

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

JTEKT CORPORATION,
Petitioner,

v.

GKN AUTOMOTIVE LTD.,
Patent Owner.

Case IPR 2016-00046

U.S. Patent No. 8,215,440 B2

**PATENT OWNER'S RESPONSE TO PETITION
FOR *INTER PARTES* REVIEW UNDER 37 C.F.R. §42.107**

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UPDATED LIST OF EXHIBITS

Exhibit No.	Description	Date	Identifier
2001	NHTSA Publication, Summary of Fuel Economy Performance	Dec. 15, 2014	NHTSA Publication
2002	NHTSA Press Release	Aug. 28, 2012	
2003	All-Wheel Drive BorgWarner Book	2009	BorgWarner Textbook
2004	Gassman GKN Seamless Drivelines Article	Sept. 2009	
2005	Honda Worldwide Article entitled <i>Honda Develops World's First Super Handling AllWheel Drive</i>	April 1, 2004	Honda Worldwide Article
2006	Institution of Mechanical Engineers Article entitled <i>Four Wheels On Demand</i>	April 2015	Institution of Mechanical Engineers Article
2007	Meritor White Paper entitled <i>Building on Rich Heritage and Designing More Value and Efficiencies</i>	2012	Meritor 2012 White Paper
2008	Elsevier White Paper entitled <i>An experimental investigation of spin power losses of a planetary gear set</i>	2015	Elsevier 2015 White Paper
2009	S. Renjith et al., <i>CFD based Prediction of Spin Power Loss of Automotive Differential System</i> , SAE Technical Paper 2015-01-2783 (2015)	2015	2015 Tata SAE Paper
2010	Andreev et al., <i>Driveline Systems of Ground Vehicles - Theory and Design</i>	2010	Andreev Book

Exhibit No.	Description	Date	Identifier
2011	Engineering Dictionary definition of “coupling”, http://www.engineering-dictionary.org/coupling , retrieved January 26, 2015	Jan. 2016	
2012	V. Vantsevich, <i>All-Wheel Driveline Mechatronic Systems: Principles of Wheel Power Management</i> , SAE Technical Paper 2006-01-0580 (2006)	April 2006	2006 SAE Paper
2013	R. Rajamani, <i>Vehicle Dynamics and Control</i> (2012)	2012	Vehicle Dynamics book
2014	How to Choose the Right ATV, http://www.atv.com/products/how-to-choose-the-right-atv-622.html , retrieved January 28, 2015	Jan. 2016	ATV article
2015	Institution Decision, Paper 7	March 25, 2016	Institution Decision
2016	Disclaimer of claims 1, 4 and 5	June 2016	Disclaimer
2017	Stein Declaration	June 2016	Stein Decl.
2018	Bosch Automotive Handbook, 4 th Edition	1996	Bosch Handbook
2019	K Newton, et al., <i>The Motor Vehicle</i> , 11 th Edition	1989	Newton Textbook
2020	Transcript of Deposition of Steven Becker	June 2, 2016	Becker Transcript
2021	D. Danesin et al., <i>Driveline Layout Influence on Four Wheel Drive Dynamics</i> , SAE Technical Paper 2004-01-0860	March 2004	2004 SAE Paper
2022	https://www3.epa.gov/fueleconomy/	February 23, 2016	
2023	Prosecution History of the ‘440 Patent		‘440 Prosecution History

Exhibit No.	Description	Date	Identifier
2024	http://www.topgear.com/car-news/frankfurt-motor-show/meet-boffins-behind-new-ford-focus-rss-revolutionary-4wd-system	Sept. 16, 2015	Topgear Website
2025	U.S. Patent No. 9,003,925	April 14, 2015	The '925 Patent
2026	http://www.gkn.com/frankfurt/news-and-Media/Pages/GKN-supplies-innovative-AWD-system-to-Ford-Focus-RS.aspx	Sept. 14, 2015	
2027	R. L. Piziali, et al., <i>Evaluation of a Proposed ATV Design Modification</i>	1994	1994 SAE Paper
2028	http://www.autonews.com/article/20151221/RETAIL/312219981/gm-seeks-a-market-beyond--the-snow-belt-for-awd-models	Dec. 21, 2015	Autonews Article
2029	http://gas2.org/2015/12/23/general-motors-will-introduce-dual-clutch-awd-on-more-cars/	Dec. 23, 2015	Gas2.org Article
2030	http://www.prnewswire.com/news-releases/gkn-driveline-honored-with-two-automotive-news-pace-awards-300249970.html#continue-jump	April 12, 2016	PR Newswire Awards Article
2031	http://www.greencarcongress.com/2013/09/20130905-gkn.html	Sept. 5, 2013	Green Car Congress Article
2032	Automotive News Pace Award	April 18, 2016	Automotive News Pace finalists
2033	Curriculum Vitae of Jeffrey L. Stein		Stein CV
2034	P. Borio, et al., <i>Evaluation Criteria for AWD Vehicles System Analysis</i>	May 2004	SAE 2004-01-2086

Exhibit No.	Description	Date	Identifier
2035	http://aeplus.com/news/land-rover-introduces-on-demand-all-wheel-drive	Aug. 24, 2013	
2036	Andreev et al., <i>Driveline Systems of Ground Vehicles - Theory and Design</i>	2010	Andreev Book
2037	All-Wheel Drive BorgWarner Book	2009	BorgWarner Textbook

I. INTRODUCTION

In response to JTEKT's Petition, the Board instituted *inter partes* review (Paper 7, the "Institution Decision") of claims 1-7 of U.S. Patent No. 8,215,440 ("the '440 Patent") based on the following grounds asserted by JTEKT:

Ground	Claims	Alleged Basis for Rejection By Petitioner
Ground 1	1, 4, and 5	Anticipated under 35 U.S.C. §102(b) by Teraoka (Ex. 1002)
Ground 2	2 and 3	Obvious under 35 U.S.C. §103(a) by Teraoka in view of Watanabe (Ex. 1002 and Ex. 1003)
Ground 3	6 and 7	Obvious under 35 U.S.C. §103(a) by Teraoka in view of Burrows (Ex. 1002 and Ex. 1004)

(Petition at 7.)

