also relies on herein. IPR2018-01064. The Hyundai IPR was settled with no preliminary response filed

The '574 Patent

The '574 patent describes and claims specific novel systems for controlling fuel pressure in a manner previously unheard of. Specifically, the '574 patent teaches a method of controlling the fuel pressure within a fuel delivery system having a fuel pump that delivers fuel to a fuel rail of an internal combustion engine. The method generally includes providing a set-point fuel pressure, generating a feed forward signal having a set of fuel pump motor control parameters based upon the set-point fuel pressure and the desired fuel flow rate, providing a pressure sensor to measure the fuel rail pressure, comparing the fuel rail pressure to the set-point fuel pressure and generating an error value based upon the difference between the fuel rail pressure and the set-point fuel pressure, providing a feed back controller adapted to receive the error value and to generate a feed back control signal, and combining the feed back control signal and the feed forward control signal to generate a motor controller signal. (Ex. 1001 at Abstract.)

The claimed invention of the '574 patent provides an improvement over prior fuel systems because the modifications in the feed forward control signals derived from the feedback controller compensate for system variations due to, for example, part-to-part tolerances and system aging, and further can provide continuous adaptations. (*Id.* at 2:38-43.)

and before the Board reached an institution decision.

Otterman

Petitioner relies on *Otterman* as a primary reference in all six Counts of its Petition. *Otterman*, U.S. Pat. No. 5,505,180, discloses “[a]n adapting mechanism for controlling the speed of a variable speed fuel pump in a returnless fuel delivery system includes a demand sensor, feedforward fuel pump values, adaptive adjustments corresponding to the feedforward values, a pump controller which controls the speed of the fuel pump, a timer, a steady demand indicator, a flow error accumulator, and an adjustor.” (Ex. 1004 at Abstract.)

Hosoya

Petitioner relies on *Hosoya* as a secondary reference for five of its six grounds, but *Hosoya* fails to cure the deficiencies in *Otterman*. *Hosoya* discloses a method and apparatus for controlling fuel injection of internal combustion engines, by directly injecting fuel into each cylinder, where fuel pressures supplied to each fuel injection valve are detected, and the fuel injection pulse width is detected according to the detected fuel pressures. (Ex. 1005 at Abstract.) *Hosoya* discloses applying a weighted average value for an engine’s operational state. (*Id.* at 5:51-6:17.) Even if *Otterman* and *Hosoya* were combined, since each of them fail to teach the elements of “generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow;” “measuring the fuel rail pressure with a fuel pressure sensor;” and “filtering the output of the fuel pressure sensor to filter out pulses due

to the opening and closing of the fuel injectors” and corresponding elements, their combination would not render any of the challenged claims obvious.

Petitioner also cites *Greiner* as a tertiary reference in attempt to show that a proposed combination of its teachings with those of the proposed combination of *Otterman* or *Otterman* with *Hosoya* would render dependent claims 5-6 and 11-18 obvious. (Petition at 12.) Even if the references were combined, they fail to teach the element of “generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow;” “measuring the fuel rail pressure with a fuel pressure sensor;” and “filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors” and the corresponding claim elements recited in each independent claim of the ’574 patent.

Petitioner cites a fourth reference, *Buckland*, which, as shown below, teaches an engine/vehicle speed control for direct injection spark ignition engine applications, where an “average fuel value” is calculated. (Petition at 20.) *Buckland* is combined with each of the three other references to allegedly supply any deficiency of “an average fuel value.” Even so, combining the references still does not render claims 1-18 obvious at least because all of these references fail to teach the element of “generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow;” “measuring the fuel rail pressure with a fuel pressure sensor;” and “filtering the output of the fuel pressure sensor to filter

out pulses due to the opening and closing of the fuel injectors” or the corresponding elements recited in each independent claim of the ’574 patent.

The ’574 invention is thus much more than a simple technique for controlling fuel pressure, as characterized by Petitioner. None of the references relied on by the Petitioner considered alone or in any possible combination thereof render any claim of the ’574 patent obvious, nor would there have been any teaching, suggestion, or motivation to combine these references at all, much less in the specific manner proposed by Petitioner.

For at least the foregoing reasons, the Petition should be denied.

II. APPLICABLE LEGAL PRINCIPLES

“[T]he decision whether to institute an *inter partes* review is discretionary.” *Unified Patents Inc. v. C-Cation Techs., LLC*, IPR2015-01045, Paper 15 at 3 (PTAB Oct. 7, 2015) (citing 37 C.F.R. § 42.108 (a)). Petitioner has the burden to show that it is likely to prevail as to at least one claim of the ’680 patent. 35 U.S.C. § 314; *SAS Institute Inc. v. Iancu*, 138 S. Ct. 1348 (2018).

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).

Petitioner also has the burden to show there would have been some motivation to combine the asserted prior art, and that the proposed combination would render the patented claims obvious. “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) (internal citation omitted); *see also In re Magnum Oil Tools Int'l.*, 829 F.3d at 1376. Even if individual modifications or choices were obvious, a petition must explain why making all of the changes at once would be obvious. *Apple Inc. v. Contentguard*, Paper 9 at 16-17 (“[T]he mere fact that individual changes might have been obvious does not make doing all of the changes at once obvious.”).

The Federal Circuit has found that, even 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.

The lack of a technological obstacle to combining references, in and of itself, does not justify a finding of obviousness. *See In re Omeprazole Patent Litig. v. Apotex Corp.*, 536 F.3d 1361, 1380-81 (Fed. Cir. 2008). A reason for combining disparate prior art references is critical and should be made explicit. *InTouch Techs., Inc. v. VGo Communs., Inc.*, 751 F.3d 1327, 1351 (Fed. Cir. 2014) (internal citation omitted).

