UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BMW of North America, LLC,
Petitioners

v.

Michigan Motor Technologies LLC,
Patent Owner

Case IPR2023-01032
Patent No. 6,581,565

PATENT OWNER'S PRELIMINARY RESPONSE

Under 35 U.S.C. § 42.107

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TABLE OF CONTENTS

I. INTRODUCTION 1
II. APPLICABLE LEGAL PRINCIPLES 4
III. THE '565 PATENT 7
A. Challenged Claims 11
IV. CLAIM CONSTRUCTION 13
V. OVERVIEW OF CITED PRIOR ART 13
A. Suzuki, Scherer and Cullen 13
B. Takahashi 17
VI. DISCRETIONARY FACTORS 18
VII. THE PETITION SHOULD BE REJECTED UNDER § 314(A) BECAUSE PETITIONERS ARE UNLIKELY TO PREVAIL WITH RESPECT TO ANY CHALLENGED CLAIM 20
A. All Grounds of the Petition Fail: Claims 1-7 Are Not Rendered Obvious by *Suzuki*, *Cullen* and *Scherer* 20
B. Petitioners do not demonstrate Ground 2 of the Petition Because Claims 2, 3, 5 and 6 Are Not Rendered Obvious by *Suzuki*, *Cullen, Scherer* and *Takahashi* 25
VIII. CONCLUSION 27

TABLE OF AUTHORITIES

Cases

Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH,
IPR2019-01469, Paper 6 (Feb. 13, 2020) 20

Apple Inc. v. Contentguard Holdings, Inc.,
IPR2015-00442, Paper 9 (PTAB July 13, 2015) 5, 6, 8

ATD Corp. v. Lydall , Inc.,
159 F.3d 534 (Fed. Cir. 1998) 26

Becton, Dickinson & Co. v. B. Braun Melsungen AG,
IPR2017-01586, Paper 8 (Dec. 15, 2017) 21

Graham v. John Deere Co.,
383 U.S. 1 (1966) 5

In re Magnum Oil Tools Int'l.,
829 F.3d 1364 (Fed. Cir. 2016) 5, 6

In re NTP, Inc.,
654 F.3d 1279 (Fed. Cir. 2011) 8

In re Omeprazole Patent Litig. v. Apotex Corp.,
536 F.3d 1361 (Fed. Cir. 2008) 7

In re Stepan Co.,
868 F.3d 1342 (Fed. Cir. 2017) 7

InTouch Techs., Inc. v. VGo Communs., Inc.,
751 F.3d 1327 (Fed. Cir. 2014) 7

KSR Int'l Co. v. Teleflex Inc.,
550 U.S. 398 (2007) 8

KSR Int'l Co. v. Teleflex Inc.,
550 U.S. 398 (2007) 8

Ortho-McNeil Pharm. v. Mylan Labs,
520 F.3d 1358 (Fed. Cir. 2008) 8

P&G v. Teva Pharms. USA, Inc.,
566 F.3d 989 (Fed. Cir. 2009) 8

SAS Institute Inc. v. Iancu,
138 S. Ct. 1348 (2018) 5

Unified Patents Inc. v. C-Cation Techs., LLC,
IPR2015-01045, Paper 15 (PTAB Oct. 7, 2015) 5

Unigene Labs., Inc. v. Apotex, Inc.,
655 F.3d 1352 (Fed. Cir. 2011) 6

Statutes

35 U.S.C. § 103 5

35 U.S.C. § 325 ..... 9, 16, 17, 20

35 U.S.C. 282 14

37 C.F.R. § 42.100 15

37 C.F.R. § 42.107 1

Petitioners Mercedes-Benz USA, LLC[1] and BMW of North America, LLC. ("Petitioners") filed a Petition for *Inter Partes* Review of U.S. Patent No. 6,581,565 ("the '565 patent") on June 1, 2023. (IPR2023-01132 Paper No. 1 ("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).

I. INTRODUCTION

Patent Owner, MMT, respectfully requests that the Board deny the Petition because Petitioners 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.