Pursuant to 35 U.S.C. §253(a) and 37 C.F.R. §1.321(a), GKN disclaims claims 1, 4 and 5 of the '440 Patent which was the sole basis of Ground 1. Attached as Exhibit 2016 is a true and correct copy of the disclaimer submitted to the Commissioner of Patents. This was done to reduce the number of claims subject to challenge. It does not reflect a view that claims 1, 4 and 5 are invalid or unenforceable.

Regarding Grounds 2 and 3, the Petition fails to prove unpatentability for at least 3 reasons: 1) there is insufficient rationale to combine the asserted references;

2) the arguments rely on conclusory, boilerplate statements and not fact-based analysis, even the Becker expert declaration is a verbatim resuscitation of the Petition – every opinion is unsupported; and 3) the arguments employ a hindsight reasoning that is impermissible.

Accordingly, GKN respectfully requests that the Patent Trial and Appeal Board (“the Board”) find that claims 2-3 and 6-7 are patentable over the combinations proposed in Grounds 2 and 3.

II. APPLICABLE LAW

The Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398 (2007) reaffirmed the framework for determining obviousness as set forth in *Graham v. John Deere Co.*, 383 U.S. 1 (1966). Per the *KSR* Court, the following factual inquiries in *Graham* are applied for determining obviousness under 35 U.S.C. §103(a): 1) determining the scope and content of the prior art; 2) ascertaining the differences between the prior art and the claims at issue; 3) resolving the level of ordinary skill in the pertinent art; and 4) considering objective evidence present in the application indicating obviousness or nonobviousness. *KSR*, 550 U.S. at 406. Moreover, “there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (emphasis added)).

Petitioner has the burden of proving unpatentability by a preponderance of the evidence. 35 U.S.C. §316(e). As explained below, Petitioner has not met its burden.

III. STATE OF THE ART DURING THE RELEVANT TIME FRAME

A. 4WD vehicle systems and fuel economy considerations

Since the introduction of environmental emissions regulations in 1963, fuel economy standards for vehicles have become increasingly stringent. (Ex. 2001, NHTSA Publication, Summary of Fuel Economy Performance at 3.) With every regulatory modification, the auto industry is challenged to design vehicles that can satisfy the new set of fuel economy standards. (Ex. 2002, NHTSA Press Release at 1.)

While the environmental regulations have been tightening, consumer demand for vehicles with greater mobility under difficult road conditions – from sports utility vehicles, crossover vehicles and the like – have increased. (Ex. 2003, BorgWarner Textbook at 18.) The essential change for these “four-wheel drive” (“4WD”) vehicles is the ability to direct power to all four-wheels on either a part-time or full-time basis. (*Id.* at 37-41.)

Automotive drivetrains (also referred to as drivelines) are the mechanisms that distribute engine power to the wheels of the vehicle. (Ex. 2017, Stein Decl. ¶22.) In a typical two-wheel drive (“2WD”) vehicle, the engine provides power

through a transmission then to a drive shaft and a single differential which distributes power between the right and left set of connected wheels, while the secondary, non-driven wheels spin freely. (*Id.* at ¶23, citing Ex. 2018, Bosch Handbook at 571-572.) In a typical 4WD vehicle, in addition to the primary drive shaft, a secondary drive shaft provides power to a secondary set of wheels through a second differential, so that all four wheels propel the vehicle. (*Id.* at ¶24.) A transfer case then allows the power to be split between the primary and secondary drivelines. (*Id.*)

The problem of fuel economy and CO₂ emissions is a particular challenge for 4WD systems and, in particular, 4WD systems that remain engaged all the time. Energy/torque losses in these systems are generally greater than their 2WD counterparts. (Ex. 2004, Gassman GKN Seamless Drivelines Article at 73.) Essentially, extra fuel is required to overcome the inertial and frictional losses associated with the additional rotating components in a 4WD driveline. (Ex. 2003, BorgWarner Textbook at 126; *see also* 170.) To overcome this issue of “driveline drag,” selectively connectable 4WD drive systems – in which one of the drivelines is permanently connected to a drive unit and a second driveline is connectable to the drive unit on demand – were introduced in 2004. (Ex. 2005, Honda Worldwide Article at 1; Ex. 2017, Stein Decl. ¶25.) For such on-demand systems, the optionally connectable driving axle is not permanently driven but rather engaged

when traction assistance is needed. By disconnecting the driving axle, a reduction in drag moments and friction forces may be achieved, reducing power losses. (Ex. 2006, Institution of Mechanical Engineers Article at 2.) In addition to improving fuel efficiency, lower power losses result in less heat generation, improved mechanical fatigue performance and often less complex, more cost-effective systems. (Ex. 2007, Meritor 2012 White Paper at 9.)

Prior art disconnectable systems activated the 4WD feature using a dog clutch – which provides a positive (*i.e.*, no slip) engagement between the two mating parts. Because a dog clutch “is typically engaged when the two sides of the clutch are not rotating or rotating at the same speed,” the switch between 2WD and 4WD could occur during vehicle idling conditions but not whilst driving. (Ex. 2017, Stein Decl. ¶26.) In contrast, a friction clutch allows “two sides of the clutch to be engaged and disengaged even when the two sides are rotating at different speeds. These clutches allowed for automatic, computerized switching between 2WD and 4WD without requiring that the vehicle be idling. (*Id.* at 27 citing Ex. 2019, Newton Textbook at 636.)

Other vehicles known as “all-wheel drive” (“AWD”) vehicles, typically transfer power to all four wheels all the time through a center differential in the transfer case which permits longitudinal equalization between the primary and secondary wheels. (*Id.* at 28, citing Ex. 2003, All-Wheel Drive Borg Warner Book

at 14, 28-34.) Like 4WD vehicles, AWD vehicles can be on-demand such that power to a secondary axle is selectively distributed. (*Id.*)