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). 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).

Moreover, the petition should not be instituted under 35 U.S.C. § 325(d). 35 U.S.C. § 325(d) states that, in determining whether to institute an IPR, “the [PTAB] Director may take into account whether, and reject the [IPR] petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office.” The Director's determination to institute or deny an IPR is nonappealable. 35 U.S.C. 314(a).

III. TECHNOLOGY BACKGROUND

The technical field of the '574 patent relates to maintaining consistent fuel pressure in an internal combustion engine in a nested, closed loop control system. (Ex. 1001 at Abstract,1:6-8.)

Prior to the '574 patent, closed loop control systems for controlling the fuel pressure within fuel rails had been developed but had not yet achieved constant fuel pressure adaptations in response to system variations. This often resulted in inefficient fuel burn, energy output, engine operation, cylinder firing, increased emissions and overall inefficient engine output.

At the time of the '574 patent, persons having ordinary skill in the art had proposed systems that responded to fuel pressure changes over time. (*Id.* at 1:12-23.) None of these prior systems was adequately successful in achieving the goal of retaining fuel pressure relatively constant in light of the varying conditions within the system. (*Id.*) The '574 patent solved this problem by providing a novel system and method of controlling the fuel pressure within a fuel delivery system, using specifically identified components and sensors of the fuel system and corresponding feed forward and feedback control signals. (*See* Ex. 1001 at Abstract.)

IV. THE '574 PATENT

A. Overview of the '574 Patent

Petitioner oversimplifies the inventive concepts set forth in the challenged claims of the '574 patent stating, “the '574 patent relates to purported improvements

to systems used to control fuel pressure in internal combustion engines.” (Pet. at 4.) Contrary to Petitioner’s characterization, the ’574 patent describes and claims specific novel systems for controlling fuel pressure in a manner previously unheard of.

1. ’574 Patent Specification

Specifically, the ’574 patent teaches a method of controlling the fuel pressure within a fuel delivery system having a fuel pump that delivers fuel to a fuel rail of an internal combustion engine. The method generally includes providing a set-point fuel pressure, generating a feed forward signal having a set of fuel pump motor control parameters based upon the set-point fuel pressure and the desired fuel flow rate, providing a pressure sensor to measure the fuel rail pressure, comparing the fuel rail pressure to the set-point fuel pressure and generating an error value based upon the difference between the fuel rail pressure and the set-point fuel pressure, providing a feed back controller adapted to receive the error value and to generate a feed back control signal, and combining the feed back control signal and the feed forward control signal to generate a motor controller signal. (Ex. 1001 at Abstract.)

The invention claimed in the ’574 patent seeks to solve the problem of fuel variance within a [closed loop] fuel system that adapts to system variations such as part-to-part tolerance differences and wear. (*Id.* at 1:14-23.)

Figure 3, depicts an exemplary embodiment of the system:

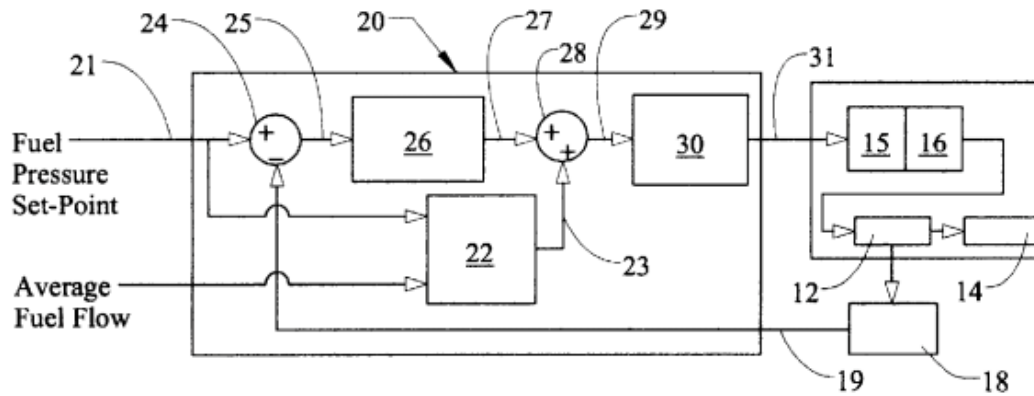


Fig. 3

FIG. 3, the fuel pump motor controller 20 is a processor that is adapted to control the fuel pump 16. Mainly, the fuel pump motor controller 20 controls the speed of a motor 15 that drives the fuel pump 16. The fuel pressure sensor 18 measures the pressure within the fuel rail 12. The fuel pump motor controller 20 receives the fuel pressure and calculates the difference between a set-point pressure and the fuel rail pressure. This difference is the fuel rail pressure error signal 25 which is used to control the fuel pump speed.

See (Id. at 2:45-52.)

The fuel pump motor controller (20) has several functions, including the following exemplary functions:

- Controlling the speed of the motor that drives the fuel pump. (*Id. at 1:57-58.*)
- Receiving the fuel pressure and calculating the difference between a set point pressure and the fuel rail pressure. (*Id. at 1:60-63.*)
- Receiving a set-point pressure signal. (*Id. at 2:3-5.*)

- Calculating and outputting a motor drive signal (calculated from the desired fuel pressure and average fuel flow demand) to the fuel pump motor. (*Id.* at 2:7-8.)
- Using a feedforward controller, a feedback controller, and fuel pump motor controller driver in a nested, closed loop servo control system. (*Id.* at 2:13-15.)