Specifically, Petitioners have not demonstrated a reasonable likelihood that any claim of the '565 patent would be obvious in view of the *Suzuki* (Exhibit 1005), *Cullen* (Exhibit 1006), *Scherer* (Exhibit 1007) and/or *Takahashi* (Exhibit 1008) references upon which they rely. For each ground, Petitioners rely upon *Suzuki* as a primary reference. For Grounds 1 and 2, Petitioners rely upon *Cullen* as a secondary reference and *Scherer* as a tertiary reference. For Ground 2, Petitioners also rely on *Takahashi* as a quaternary reference.

[1] Mercedes-Benz USA, LLC has moved to withdraw from the IPR after a settlement with MMT. (Paper 9)

The '565 patent was previously the subject of an IPR petition in 2020, filed by Volkswagen Group of America, Inc. (IPR2020-00445 or the "Volkswagen IPR"), using the same references *Suzuki*, *Scherer* and *Takahashi* as in the instant Petition. Petitioners here exchange the primary reference in the Volkswagen IPR, *Robichaux*, with the *Suzuki* reference and add an additional reference in combination with *Suzuki* - along with the *Scherer* and *Takahashi* references asserted in the Volkswagen IPR - to assert that that the '565 Patent is rendered obvious, but still do not demonstrate a reasonable likelihood of obviousness.

Moreover, Petitioners' attempt to put forth *Scherer* as a prior art reference is now the *third* time this reference has been evaluated against the '565 patent. The *Scherer* reference was first considered by the Examiner in the prosecution of the '565 patent. Next, the Volkswagen IPR raised *Scherer* as well.

The '565 patent

The '565 patent teaches and the challenged claims of the '565 patent encompass a device controlling torque output of an engine. (Ex. 1001 at 4:1-22.). The device includes a comparator that produces a difference signal representing the difference between (1) a desired torque signal and (2) a signal representing an estimate of the current torque. (*Id.*) The device uses high-pass filters to filter the "difference signal" to eliminate low frequency components. (*Id.*) A transient torque controller receives as an input the high-pass filtered difference signal and

outputs a fuel adjustment signal and a spark adjustment signal. (Ex. 1001 at 4:1-22.)

Suzuki

Suzuki is a primary 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.)

Cullen

Cullen is a secondary reference which discloses an engine controller for "inferring and predicting engine torque [as] a function of . . . speed . . . air/fuel ratio and spark advance." (Ex. 1006 at Abstract.)

Scherer

Scherer is a tertiary reference which discloses a process and an apparatus for controlling the engine torque of an internal combustion engine by regulating the ignition point in an Otto (*i.e.*, gasoline) engine, or by regulating the start and the duration of the fuel injection in a diesel engine. (Ex. 1007 at Abstract, 1:7-11.) *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.

Takahashi

Takahashi is a quaternary reference. It teaches control of 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 1:5-9.)

Takahashi 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." (*Id*. at 1:5-9.) The target torque is used to control the fuel injection and electronic throttle control.

Petitioners' proposed combination of *Suzuki*, *Cullen*, *Scherer* and *Takahashi* to purportedly render obvious the challenged claims of the '565 patent fails because (1) no references disclose critical limitations of the challenged claims, and (2) petitioners rely on impermissible hindsight in a misguided attempt to piece together the elements of the claimed invention using the challenged claims and disclosure of the '565 patent as a blueprint or roadmap for doing so.

In sum, to support its obviousness analysis, Petitioners attempt to modify *Suzuki*, which is cumulative of the admitted prior art of record, by using *Cullen*, a cumulative prior art reference and a teaching of *Scherer*, which is already of record, to arrive at a claimed combination that neither of these references discloses.

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)). Petitioners have the burden to show that it is likely to prevail as to at least one claim of the '565 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).

Petitioners also have 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) (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).