B. Differentials and their functionality

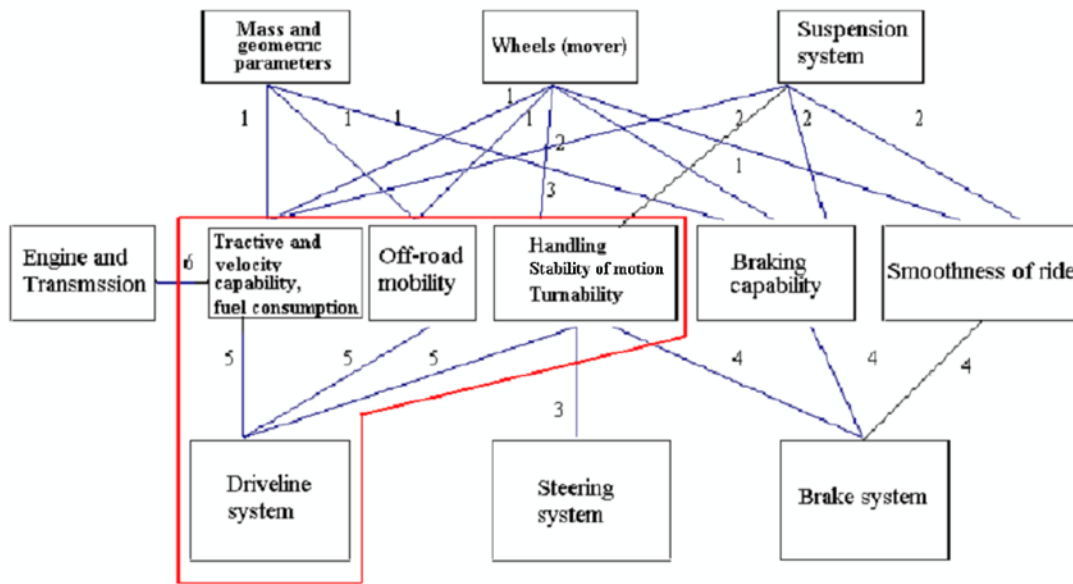
A differential distributes power to the left and right wheels, allowing the two wheels to spin at different speeds, for example, when the vehicle is traveling around a corner and the outside wheel is covering more ground and needs to spin faster than the inside wheel—referred to as transverse equalization. (Ex. 2017, Stein Decl. at ¶29, citing Bosch Handbook at 571-572.) Similarly, a differential can be used to split power between a primary and secondary axle, allowing the two axles to spin at different speeds to allow, for example, “the vehicle to travel around corners with the primary wheels covering a different amount of ground than the secondary wheels. This is called longitudinal equalization.” (*Id.*)

Over time, different types of differentials have been developed. “Conventional differentials are not well-equipped to accommodate a difference in traction amongst the two wheels across the differential.” (*Id.* ¶30.) For example, if one wheel is on ice and the other on pavement, power would be provided to the wheel on ice with the other wheel receiving almost no power. (*Id.*) In contrast, limited slip differentials provide more control to adjust the power split between left and right wheels using a clutch-like element to ensure that some power goes to both wheels. (*Id.* ¶¶30-31, citing Ex. 2019, Newton Textbook at 634-638.)

C. Designing a driveline

The main objective for the design of a driveline system is to optimally distribute power to the wheels to achieve the desired performance capabilities for a given vehicle, its mode of operation and primary terrain conditions. (Ex. 2017, Stein Decl., ¶33.) In a 2006 SAE paper, noted driveline expert Dr. Vladimir Vantsevich explains the relevant considerations for driveline design: “dynamics and performance of vehicles with four or more drive wheels result[s] from vehicle operational or functional properties such as energy/fuel efficiency, cross-country mobility, tractive and velocity properties, vehicle turnability, and stability of motion and handling.” (*Id.*; Ex. 2012, 2006 SAE Paper at 4.) Notably, for a given set of road conditions “the same vehicle with a constant total power at the drive wheels, but with different power distributions among the drive axles and left and right wheels of each axle will perform differently.” (*Id.*) “In other words, the same vehicle with a different driveline component can perform differently.” (Ex. 2017, Stein Decl., ¶33.)

Because the driveline interfaces with the vehicle’s primary systems (e.g., engine, wheels, suspension, steering and braking systems), it has a major role in determining vehicle performance characteristics. (Ex. 2012, 2006 SAE Paper at 4.) This interconnection between the driveline system and other vehicle systems and operational properties is illustrated below:



Ex. 2012, 2006 SAE Paper at 4; Ex. 2017, Stein Decl., ¶34

“As is clear from this representation, any change in the design of the driveline system must also take into consideration the resulting changes in the tractive and velocity capability, the fuel consumption, the off road capabilities, as well as the handling, stability of motion, and turnability.” (Ex. 2017, Stein Decl. ¶35.) As is further shown in the above figure, operational properties such as mobility, fuel consumption etc. are impacted by the mode of operation or “vehicle dynamics” (e.g. speed, acceleration, cornering, braking etc.). These “vehicle dynamics” are controlled by such aspects as vehicle mass, geometry, components, etc. and further impacted by the driver’s actions. (*Id.* ¶37.)

Advances in computer systems have allowed these vehicle systems to be networked together, such that vehicle performance can be improved by

understanding and then controlling driveline components in a manner that achieves the desired vehicle behavior. (*Id.* ¶¶37-38.) Thus, “driveline design methodologies need to account for this complex interplay between the desired operational performance, the road/terrain conditions, and the general vehicle state or properties.” (*Id.* ¶39.) Expanding on this general understanding, in his declaration, Dr. Stein identifies four wheel power management principles that should be considered when designing a driveline system. (*Id.* ¶¶39-44.) “First, one specifies the required kinematic parameters of the vehicle in motion to determine the total power required for vehicle motion, while also finding optimum combinations of the total power distributions to the drive wheels that correspond to given kinematic parameters of the vehicle.” (Ex. 2017, Stein Decl. at ¶39.) “Second, the optimum combinations of power distributions to the drive wheels are determined in a way of providing the extreme values of criteria of vehicle operational properties in the specified modes of operation and in the given road/terrain conditions.” (*Id.* at ¶40.) Third, based on the optimal wheel distributions, one would have to “synthesize and establish optimal characteristics for a hypothetical driveline system.” (*Id.* at ¶41.) And fourth, “once one has the optimal driveline system characteristics synthesized, one can then finally begin designing a driveline system that implements the optimal (or near optimal) characteristics.” (*Id.* at ¶42.)