As set forth within the '574 patent, the presence of the particular feedforward system described and claimed in the '574 patent is an improvement over previously known systems because it measures important disturbance variables and takes corrective action before they upset the process of maintaining fuel pressure. (*Id.* at 2:32-36.) The exemplary motor drive signal responsible for performance is a result of a feed forward control signal and the feedback control signal processed in a series of summing junctions and using a motor controller signal. (*Id.* at 2:22-37.)

The claimed invention of the '574 patent provides an improvement over prior fuel systems because the modifications in the feed forward control signals derived from the feedback controller compensate for system variations due to, for example, part-to-part tolerances and system aging, and further can provide continuous adaptations. (*Id.* at 2:38-43.)

2. Challenged Claims of the '574 Patent

The Petitioner challenges claims 1-18 of the '574 patent.

The '574 patent has three independent claims (claims 1, 7, and 13) and fifteen dependent claims (claims 2-6, 8-12, and 14-18). (*Id.* at 3:61-4:67.)

Claim 1 recites:

1. A method of controlling the fuel pressure within a fuel delivery system having a fuel pump which delivers fuel to a fuel rail of an internal combustion engine comprising:

providing a set-point fuel pressure;

providing the estimated average fuel flow through the system;

generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow;

measuring the fuel rail pressure with a fuel pressure sensor;

filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors;

comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure and the set-point fuel pressure; and

modifying the feed forward control signal based upon the error signal thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor.

Claims 2-6 depend from claim 1 and recite additional features of the invention. (Ex. 1001 at 4:17-46.)

Claim 7 recites:

7. A fuel delivery system comprising:

a fuel rail adapted to deliver fuel to fuel injectors of an automotive vehicle, a fuel pump adapted to deliver fuel to said fuel rail, a fuel pressure sensor adapted to measure the fuel rail pressure, a low-pass filter adapted to filter the output of said fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors, and a fuel pump motor controller having:

a feed forward controller adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the average fuel flow through said system;

a first summing junction adapted to compare the fuel rail pressure to the set-point fuel pressure and to generate an error value based upon the difference between the fuel rail pressure and the set-point fuel pressure;

a feed back controller adapted to receive the error value and to generate a feed back control signal;

a second summing junction adapted to receive the feed back control signal from said feed back controller and the feed forward control signal from the feed forward controller and to modify the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal; and

a fuel pump motor controller driver adapted to receive the motor controller signal and to control the speed of said fuel pump based upon the motor controller signal.

Dependent claims 8-12 depend from claim 7 and recite additional features of the invention. (*Id.* at 5:10-27.)

Claim 13 recites:

13. A method of controlling the fuel pressure within a fuel delivery system having a fuel pump which delivers fuel to a fuel rail and fuel injectors of an internal combustion engine comprising:

providing a set-point fuel pressure;

providing the estimated average fuel flow through the system;

generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow;

measuring the fuel rail pressure with a fuel pressure sensor;

comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure and the set-point fuel pressure;

modifying the feed forward control signal based upon the error signal thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor;

detecting pulses in the signal from the fuel pressure sensor to establish when the fuel injectors open and close;

measuring the time between when an injector opens and closes to determine how long the injector is open;

using the injector flow rate and the injector open time to calculate the average fuel flow.

Claims 14-18 depend from claim 13 and recite additional features of the invention. (*Id.* at 6:14-6:39.)

B. Person of Ordinary Skill in the Art

The level of ordinary skill in the art applicable to the '574 patent around the time of the invention in 2001 is a person with (1) a B.S. in mechanical engineering or a closely related field with three or more years' experience in either engine systems or engine control systems or (2) at least a M.S. in mechanical engineering.

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).

Petitioner has not provided any terms for proposed claim construction.

Patent owner proposes the claim terms be given their plain and ordinary meaning.

VI. OVERVIEW OF CITED PRIOR ART

A. *Otterman*

In all six Counts of the Petition, the Petitioner relies on “Returnless Fuel Delivery Mechanism With Adaptive Learning,” U.S. Patent No. 5,505,180A (“*Otterman*”) as the primary reference. *Otterman* generally relates to “controlling the speed of a variable speed fuel pump in a returnless fuel delivery system includes a demand sensor, feedforward fuel pump values, adaptive adjustments corresponding to the feedforward values, a pump controller which controls the speed of the fuel pump, a timer, a steady demand indicator, a flow error accumulator, and an adjustor.” (Ex. 1004, Abstract.)

First, *Otterman* fails to disclose several limitations of the independent claims, including “providing a set-point fuel pressure;” providing the estimated average fuel flow through the system;” “generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow;” “measuring the fuel rail pressure with a fuel pressure sensor;” “filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors;” and “comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure and the set-point fuel pressure.” Because *Otterman* and the combination with other references entirely fails to disclose multiple elements of the challenged claims, the Petition’s assertion of obviousness should be rejected.

In addition, Claims 4 and 16 recite “monitoring the error signal” and “updating the feed forward controller after the error signal has stabilized”. (Ex. 1001 at 4:33-34; 6:29-31.) In contrast, *Otterman* generally teaches an adapting mechanism for controlling the speed of a variable speed fuel pump in a returnless fuel delivery system that includes a demand sensor, feedforward fuel pump values, adaptive adjustments corresponding to the feedforward values, a pump controller which controls the speed of the fuel pump, a timer, a steady demand indicator, a flow error accumulator, and an adjustor. (Ex. 1004 at 1:59-66.)

Unlike the claimed invention of the '574 patent, the system in *Otterman* (as shown in Figure 5 below) looks at the engine's fuel demand and chooses a corresponding feed forward value and combines this feed forward value with a corresponding adaptive adjustment and uses the combination to drive the fuel pump. (*Id.* at 1:66-2:4.)