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. THE '565 PATENT

The '565 patent generally relates to an engine torque controller for a 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. (*Id*. 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 is a block diagram of a torque producer, in accordance with the '565 patent:

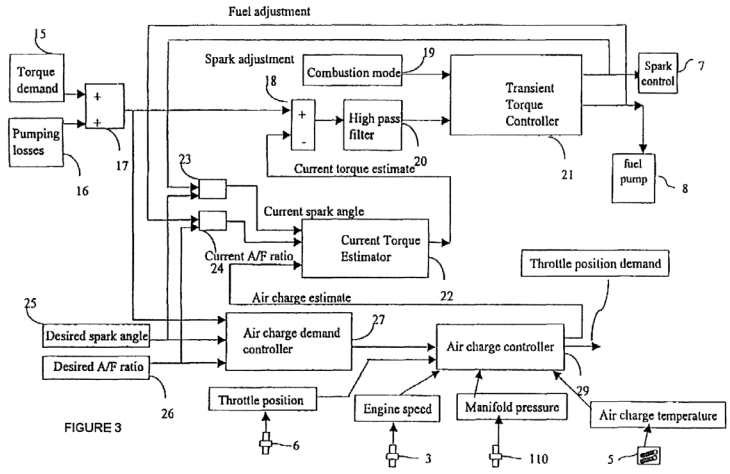

FIGURE 3

As the patent explains,

> The 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 controlling the engine torque 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.

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. 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. The error or difference signal is generated by subtracting the current torque estimate from the torque demand signal. 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 and only allows larger differences to pass through to the transient torque controller. In this way, 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.

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. 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 at 1:36-45.) This disclosure constitutes the "admitted prior art" of the '565 patent.

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

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

A. Challenged Claims

Petitioners challenge 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.

(Ex. 1001 at 4:1-23.)

Dependent claims 2-6 recite additional features. (*Id*. at 4:24-51.)

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.

(*Id*. at 4:52-65.)

B. Person 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 2001 is a person with (1) a B.S. in mechanical engineering or a closely related field 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. 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).

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 Petitioners.

V. OVERVIEW OF CITED PRIOR ART

A. Suzuki, Scherer and Cullen

In both Grounds of the Petition, Petitioners rely on U.S Patent No. 6,006,717, titled "Direct-Injection Spark-Ignition Type Engine Control Apparatus" ("*Suzuki*") as the primary reference, U.S. Patent No. 5,241,855, titled "Method And Apparatus For Inferring Engine Torque" ("*Cullen*") as a secondary reference and U.S. Patent No. 6,047,681, titled "Process and Apparatus for Adjusting the

Torque of an Internal Combustion Engine" ("*Scherer*") as a tertiary reference. (Paper 1 at 29 and 70.)

1. Suzuki

Suzuki discloses a method of torque control of a DISI engine. The torque control method of *Suzuki* covers the engine combustion operation of both stratified and homogeneous modes. Torque correction is realized by controlling spark timing for torque correction in homogeneous combustion operation and air/fuel ratio during stratified combustion operation.

Suzuki thus discloses what the '565 patent admits 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 produced." (Ex. 1001 at 1:36-45.) Thus, *Suzuki* is merely cumulative of the prior art of record as well as the disclosure of the prior art in the '565 patent, and should not be considered under 35 U.S.C. § 325(d).

Further, *Suzuki* does not 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" (*Id*. at Claim 1) or "filtering out a plurality of low frequency components from the difference signal" (*Id*. at Claim 7) as disclosed in the '565 patent.

2. Cullen

Cullen is a secondary reference which discloses an engine controller for "inferring and predicting engine torque [as] a function of . . . speed . . . air/fuel ratio and spark advance." (Ex. 1006 at Abstract.)

Cullen purportedly discloses

> a predicted torque calculation [that] can be made more accurate by predicting the air conditioning torque requirement versus head pressure, power steering torque requirements versus power steering pressure switch, cold engine friction versus time since start and engine coolant temperature, green engine friction versus total engine revolutions since new, and the influence of non-gasoline fuels like methanol measured by a percent methanol sensor.

Id. at 2:32-41.

Therefore, *Cullen* is also cumulative of the prior art of record, as discussed by the '565 patent. Moreover, *Cullen* does not disclose a high pass filter (or a filter of any kind), a necessary limitation in the '565 patent claims. For those reasons, *Cullen* should not be considered under 35 U.S.C. § 325(d).