IV. OVERVIEW OF THE ‘440 PATENT

A. The invention

The ‘440 Patent is directed to a selectively connectable 4WD driveline system that enables distribution of “drive power to all drive wheels” without the “series of disadvantages” introduced by prior art systems. These disadvantages, detailed in the “Description of Related Art” section, include problems with longitudinal and transverse equalization, cost, complexity, increased weight, increased fuel consumption and notably, diminished net drive output.¹ For the latter problem, the ‘440 Patent explains that even when the secondary drive axle is disconnected:

¹ On the need for longitudinal and transverse equalization the ‘440 Patent provides:

care should be taken that the drive wheels of the primary axle and the drive wheels of the secondary axle in particular travel different trajectories when driving round curves ... which without a corresponding speed difference balance would lead to tensions in the drive train. In order to lower tensions caused by different drive wheel speeds on primary axle and secondary axle **longitudinal equalization** or respectively longitudinal differential is to be provided. Tensions caused by different drive wheel speeds of the drive wheels of the secondary axle are offset by a **transverse equalization** usually formed by transverse differential.

Ex. 1101, ‘440 Patent, 1:62-2:6 (emphasis added.)

[t]he components of the secondary drive train however are still being driven either by the vehicle drive via the primary axle and/or by the secondary drive wheels or respectively dragged along passively, without transmitting drive power. This gives rise to **friction losses** (bearing friction, churning losses, friction of gear wheel engagement, etc.) and the rotating masses of the secondary driven train components (differential, intermediate shaft, couplings, etc.) are to be accelerated or respectively relented constantly with the vehicle during dynamic driving. This **power loss** contributes significantly to the fact that fuel consumption in a vehicle with connectable secondary axle even with uncoupled secondary axle is noticeably higher than in a vehicle having no drivable secondary axle.

(Ex. 1001, '440 Patent at 2:27-40.)

This problem is captured by Figs. 1 and 2 of the '440 Patent, reproduced on page 9, which illustrate two distinct prior art systems. In the Fig. 1 system (on the left), the secondary driveline contains hang-on coupling 10, used to connect the primary driveline 1 with the secondary driveline 2. Coupling 10 is in-line with the propeller shaft 11, and on the engine side of axle drive unit 9, which means the entire secondary driveline from the wheels to propeller shaft 11 rotates or is “dragged along”, even in two-wheel drive mode. (Ex. 1001, '440 Patent at 6:18-25.) More specifically, movement of the rear wheels along the roadway will cause rotation of the secondary driveline.

By contrast, in the Fig. 2 system (on the right), while a wheel hub coupling

13 prevents the parts of the secondary driveline from rotating in two-wheel drive mode, this design creates other constraints. Specifically, there is no ability to differentially spin the front and rear wheels at different speeds, which is needed for cornering. (*Id.* at 1:61-2:10.) In addition, there is no ability to differentially control the torque transmitted to each of the rear wheels through side shafts 12. (*Id.* at 6:42-46.) Finally, dog clutches 13 require that the vehicle be stationary in order to engage the rear wheels. (*Id.* at 6:2-8). Thus, the vehicle must be stopped to engage or disengage the dog clutches 13, even if the road conditions require immediate four wheel drive engagement.