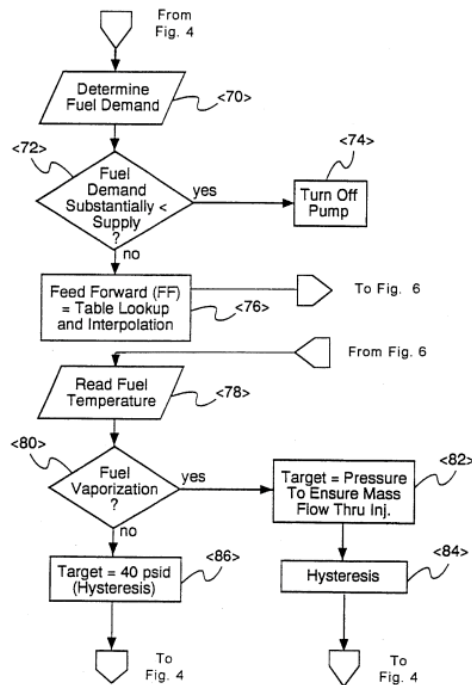
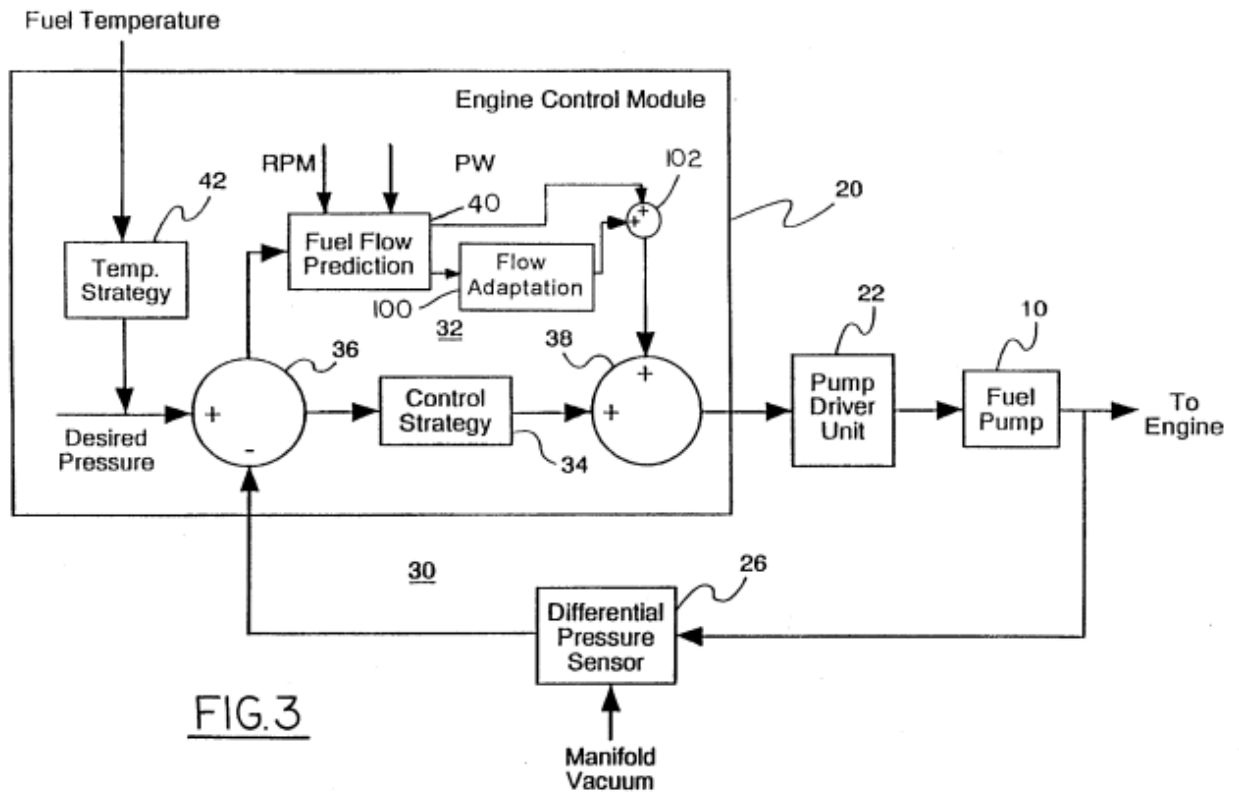


FIG.5

Further, *Otterman* monitors the average flow error (as shown in Figure 3 below) *over time and responds to repeated errors, and only after the average flow error has exceeded a predetermined threshold* does the system modify the fuel flow to offset the error. (*Id.* at 2:2-8.) This system is intended to track fundamental changes, not be continuously responsive to system changes as taught by the '574 patent. (*Id.* at 2:12-13.)



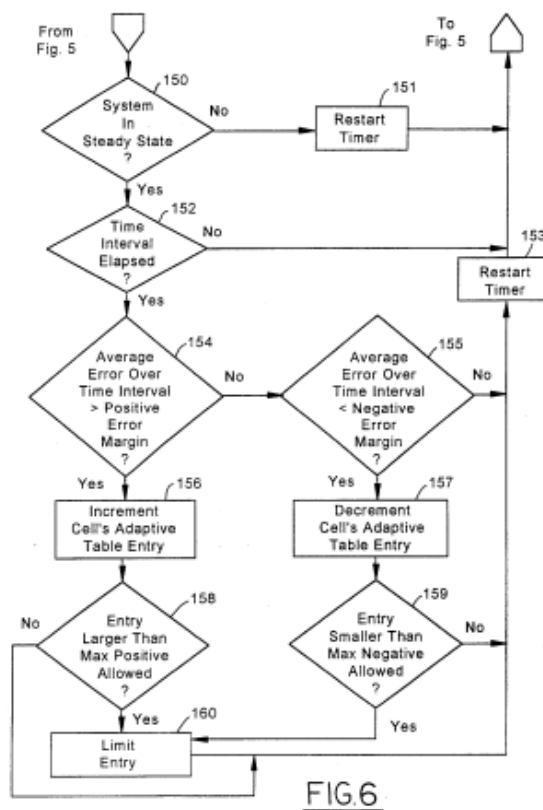
The *Otterman* specification discloses calculating “average flow error” “over a time interval” and “generating cumulative adaptive adjustments to the duty cycle” based on the fuel flow prediction block 40. (*Id.* at 4:9-24.)