3. Scherer

Scherer is directed to a system and method for controlling engine torque by regulating the ignition point and air flow rate of an Otto (*i.e.,* gasoline) engine, or

by regulating the start and duration of fuel injection in a diesel engine. *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.

One major shortcoming of *Scherer* is that there is no consideration of a stratified charge operation mode for a DISI engine as the '565 patent teaches and the challenged claims of the '565 patent require, and *Scherer* teaches diesel engine control, which the '565 does not teach or claim. Thus, for at least these two reasons, *Scherer* "teaches away" from the challenged claims of the '565 patent. A second major shortcoming of *Scherer* is that it only filters a desired engine torque signal, which is an input to a comparator, and does not high-pass filter "the difference signal," which is the output of a comparator.

Scherer does disclose homogeneous operation of a spark ignition engine but fails to consider the stratified charge operation of a DISI engine. Another fundamental flaw of *Scherer* as it relates to obviousness is that even though a high-pass filter is disclosed, it is not employed in the unique manner of the teachings and challenged claims of the '565 patent. *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.) *Scherer* thus only filters a desired engine torque signal, which is an input to a

comparator, and does not high-pass filter "the difference signal," which is the output of a comparator.

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.) 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." (*Id*. at 3:35-37.) This is markedly different and patentably distinct from what *Scherer* teaches.

Finally, *Scherer* is prior art of record and has already been considered by the patent examiner during prosecution of the '565 patent, and so should not be considered under 35 U.S.C. § 325(d).

For at least the above-stated reasons, a POSITA would not consider combining *Cullen* and *Scherer* with *Suzuki* because they teach away from each other and teach away from the challenged claims of the '565 patent.

B. Takahashi

U. S. Patent No. 5,282,449 titled "Method and System for Engine Control" ("*Takahashi*"), is a quaternary reference cited by Petitioners for Ground 2. (Paper 1 at 70.) *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 1:5-9.) *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. The target torque is used to control the fuel injection and electronic throttle control. (*Id*. at 6:13-17.) *Takahashi* is combined with *Suzuki*, *Cullen* and *Scherer* for Ground 2 to allegedly render obvious claims 2, 3, 5 and 6 of the '565 patent.

VI. DISCRETIONARY FACTORS

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).

In *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (Feb. 13, 2020) (designated precedential on March 24, 2020), the PTAB established a "two-part framework" for determining whether § 325(d) applies: "(1) whether the same or substantially the same art previously was presented to the [Patent] Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of first part of the framework is satisfied,

whether the [IPR] petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims."

According to *Advanced Bionics*, "[i]f a condition in the first part of the framework is satisfied and the petitioner fails to make a showing of material error, the Director generally will exercise discretion not to institute inter partes review. If reasonable minds can disagree regarding the purported treatment of the art or arguments, it cannot be said that the Office erred in a manner material to patentability."

Whether previously presented art or argument is "substantially the same" as that asserted in the IPR petition can be evaluated using "factors (a), (b) and (d)" from the PTAB's prior precedential decision *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 (Dec. 15, 2017), *i.e.*, (a) the similarities and material differences between the asserted art and the prior art involved during examination 1; (b) the cumulative nature of the asserted art and the prior art evaluated during examination; and (d) the extent of the overlap between the arguments made during examination and the manner in which petitioner relies on the prior art.

Here, Petitioners assert the same reference, *Suzuki*, as in the Volkswagen IPR, as well as the same combining references *Scherer* and *Takahashi*. Petitioners in the instant IPR swap out *Robichaux* – the primary

reference in the Volkswagen IPR – with *Suzuki*, a secondary reference in the Volkwagen IPR with even less relevance to the '565 patent than *Robichaux*. In addition, *Scherer* was considered by the U.S.P.T.O. during the prosecution of the '565 patent – this is the *third* time Scherer is put forth as an alleged prior art reference for the '565 patent.

The newly introduced asserted reference, *Cullen*, is substantially similar and cumulative of the references asserted in the Volkswagen IPR. Moreover, Petitioners have failed to demonstrate that the Office erred in prosecution before the Patent Office in a manner material to the patentability of challenged claims.