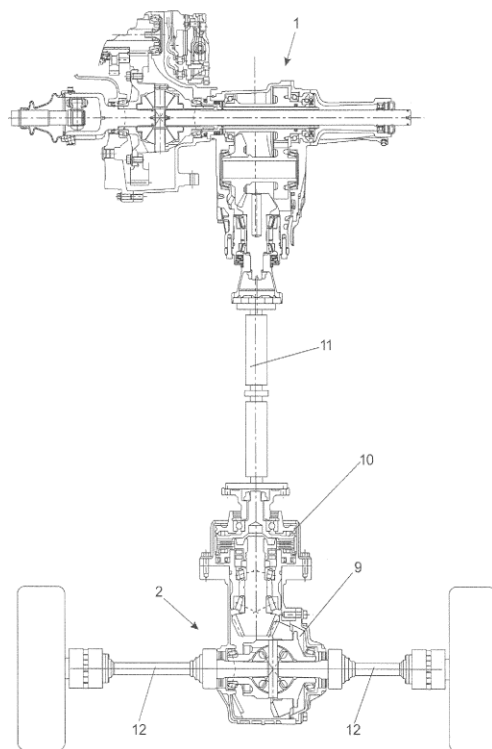


FIG. 1

Ex. 1001, '440 Patent, Fig. 1

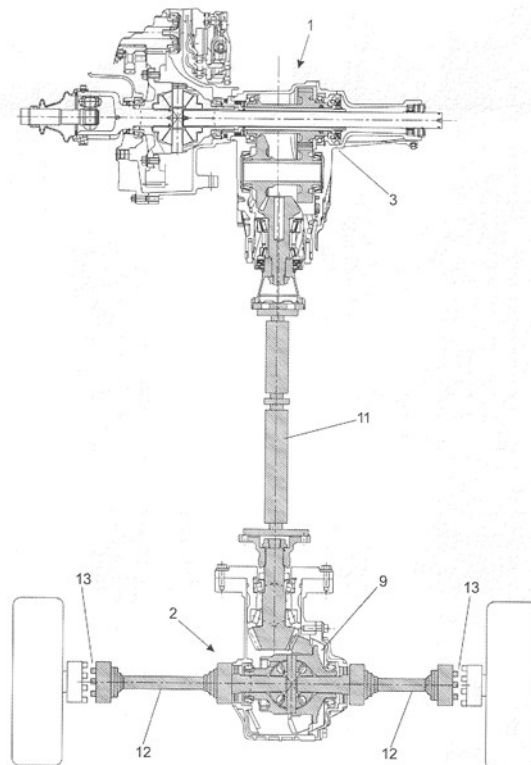


FIG. 2

Ex. 1001, '440 Patent, Fig. 2

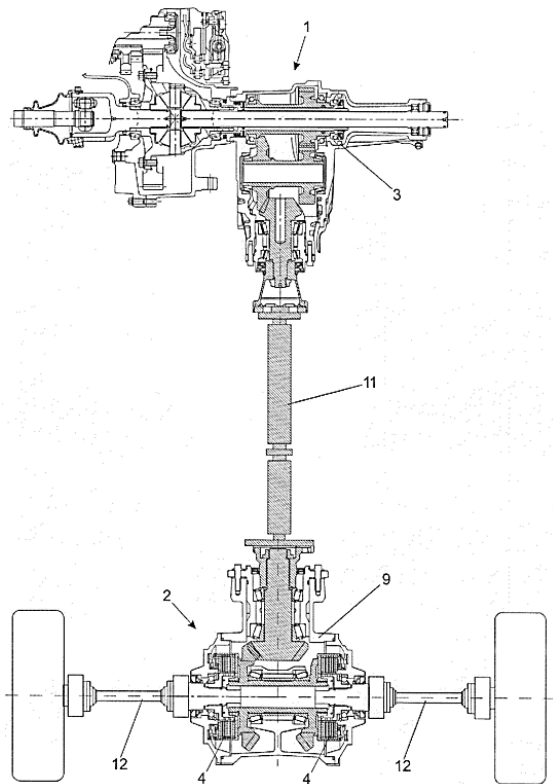
In the ‘440 Patent, these disadvantages of the prior art systems are solved by 1) moving the secondary driveline coupling from an in-line position with the propeller shaft to a side shaft location and 2) introducing a switch-on mechanism that works in conjunction with the side shaft coupling to provide a shut-down section “that has no more power loss,” “whereby connecting the secondary drive during travel is possible . . . and losses in comfort and practicability do not have to be tolerated.” (Ex. 1001, ‘440 Patent, Abstract.) This integrated system also allows for more control of the torque provided to the drive wheels: “[t]he drive torque and slippage to be transferred are freely adjusted by these freely adjustable side shaft couplings 4, such that with this axle drive functions of longitudinal differential and of active-yaw differential can be shown in addition to the functions of transverse differential.” (*Id.* at 6:42-46.)²

Representative figures are provided below, with annotations to illustrate the embodiments claimed in the ‘440 Patent.

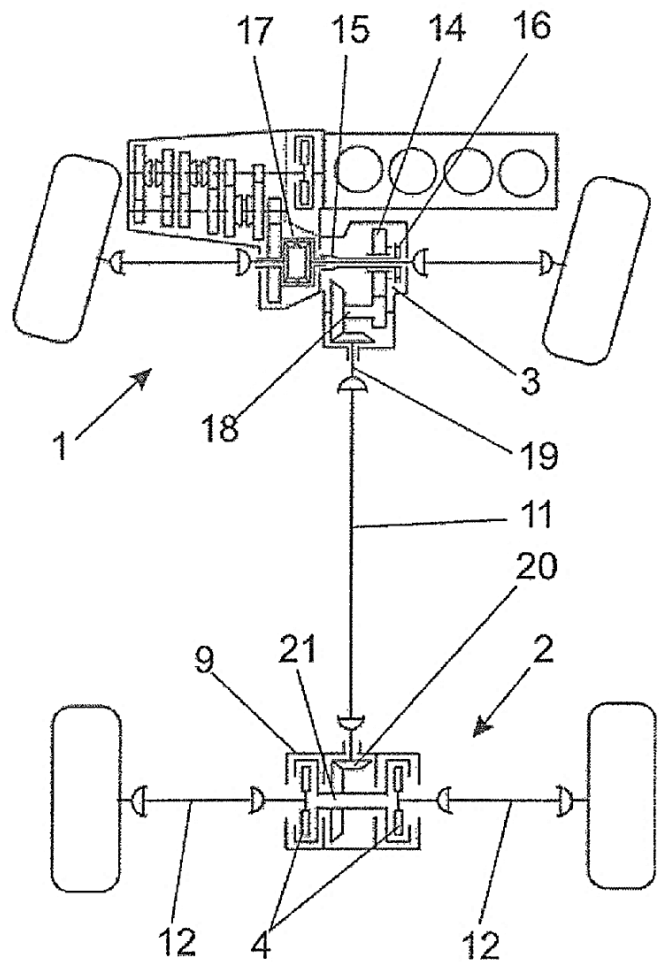
The first set of side-by-side illustrations (Figures 3 and 8 of the ‘440 Patent) relate to the Figure 3 drive train embodiment which includes a front primary axle 1 that is permanently driven by the engine and a rear secondary axle 2, that is disconnectable in 2WD mode – allowing significant portions of the drive train to

² Yaw is an indication of how far the vehicle is angled left or right from its center vertical axis. (Vehicle Dynamics Book, Ex. 2013 at 5-6.)

be inoperative in 2WD. (Ex. 1001, '440 Patent at 5:17-19, 6:34-37.) The schematic of Figure 8 corresponds to the drive train shown in detail in Figure 3. (*Id.* at 8:63-64.) A switch-on device 3 is located near the front of the vehicle and disengages spur gear step 14 to decouple engine output torque from the rear secondary axle 2. (*Id.* at 7:11-16, 6:49-52.) By decoupling the rear secondary axle 2 from the engine, the “section of the secondary drive train . . . located between side shaft couplings 4 and switch-on device 3 is inoperative.” (*Id.* at 6:35-37.)