The system in *Otterman* receives a fuel temperature input from a fuel temperature sensor 24 as well as input from a differential pressure sensor 26, which responds to intake manifold vacuum and to the pressure in fuel rail 16 to provide a differential pressure signal to module 20 that uses this information to determine the fuel pump voltage needed to provide the engine with optimum fuel pressure and fuel flow rate. (*Id.* at 2:59-65.) Where *Otterman* uses a series of sensors, for example, a fuel temperature sensor or a differential pressure sensor, in determining the desired

fuel pressure and flow rate, the claimed invention of the '574 patent is directed to generating a motor drive signal using the desired fuel pressure and average fuel flow demand. (Ex. 1001 at 2:7-12.)

Thus *Otterman* teaches away from “monitoring the error signal” and “updating the feed forward controller after the error signal has stabilized” as recited in claims 4 and 16 of the '574 patent. (*See generally* Ex. 1001.)

Otterman also does not teach an “adaptive learning controller” as recited in claim 10 of the '574 patent. Petitioner points to *Otterman*’s “adaptive learning improvement” and incorrectly states that it is an “adaptive learning controller”. (Petition at 75).



As highlighted above (and shown in Figure 6), the calculations in *Otterman* are computed “throughout the time interval over which an adjustment is to be computed.” (Ex. 1004 at 5:63-66.) This is distinguishable from the constantly updated values computed by the “adaptive learning controller” of claim 10. Therefore, Petitioner’s attempt to combine the teachings of *Otterman* with the discredited attempted combination of the teachings of *Heiko* and *Frischmuth* to meet the elements of claim 10 of the ’574 patent fails.

Accordingly, the system in *Otterman* “adapts the output of fuel flow prediction block 40 for changes in the system over time which manifest themselves as constant systematic or offset error.” (*Id.* at 4:12-15.) *Otterman* further teaches that adjustments in fuel flow should be made at time intervals based on systematic errors and fuel flow demand. (*Id.* at 5:55-6:24.)

Otterman alone or combined with *Hosoya*, *Greiner* or *Buckland* fails to disclose any of the claim elements recited in dependent claims 1-18.

B. *Hosoya*

Petitioner cites “Method Of And Apparatus For Controlling Fuel Injection Of Internal Combustion Engine,” U.S. patent No. 5,806,497 (“*Hosoya*”) as a secondary reference in four of its six Counts. (*See generally* Petition.) *Hosoya* discloses a method and apparatus for controlling fuel injection of internal combustion engines, by directly injecting fuel into each cylinder, where fuel pressures supplied to each

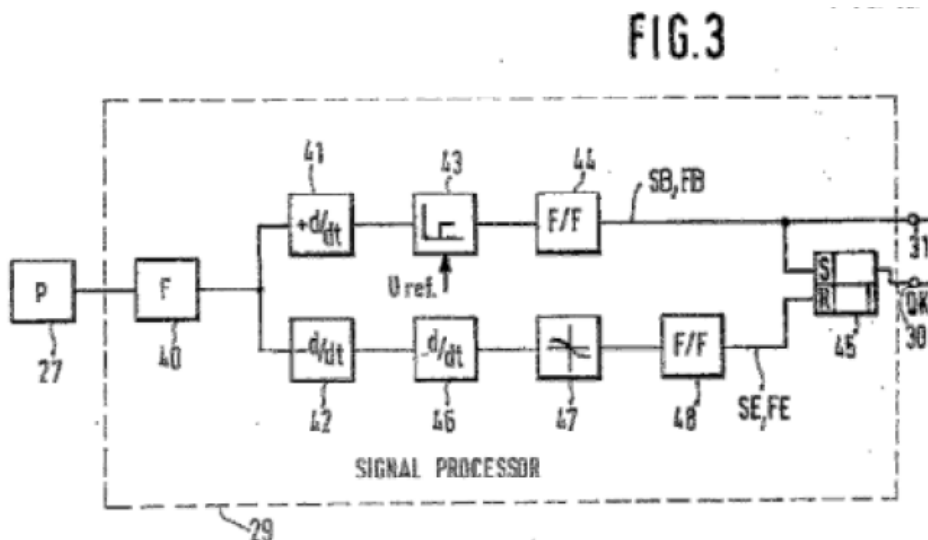
fuel injection valve are detected, and the fuel injection pulse width is detected according to the detected fuel pressures. (Ex. 1005 at Abstract.) *Hosoya* discloses applying a weighted average value for an engine's operational state. (*Id.* at 5:51-6:17.)

Hosoya is included in combination with *Otterman* to allegedly cure the deficiencies of *Otterman* in disclosing “filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors” as recited in the ‘574 claims. (Pet. at 31.) However, *Hoyosa* fails to disclose at least “filter[ing] out pulses due to the opening and closing of the fuel injectors,” because *Hoyosa* is directed to monitoring and adjusting an operational state of an engine, and any filtering is done based on engine rotational speed. (Ex. 1005 at 6:13-26.) Therefore, including *Hosoya* with any of the other asserted references does not render any claims of the ‘574 Patent obvious.