VII. THE PETITION SHOULD BE REJECTED UNDER § 314(A) BECAUSE PETITIONERS ARE 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 Petitioners will prevail with respect to any challenged claim of the '565 patent.

A. All Grounds of the Petition Fail: Claims 1-7 Are Not Rendered Obvious by *Suzuki*, *Cullen* and *Scherer*

1. *Suzuki*, *Cullen* and *Scherer* do not disclose or suggest all of the limitations of the challenged claims

The asserted references *Suzuki*, *Cullen* and *Scherer* critically do not disclose or suggest all of the claimed limitations in the '565 patent. Petioners admit that *Suzuki* does not explicitly disclose a high pass filter, required by claim 1. (Paper 1

at 33.) At most, Petitioners hang their hat on *Suzuki* by stating "Suzuki's processing of the torque correction demand signal into either a spark timing correction signal or an air/fuel ratio adjustment signal generates an exponential decay curve." (*Id*.)

Cullen does not disclose a high pass filter—or use of the word "filter" —nor do Petitioners assert that *Cullen* discloses use or suggestion of a high-pass filter. Instead, Petitioners raise *Scherer*, previously considered in both the prosecution of the '565 patent and the Volkswagen IPR, to supply the missing high-pass filter lacking in both *Suzuki* and *Cullen*.

The fundamental flaw in Petitioners' analysis 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*, as Petitioners admit, only discloses "a torque controller that adjusts torque output through correcting spark timing for homogeneous engine operation or fuel delivery for heterogeneous (i.e., stratified-charged) engine operation." (Paper 1 at 16.) *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. (Exhibit 1007 at 4:31-45 and Figure 1.)

In contrast, 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." (*Id*. at 3:29-39.) 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." (*Id*. at 3:41-42.) *Scherer* does not teach the use of this type of high pass filtered signal.

2. There is no motivation to combine *Cullen* and *Scherer* with *Suzuki*

A POSITA would not consider combining *Cullen* and *Scherer* with *Suzuki* because they teach away from each other and from the challenged claims of the '565 patent as shown below.

Petitioners assert, " . . . the claims recite well-known components such as a controller for generating a demanded torque, an estimator for estimating current torque, a comparator for outputting the difference between demanded torque and estimated torque, a high pass filter, and a transient controller for outputting fuel and spark adjustment signals based on the filtered difference signal. . . . [E]ngines with these components were well known in the prior art years before the '565 patent's priority date." (Paper 1 at 3.) Petitioners further assert that "[a] POSITA viewing *Suzuki*'s torque control system would have been motivated to include an estimator as described in claim 1 of the '565 patent and high pass filtering based on the teachings of *Cullen* and *Scherer*, respectively." (*Id*. at 31.)

As is generally recognized, almost all inventions comprise a combination of elements that each were independently known in the prior art. Petitioners argue that a POSITA would have been well-aware of the prior art references being relied upon by Petitioner. (*Id*.) However, the mere fact that the inventors of these prior art references were inarguably at least POSITAs but did not themselves think to combine the individually known elements to arrive at the particularly claimed combination 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.

By combining particular elements of the prior art references in a particular manner such that a POSITA would arrive at a claimed combination that has distinct advantages over the prior art, the Petitioners are using impermissible hindsight reasoning to find any prior art references that fit the '565 patent. The "[d]etermination of obviousness cannot be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention." *ATD Corp. v. Lydall , Inc.*, 159 F.3d 534, 546 (Fed. Cir. 1998). That the inventors did not themselves think to combine the individually known elements in the prior art to arrive at the particularly claimed combination to achieve these admitted advantages is itself the best, most objective, and most contemporaneous evidence of non-obviousness of the claimed invention In short,

the realization that the claimed combination of elements of the challenged claims would yield these distinct advantages over the prior art is what the three co-inventors of the '565 patent recognized, but which the prior art inventors did not.