Ex. 1001, '440 Patent, Fig. 3



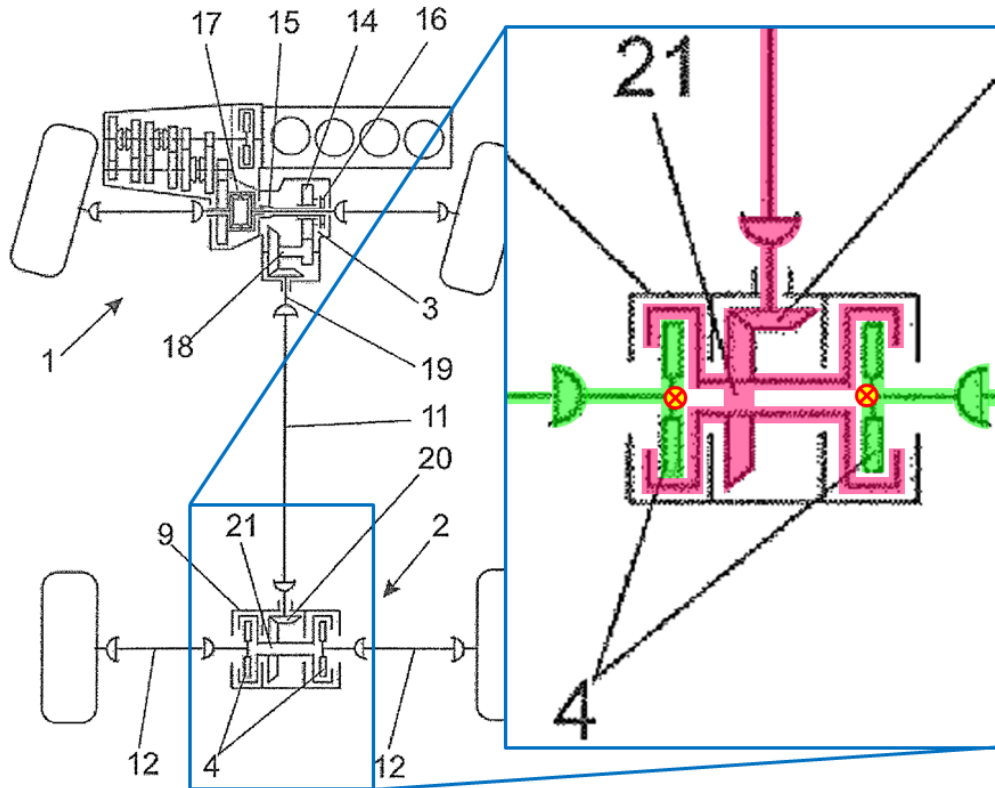
Ex. 1001, '440 Patent, Fig. 8

In contrast to the other embodiments disclosed in the '440 Patent, rear axle

drive unit 9 is provided without a rear differential. (*Id.* at 8:61-64.) Here, an additional decoupling is provided by an opposing pair of frictionally-engaged side shaft couplings 4, “which transmit the secondary drive output to the side shafts 12 of the secondary axle.” (*Id.* at 6:39-42; 8:61-64.) “To shut down the secondary drive train the side shaft couplings 4 are opened and the secondary drive train is uncoupled from the permanently driven part of the drive train via the switch-on device 3.” (*Id.* at 6:49-52.)

The rear axle portion of Figure 8 has been enlarged and annotated below to distinguish between idled components (highlighted in pink) and rotating components (highlighted in green) when the secondary axle is disengaged. The torque decoupling locations are denoted with “” below.

As shown in Figure 8, each opposing side shaft 12 is decoupled from the drive train at side shaft couplings 4 and independently rotated along with the rear wheels. Unlike the prior art systems, the internal components of the rear axle drive unit 9 (highlighted in pink) are disconnected from the rear wheels and idled in 2WD mode. (*Id.* at 6:49-52.)



Ex. 1001, '440 Patent, Fig. 8 (annotated)

Providing a torque decoupling on either side of the drive unit 9 allows idling of additional drive train components which would otherwise rotate. “This [Fig. 3] configuration . . . makes it possible to completely shut down a majority of the secondary drive train with the secondary axle uncoupled. The drive train components belonging to the shutdown section of the secondary axle drive train consequently cause no power loss.” (*Id.* at 3:20-24.)

As compared to the axle drive units 9 in prior art Figures 1 and 2 above, “[t]he added advantage here is that not only transverse equalization but at the same time also longitudinal equalization can be guaranteed via the side shaft couplings.” (*Id.* at 3:45-48.) In addition, with this type of axle drive unit “other functions are

also conceivable, such as that of an active yaw differential, in which a yawing moment can be produced specifically by the individual actuation of the couplings . . . Omitting a plurality of otherwise necessary drive train components (wheel hub switching, transverse and longitudinal differential) makes a cost-optimized and weight-optimized configuration of the drive train possible.” (Ex. 1001, ‘440 Patent at 3:55-65.)

B. Independent Claim 1

Claim 1 (annotations and emphasis added) is directed to:³

[1.a.] *A drive train of a vehicle, comprising a primary drive train and a secondary drive train, further comprising:*

[1.b.] *a primary axle which is permanently driven via the primary drive train; and*

[1.c.] *a secondary axle as part of the secondary drive train;*

[1.d.] *wherein the secondary axle is connectable to the primary axle via a switch-on mechanism of a switch-on device in order to allow the integration of the secondary drive train into the drive train so that the overall drive train power is transferred over both the primary axle and the secondary axle, and*

[1.e.1] *wherein when the secondary axle is connected to the primary axle, the secondary drive train power is conveyed via at least one side shaft couplings into side shafts of the secondary axle and is*

³ For ease of reference, quoted claim language has been italicized throughout.

transmitted to wheels of the secondary axle [1.e.2.] the secondary drive train having a shutdown section located between the switch-on device and the at least one side shaft coupling, whereby:

[1.f.] the switch-on mechanism and/or the side shaft couplings comprise at least one frictionally engaged coupling and [1.g.] when the secondary axle is disconnected from the primary axle in order to transfer the overall drive train power via the primary axle only, the shutdown section of the secondary drive train is decoupled from both the primary axle of the primary drive train and the wheels of the secondary axle.

[2] The drive train as claimed in claim 1, having a side shaft coupling for each side shaft of the secondary axle and wherein when the secondary axle is connected to the primary axle, the side shaft couplings allow a driving power distribution without a differential gearing between the drive wheels of the secondary axle to ensure transverse compensation.

V. PERSON OF ORDINARY SKILL IN THE ART

A “person of ordinary skill in the art” is one who is presumed to be aware of all pertinent art as of the relevant timeframe, thinks along conventional wisdom in the art, and is a person of ordinary creativity. *KSR*, 550 U.S. at 421; *Std. Oil Co. v. Am. Cyanamid Co.*, 774 F.2d 448, 454 (Fed. Cir. 1985). The level of skill in the art is evidenced by the prior art references. The ’440 Patent is to be interpreted based on how it would be read by a person of ordinary skill in the art during the relevant timeframe – on or before May 6, 2008. Factors such as the education

level of those working in the field, the sophistication of the technology, the types of problems encountered in the art, the prior art solutions to those problems, and the speed at which innovations are made may help establish the level of skill in the art. A person of ordinary skill in the art is not a specific real individual, but rather is a hypothetical individual having the qualities reflected by the factors above. *In re GPAC*, 57 F.3d 1573, 1579 (Fed. Cir. 1995).

Both parties agree that a person having ordinary skill in the art at the relevant timeframe would be someone with an engineering degree and at least some experience in driveline mechanics and/or design. (Stein Decl., Ex. 2017, 20; Petition at 12.)