C. Greiner

Petitioner cited “Apparatus for detecting the fuel quantity delivered to the combustion chambers of a diesel engine,” U.S. Patent No. 4,426,981 (“Greiner”) as a tertiary reference in four of its six Counts. Greiner is directed to an apparatus for detecting the fuel quantity delivered to the combustion chambers of a diesel engine. (Ex. 1006.) As shown in Fig. 3, Greiner describes that a “pressure sensor 27 for detecting the fuel pressure emits its output signal to a signal processing

circuit 29 . . . which has two outputs 30 and 31 for the injected fuel quantity and the injection onset.” *Id.*, 2:21-26, Fig. 3.



Greiner describes an onset and end of an injection pulse, allegedly describing a fuel injection start and end. (*Id.* at 3:20-34.) Greiner is introduced to cure a deficiency in *Otterman* for Claim 13 - “detecting pulses in the signal from the fuel pressure sensor to establish when the fuel injectors open and close.” (Pet. at 55.) However, Greiner in combination with *Otterman* and/or *Hosoya* does not cure the missing limitations in the claims of the ‘574 Patent and a combination of *Otterman* and Greiner/*Hosoya* does not render claims 5-6 and 11-18 obvious.

D. *Buckland*

Petitioner cites “Engine/Vehicle Speed Control For Direct Injection Spark Ignition Engine Applications,” U.S. patent No. 6,349,700 (“*Buckland*”) to support its position that Claims 1-18 should be rendered obvious. (Pet. at 67.) *Buckland*

was cited as a reference during patent prosecution, and therefore, has already been considered. (Ex. 1001 at References Cited.) Petitioner relies on *Buckland* to supply a deficiency of “average fuel value” lacking in the other asserted references. (Pet. at 67.)

However, *Buckland* in combination with *Otterman*, *Hosoya* and Greiner does not aid to satisfy all of the elements missing in the asserted references and Petitioner’s obviousness arguments should be rejected.

VII. DISCRETIONARY FACTORS

A. The Petition Should Be Rejected Under the *Fintiv* Factors Because the Petitioner and the Patent Owner are Presently Engaged in Settlement Negotiations to Dismiss the Pending District Court Litigation

The *Fintiv* factors weigh in favor of discretionary denial. *Apple Inc. v.*

Fintiv, Inc., IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential).

Petitioner and Patent Owner are actively engaged in settlement discussions in the related district court action. In fact, Patent Owner asked for, and Petitioner agreed with (and the Patent Board allowed) a seven day extension of time to file a POPR for IPR2023-01031, IPR2023-01234 and IPR2023-01224, three other patents upon which Petitioner filed IPR Petitions against MMT’s patents. The extension was requested at least in part on the basis that “Patent Owner MMT is in discussions with Petitioner BMW NA to dismiss the pending lawsuit *Michigan Motor Technologies LLC, v Bayerische Motoren Werke AG, and BMW of North America,*

LLC Civil Action No. 1:22-cv-3804-SCS-MV in the Northern District of Illinois.”
(Ex. 2001.)

A settlement and dismissal of the related district court action is expected long before a Final Written Decision is expected, in February 2025. (Pet. at 70.) Discretionary denial of the Petition would serve judicial economy in this matter and avoid the Board expending resources in continuing the process at this point. Therefore, this factor weights in favor of discretionary denial under *Fintiv*.

B. The Petition Should Be Rejected Under §325(D) Because Cited References Were Presented in a Prior IPR And Patent Prosecution

Ottermann was considered by the PTAB in the Volkswagen IPR, as discussed *infra*. In the Volkswagen IPR, *Ottermann* was a secondary reference in all four Counts raised. Here, *Ottermann* has been elevated to a primary reference in all six Counts presented in the Petition. The Board in the Volkswagen IPR did not consider *Ottermann* to be sufficient in combination with the other references in that IPR and denied institution of the Volkswagen IPR. Moreover, *Buckland* was cited in the prosecution history of the ‘574 Patent and acknowledged by Petitioner as such. (See Pet. at 68.)

The Board should come to the same conclusion as the Volkswagen IPR in the instant Petition and therefore the Board should deny institution under § 325(d).

**VIII. THE PETITION SHOULD BE REJECTED UNDER § 314(A)
BECAUSE PETITIONER IS UNLIKELY TO PREVAIL WITH
RESPECT TO ANY CHALLENGED CLAIM**

The Board should decline review under 35 U.S.C. § 314(a) because as set forth in more detail below, there is no likelihood that Petitioner will prevail with respect to any challenged claim.

A. Grounds 1-3 of the Petition Fail: Claims 1-18 Are Not Rendered Obvious by Combining *Otterman* and *Hosoya* and *Greiner*

Ground 1 challenges claims 1-4 and 7-10 under a combination of *Otterman* and *Hosoya*. Ground 2 challenges claims 13-16 under a combination of *Otterman* and *Greiner*. Ground 3 challenges claims 5-6, 11-12 and 17-18 under the combination of *Otterman*, *Hosoya* and *Greiner*.

- i. Ground 1 – *Otterman* in combination with *Hosoya* does not render claims 1-4 and 7-10 obvious.

Neither *Otterman* nor *Hosoya* disclose several limitations of independent claims 1 and 7 and therefore cannot render obvious these claims. For claim 1, *Otterman* in combination with *Hosoya* fails to disclose “providing a set-point fuel pressure” (Element 1[a]). Petitioner alleges that *Otterman* discloses “providing a set-point fuel pressure” (Element 1[b]) where *Otterman* discloses “a desired fuel pressure” as the “desired ‘differential’ pressure” in *Otterman*. (Pet. at 23.) However, neither the claim limitation nor the specification of the ‘574 Patent recites

or specifies a “differential pressure.” Therefore, *Otterman* does not disclose Element 1[a].