Petitioners state the following regarding *Cullen* and *Suzuki*:

> A POSITA would have been motivated to use an estimator with Cullen's spark and fuel inputs in Suzuki because Suzuki expressly teaches adjusting either spark timing (Ex. 1005 at FIG. 6 (S38)-(S39)) or air/fuel ratio (id. at FIG. 6 (S34)) to adjust the engine's torque output. Ex. 1003 at ¶¶ 61-64. A POSITA would understand that including spark and fuel inputs like those taught by Cullen would assist in Suzuki's process of spark and fuel adjustment.

(Paper 1 at 31.)

Regarding the combination of *Suzuki* with *Cullen* and *Scherer*, Petitioners state:

> A POSITA would have been motivated to modify Suzuki's torque controller to include a high pass filter like that taught by Scherer. In fact, a POSITA would understand that Suzuki's system already implicitly recites using such a high pass filter. In particular, as shown in the below excerpts from Figure 13, Suzuki's processing of the torque correction demand signal into either a spark timing correction signal or an air/fuel ratio adjustment signal generates an exponential decay curve.
>
> (*Id*. at 33.)

Here, Petitioners assert that the motivation to combine the teachings of *Suzuki* and *Cullen* and *Suzuki* with *Cullen* and *Scherer* is that such a combination of elements from these two references would result in certain advantages over the prior art. (*Id*.) Petitioners' analysis is misguided because a proper prior art

analysis would explain where the references themselves provide the teaching, motivation or suggestion to combine their teachings. The claimed invention of the presently challenged claims of the '565 patent was created in order to provide advantages over the prior art, including those highlighted by Petitioners. (Ex. 1001 at 1:46-59.)

The issue with *Scherer* is that there is no consideration of a stratified charge operation mode for a DISI engine as the '565 teaches and thus *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, the focus of the '565 patent.

A POSITA would know that diesel engines operate differently from 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. Therefore a POSITA would have no motivation – other than hindsight reconstruction – to combine *Cullen* and *Scherer* with *Suzuki* to render the challenged claims obvious.

B. Petitioners do not demonstrate Ground 2 of the Petition Because Claims 2, 3, 5 and 6 Are Not Rendered Obvious by *Suzuki*, *Cullen, Scherer* and *Takahashi*

As demonstrated above, the combination of *Suzuki*, *Cullen* and *Scherer* does not render claim 1 obvious, despite Petitioners' efforts to cobble together the three references that lack critical limitations of the claim and for which there is no motivation to combine the three references. For Ground 2, Petitioners assert *Takahashi* as a quaternary reference for obviousness of challenged claims 2, 3, 5 and 6. (Paper 1 at 70.)

Takahashi is only concerned with the operation of a homogeneous combustion method. *Takahashi* does not disclose spark timing control nor does it teach a DISI engine that operates in a stratified combustion mode. Figure 1 of Moreover, *Takahashi* discloses a port fuel injection engine, not a direct injection spark ignition engine (DISI) (Ex. 1008 at Fig. 1)(emphasis added.)

Takahashi is irrelevant to the challenged claims of the '565 patent with its deficiencies in disclosing spark timing control as required by the challenged claims. Because the base combination of *Suzuki*, *Cullen* and *Scherer* does not disclose or suggest the limitations of the challenged claims, the combination of *Takahashi* with those references cannot render the challenged claims of Ground 2 obvious.

VIII. CONCLUSION

For the foregoing reasons, the Petition to institute *inter partes* review of any claim of the '565 patent should be denied.

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Respectfully submitted,

/s/ *Timothy Devlin*

Timothy Devlin
Registration No. 41,706
DEVLIN LAW FIRM LLC
1526 Gilpin Avenue
Wilmington, DE 19806
(302)-449-9010
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 5,979 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 Avenue
Wilmington, DE 19806
(302)-449-9010
TD-PTAB@devlinlawfirm.com
Attorney for Patent Owner

CERTIFICATE OF SERVICE

I hereby certify that on November 14, 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 Petitioners' consent.

QUINN EMANUEL URQUHART & SULLIVAN, LLP
51 Madison Ave, 22nd Floor
New York, New York 10010
Tel: (212) 849-7000
Fax: (212) 849-7100
jimglass@quinnemanuel.com;
jeffgerchick@quinnemanuel.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
TD-PTAB@devlinlawfirm.com
Attorney for Patent Owner