VI. CLAIM CONSTRUCTION

A. “Switch-on device” / “Switch-on mechanism”

Independent claim 1 recites, in relevant part:

[1.d.] *wherein the secondary axle is connectable to the primary axle via a **switch-on mechanism** of a **switch-on device** in order to allow the integration of the secondary drive train into the drive train so that the overall drive train power is transferred over both the primary axle and the secondary axle, and*

(Ex. 1001, ‘440 Patent, Claim 1 (boldface added).)

The Board agreed with GKN that the terms “*switch-on device*” and “*switch-on mechanism*” requires no construction. The terms’ plain and ordinary meaning,

as understood by a person of ordinary skill in view of the ‘440 patent, will apply.
(Ex. 2015, Institution Decision at 12.)

B. “A shutdown section”

Independent Claim 1 recites, in relevant part:

[1.e.2.] *the secondary drive train having **a shutdown section located between the switch-on device and the at least one side shaft coupling**, whereby . . . [1.g.] when the secondary axle is disconnected from the primary axle in order to transfer the overall drive train power via the primary axle only, **the shutdown section of the secondary drive train is decoupled from both the primary axle of the primary drive train and the wheels of the secondary axle.***

(Ex. 1001, ‘440 Patent, Claim 1 (boldface added).)

The Board agreed with GKN’s proposed construction of the claim term “*shutdown section*” and concluded that the term means “the portion of a secondary drive train that is decoupled from both the primary axle and the wheels of the secondary axle located between the switch-on device and side shaft coupling.”
(Ex. 2015, Institution Decision at 11.)

In view of the different claim construction standards, GKN reserves the right to assert a different claim construction in any litigation involving the ‘440 Patent.

C. “Side shaft coupling”

Independent claim 1 recites, in relevant part:

[1.e.1] *wherein when the secondary axle is connected to the primary axle, the secondary drive train power is conveyed via at least one side shaft couplings into side shafts of the secondary axle and is transmitted to wheels of the secondary axle* [1.e.2.] *the secondary drive train having a shutdown section located between the switch-on device and the at least one side shaft coupling, whereby:*

(Ex. 1001, ‘440 Patent, Claim 1 (emphasis added).)

The Board adopted GKN’s plain meaning construction of the term “*side shaft coupling*” as “the connecting device that conveys power from the secondary drive train into side shafts of the secondary axle.” (Ex. 2015, Institution Decision at 11-12.)

VII. PATENTABILITY ANALYSIS-GROUND 2 BASED ON AN OBVIOUSNESS COMBINATION OF TERAOKA AND WATANABE AGAINST CLAIMS 2 AND 3 IS DEFICIENT

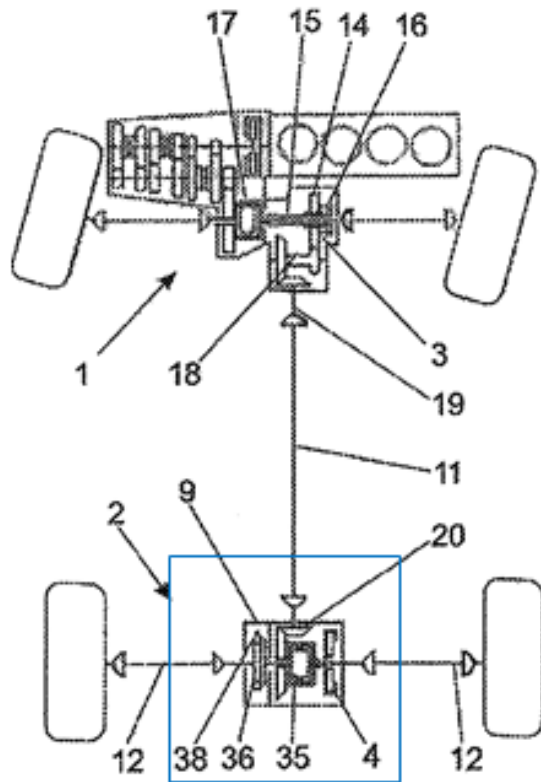
A. Overview of Teraoka

Teraoka is directed to a four-wheel drive system in which either set of wheels can be disengaged when in two-wheel drive through a two-four switching mechanism 7 (dog clutch) as shown in Figure 1, that selectively transfers power to a secondary drivetrain. (Ex. 1002, Teraoka at 3, 5; Ex. 1217, Stein Decl. at ¶¶72-73.) The problem “to be solved” in Teraoka involves simplifying the configuration while reducing the drag torque created by the coupling during two-wheel drive travel. (Ex. 1002, Teraoka at 3-4.) More specifically in prior art systems, “since a wet multi-plate clutch is used for the coupling 521, even when it is uncoupled by

the controller, if rotation is inputted into one side, the viscosity of the oil will generate drag torque between the clutch plates.” (Ex. 1002, Teraoka, Abstract at 2.)

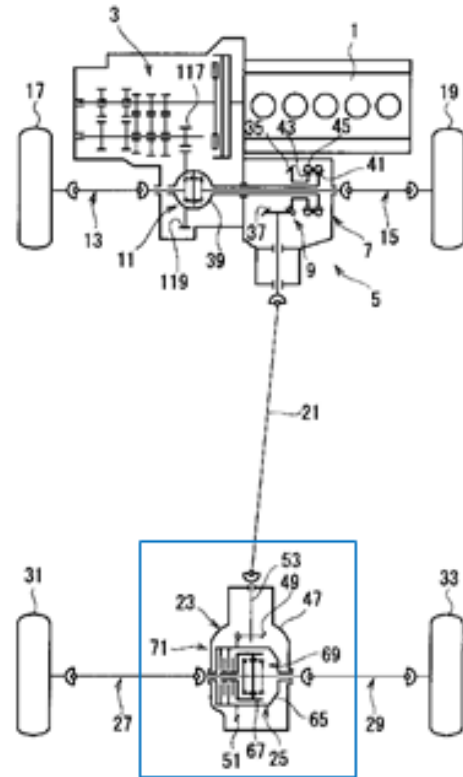
As illustrated in Figure 1, reproduced below, four-wheel drive is achieved when the two-four switching mechanism [7] and the coupling [clutch mechanism 71] are coupled, the driving force of the prime mover [engine 1] is transmitted from the transfer case [5] and two-four switching mechanism [7] to the final speed reduction mechanism [23] and subjected to speed reduction, after which it is distributed from the coupling [clutch mechanism 71] via the differential device [51] to the left and right wheel sides [27,29], and the vehicle enters a four-wheel drive state.