Petitioner alleges that *Otterman* discloses “providing the estimated average fuel flow through the system.” (*Id.* at 24-25.) Petitioner claims *Otterman* discloses a “fuel flow prediction block 40 to predict mass fuel flow demanded.” (*Id.*) But, *Otterman* does not anywhere disclose “providing the estimated **average** fuel flow” as recited in Element 1[b]. Petitioner continues that “[a] POSITA would appreciate that ‘to determine the average flow error over time, the PID [proportional integral derivative] device [in *Otterman*] would also determine the average fuel flow.’” However, this conclusion does not necessarily follow and pulls “average fuel flow” out of thin air without support in the claim language or the specification. Therefore, *Otterman* does not disclose Element 1[b].

Petitioner alleges that *Otterman* discloses “generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow.” (Element 1[c]) (Pet. at 27-28.) However, because *Otterman* fails to disclose “the set-point fuel pressure and the average fuel flow” as discussed in relation to Elements 1[a] and 1[b] *infra*, *Otterman* does not disclose “generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow.”

Petitioner alleges that *Otterman* discloses “measuring the fuel rail pressure with a fuel pressure sensor” (Element 1[d]) because a “POSITA would appreciate

that the ‘differential pressure signal’ provided by the differential pressure sensor 26, as disclosed in *Otterman*, is ‘the pressure of the fuel rail relative to a reference manifold pressure.’” However, neither the language of Element 1[d] or the specification of the ‘574 Patent recites “differential pressure.” Therefore, *Otterman* does not disclose Element 1[d].

Petitioner alleges that *Otterman* in combination with *Hosoya* discloses “filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors.” (Element 1[e]) (Pet. at 31.) Petitioner argues that “*Otterman* discloses a PID device with an “integral function whose output represents the average error over time between the desired fuel flow and the system’s actual fuel flow,” so that “*Otterman* describes smoothing or averaging the difference between the desired fuel flow and the measured fuel flow.” (*Id.*) However, it does not follow logically that a PID integral function in *Otterman* is a “filtering” as alleged by Petitioner.

Petitioner then relies on *Hosoya* to argue that “*Hosoya* similarly provides using a variety of approaches, including weighted averaging and using a low pass filter to remove the pulses due to the opening and closing of the fuel injectors,” (*id.*) thus disclosing Element 1[e] with the combination of *Otterman* and *Hosoya*. However, *Hosoya* does not disclose “filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors” because

Hosoya discloses applying a low-pass filter with a cut-off frequency based on engine rotational speed, rather than “opening and closing of the fuel injectors” as recited in Element 1[d]. (*Hosoya*, Ex. 1008 at 6:19-26.) Therefore, *Otterman* in combination with *Hosoya* does not disclose or suggest the limitations of Element 1[e].

Petitioner argues that *Otterman* discloses Element 1[f], “comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure and the set-point fuel pressure” because *Otterman* teaches that “the comparator 36 provides an “error output . . . which represents the difference between a desired differential pressure input and the actual differential pressure as input from a differential pressure sensor 26.” (Pet. at 32.) However, as discussed *infra* for Elements 1[a] and 1[d], neither the claim language nor the specification of the ‘574 Patent recite “differential pressure” for “fuel rail pressure” or “set-point fuel pressure.” Therefore, *Otterman* does not disclose the limitations of Element 1[f].

Therefore, for at least these reasons, neither *Otterman* nor *Hosoya*, alone or in combination, disclose or suggest all the limitations of Independent Claim 1.

Petitioner’s arguments for dependent claims 2-4 fail as well for at least the reason that *Otterman* in combination with *Hosoya* discloses all the limitations of the independent claim 1 from which claims 2-4 depend from. In addition, *Otterman* does not disclose all of the limitations of claim 4 – “[t]he method of claim 3 further

including monitoring the error signal, and updating the feed forward controller after the error signal has stabilized and is below a pre-determined level.”

Otterman teaches away from “monitoring the error signal” and “updating the feed forward controller after the error signal has stabilized” as recited in claims 4 and 16 of the ’574 patent. (*See generally* Ex. 1001.)

The system in *Otterman* “adapts the output of fuel flow prediction block 40 for changes in the systems over time which manifest themselves as constant systematic or offset error.” (Ex. 1008 at 4:12-15.) *Otterman* further teaches that adjustments in fuel flow should be made at time intervals based on systematic errors and fuel flow demand. (*Id.* at 5:55-6:24.)

As such, *Otterman* alone or combined with *Hosoya* fails to disclose any of the claim elements recited in dependent claim 4.

Independent Claim 7 (of Ground 1) recites substantially the same limitations as Claim 1 – “a fuel rail adapted to deliver fuel to fuel injectors of an automotive vehicle, a fuel pump adapted to deliver fuel to said fuel rail, a fuel pressure sensor adapted to measure the fuel rail pressure, a low-pass filter adapted to filter the output of said fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors, and a fuel pump motor controller.” Petitioner argues again that *Otterman* in combination with *Hosoya* discloses these limitations. And, for the same arguments made before for Elements 1[a]-1[e] (*see infra*), Petitioner fails to show

that *Otterman* in combination with *Hosoya* discloses all the limitations of Independent Claim 7.

Petitioner's arguments for dependent claims 8-10 fail as well for at least the reason that *Otterman* in combination with *Hosoya* discloses all the limitations of the independent claim 7 from which claims 8-10 depend from.

In addition, *Otterman* also does not teach an "adaptive learning controller" as recited in claim 10 of the '574 patent. Petitioner points to *Otterman's* "adaptive learning improvement" and incorrectly states that it is an "adaptive learning controller". (Petition at 49). The "adaptive learning controller" recited in dependent claim 10 of the '574 patent operates continuously and not as a function of calculated time intervals and the combination of *Otterman* with *Hosoya* does not render claim 10 of the '574 patent obvious for that reason alone. (*Id.*)

- ii. Ground 2 – *Otterman* in combination with *Greiner* does not render claims 13-16 obvious

Independent claim 13 recites, among other limitations:

- providing a set-point fuel pressure;
- providing the estimated average fuel flow through the system;
- generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow;
- measuring the fuel rail pressure with a fuel pressure sensor; and

comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure and the set-point fuel pressure.

These limitations are the same as those argued in Ground 1 for claim 1. The addition of *Greiner* in combination with *Otterman* does not, and Petitioner does not argue as such, supply any support lacking in claim 1 as argued above. For the same reasons as discussed in relation to Claim 1 *infra*, the combination of *Otterman* with *Greiner* does not render independent claim 13 obvious.

Dependent claims 14-16 are also not rendered obvious by the combination of *Otterman* with *Greiner*, because Petitioner has failed to show that the combination of *Otterman* with *Greiner* discloses all the limitation of independent claim 13.

In addition, *Otterman* in combination with *Greiner* does not render claim 16 - “[t]he method of claim 15 further including monitoring the error signal, and updating the feed forward controller after the error signal has stabilized and is below a pre-determined level” - obvious, for the same reasons argued above with respect to claim 4. The addition of *Greiner* does not supply, nor does Petitioner argue that, any lack of support in the asserted references for claim 16 is cured by the combination of *Otterman* and *Greiner*.

Therefore, Petitioner’s Ground 2 fails to render claims 13-16 obvious under the combination of *Otterman* with *Greiner*.

- iii. Ground 3 - *Otterman* in combination with *Hosoya* and *Greiner* does not render claims 5-6, 11-12 and 17-18 obvious

Dependent claims 5-6 depend from claim 1. Dependent claims 11-12 depend from claim 7. Dependent claims 17-18 depend from claim 13. Because *Otterman* in combination with *Hosoya* or *Otterman* in combination with *Greiner* do not disclose all of the limitations of the independent claims as argued above, *Otterman* with *Hosoya* and *Greiner* does not disclose all the limitations of the dependent claims 5-6, 11-12 and 17-18. Therefore, Ground 3 fails to show that claims 5-6, 11-12 and 17-18 are obvious.

B. Grounds 4-6 of the Petition Fail: Claims 1-18 Are Not Rendered Obvious by Combining *Otterman* and *Hosoya* and *Greiner* with *Buckland*

Petitioner argues that, to the extent that *Otterman*, *Hosoya* or Gartner alone or in combination do not disclose providing “an estimated average fuel flow,” *Buckland* supplies support for this limitation. (Pet. at 67.) Therefore, Petitioner argues that *Buckland* added to Grounds 1, 2, and 3 for the “estimated average fuel flow” limitation renders claims 1-18 obvious. (*Id.*)

Buckland still fails to supply all of the limitations missing in independent claims 1, 7 and 13, nor does Petitioner argue, except for disclosing “an estimated fuel flow,” that *Buckland* supplies deficiencies in *Otterman*, *Hosoya* or *Greiner* as argued above.

Therefore the combination of *Buckland* with either *Otterman* and *Hosoya*, *Otterman* and *Greiner* or *Otterman* and *Hosoya* and *Greiner* does not render claims 1-18 obvious.

IX. CONCLUSION

For the foregoing reasons, the Petition to institute *inter partes* review of any claim of the '574 patent should be denied.

Dated: November 15, 2023

DEVLIN LAW FIRM LLC

/s/ Timothy Devlin

Timothy Devlin

Registration No. 41,706

1526 Gilpin Ave.

Wilmington, DE 19806

(302)-449-9010

tdevlin@devlinlawfirm.com

TD-PTAB@devlinlawfirm.com

Attorney for Patent Owner

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that there are 7,160 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,

/s/ Timothy Devlin

Timothy Devlin
Registration No. 41,706
DEVLIN LAW FIRM LLC
1526 Gilpin Ave.
Wilmington, DE 19806
(302)-449-9010
tdevlin@devlinlawfirm.com
TD-PTAB@devlinlawfirm.com
Attorney for Patent Owner

CERTIFICATE OF SERVICE

I hereby certify that on November 15, 2023, 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.

Counsel for the Petitioner BMW of North America, Inc.

Edward H. Sikorski
Reg. No. 39,478
DLA Piper LLP (US)
4365 Executive Drive, Suite 1100
San Diego, California 92121-2133
Phone: 619.699.2645
Fax: 858.677.1401
Email:
ed.sikorski@us.dlapiper.com

Brian Biggs (pro hac vice application forthcoming)
DLA Piper LLP (US)
1201 N. Market St., Suite 2100 Wilmington, Delaware
19801-1147
Phone: 302.468.5661
Fax: 302.778.7935
Email:
brian.biggs@us.dlapiper.com

Matthew S. Middleton
Reg. No. 77,117
DLA Piper LLP (US)
1201 N. Market St., Suite 2100
Wilmington, Delaware
19801-1147
Phone: 302.468.5675
Fax: 302.778.7935
Email: matthew.middleton@us.dlapiper.com

Respectfully submitted,

/s/ Timothy Devlin

Timothy Devlin

Registration No. 41,706

DEVLIN LAW FIRM LLC

1526 Gilpin Ave.

Wilmington, DE 19806

(302)-449-9010

tdevlin@devlinlawfirm.com

TD-PTAB@devlinlawfirm.com

Attorney for Patent Owner