(Ex. 1002, Teraoka at [0024].)



Hoffmann '440 Patent

Figure 12



TeraokaJP '557

Figure 1

Under this configuration in 2WD mode

due to uncoupling of the two-four switching mechanism 7, rotation of the power transmission system (especially the large mass propeller shaft 21) stops from the two-four switching mechanism 7 to outer case 65, which is the input side member of the clutch mechanism 71, and to the outer plates 121, 123 of the main clutch 89 and pilot clutch 97.

(Ex. 1002, Teraoka, [0075]-[0076].)

Switching between 2WD and 4WD occurs through simultaneous coupling and decoupling of the two-four switching mechanism 7 and the clutch mechanism 71:

The controller simultaneously couples the two-four switching mechanism 7 and clutch mechanism 71 when switching from two-wheel drive state to four-wheel drive state and simultaneously uncouples them when switching from four-wheel drive state to two-wheel drive state.

(Ex. 1002, Teraoka, [0072].)

Thus, the problem in Teraoka is solved by providing a four-wheel drive system where the “coupling is arranged between the final speed reduction mechanism and the wheels . . . drag rotation of the wheels is inputted into the coupling without undergoing speed increase by the final speed reduction mechanism.” (Ex. 1002, Teraoka at [0027].) This arrangement will also reduce the drag torque of oil arising in the coupling. (*Id.* at [0028].)

B. Overview of Watanabe

The objective of the Watanabe patent, entitled “Power Transmission Device,” is to improve the durability of clutches in a power transmission device. (Ex. 1003, Watanabe at 2.) “According to Watanabe, when multiple-plate clutches contained in a case are packed compactly, there is very little space between the individual plates, which creates trouble for lubricating oil to flow to the friction plates.” (Ex. 1217, Stein Decl. at ¶81; Ex. 1003, Watanabe at 2.) Watanabe therefore identifies a single aim of the invention: the “present invention has an object to provide a power transmission device in which friction plates do not suffer

from lack of lubrication, seizing or the like.” (*Id.*)

In reference to Figures 1-2, Watanabe solves the problem of friction plates, described as “multiple plate clutches 89 and 91, in the context of a “power transmission system for a four-wheel drive (4WD) car.” (Ex. 1217, Stein Decl. at ¶82; Watanabe at 3.) More specifically, the problem of oil delivery to the clutches is solved by using a flow path in which “[o]il pressure is supplied to oil ports 137 and 139 of the actuators 133 and 135 via a control valve device 143 and oil passages 145 and 147 from an oil pressure source 141.” (Ex. 1003, Watanabe at 4; Ex. 1217, Stein Decl. at ¶83.) “Tightening, adjustment of tightening force, and release, etc., of the multiple plate clutches 89 and 91 are performed by adjusting this oil pressure.” (Watanabe at 4; Ex. 1217, Stein Decl. at ¶83.) By changing the oil pressure supplied to the multiple plate clutches 89 and 91, Watanabe teaches activating and deactivating a 4WD mode:

In switching between 2WD and 4WD, Watanabe teaches altering clutch pressure to either allow or prevent power from the engine to transfer to the already rotating axle. This can provide switching between 2WD and 4WD “without requiring an intermittent mechanism such as a 2-4 switching mechanism” because the “2-4 switching mechanism is unneeded.”

(*Id.*)

While Watanabe describes a two-clutch system for use in a 4WD,

differential-free secondary axle system, it is not directed to the issue of power loss or decoupling the secondary driveline from the primary driveline to improve fuel economy Dr. Stein thus concludes it is “my opinion that the disclosure of Watanabe is not concerned at all with increasing fuel economy by reducing losses caused by drag and churning losses of the spinning parts even when those spinning parts are not necessary for power transmission.” (Ex. 1217, Stein Decl. at ¶85.)

C. Dependent Claims 2 and 3

Claims 2 and 3 depend from independent claim 1 and add the following limitations:

2. The drive train as claimed in claim 1, having **a side shaft coupling for each side shaft of the secondary axle** and wherein when the secondary axle is connected to the primary axle, the side shaft couplings allow a driving power distribution **without a differential gearing** between the drive wheels of the secondary axle to ensure transverse compensation.

3. The drive train as claimed in claim 1, having **a side shaft coupling for each side shaft of the secondary axle** and wherein when the secondary axle is connected to the primary axle, the side shaft couplings allow a drive power distribution **without differential gearing** between the primary axle and the secondary axle, to ensure longitudinal compensation.

(Ex. 1001, ‘440 Patent, Claims 2 and 3 (emphasis added).)

D. Ground 2 is deficient against claims 2 and 3 because petitioner's rationale to combine Teraoka and Watanabe lacks rational underpinning

1. Petitioner's conclusory arguments are deficient

Petitioner distorts the claimed invention in an attempt to paint a picture of simplicity to the Board. Per the Petition, “[c]laim 1 of the ‘440 patent merely requires a four wheel drive system that includes at least one side shaft coupling.” (Petition at 19.) This simplified description eliminates the claimed relationship between the switch-on device and the side shaft couplings which “cooperate synergistically” to shut down the secondary drive train in 2WD mode. (Ex. 1001, ‘440 Patent at 6:53-56.) Having recast claim 1, Petitioner then asserts that “[i]t would have been a matter of simple substitution to replace the rear, secondary drive train [of Teraoka] with the rear, secondary drive train of Watanabe to yield the predictable result of reducing mass and rotating losses.” (Petition at 19.) Nothing more is provided in terms of how the combination would be achieved. “[S]tatements of general principles from the case law . . . are not a substitute for a fact-based analysis of the proposed combination of references necessary to support those conclusions.” *Kinetic Technologies, Inc. v. Skyworks Solutions, Inc.*, IPR2014-00529, Paper 8 at 15 (PTAB Sept 24, 2014).

On the issue of motivation to combine, the Petition simply states: “it would have been obvious to replace the clutch 71 and differential 25 of Teraoka with side

shaft couplings on each side of the secondary axle without differential gearing in between, as doing so would achieve the well-known goals of eliminating the heavy bevel gear differential, therefore reducing the weight and fuel consumption of the vehicle.” (*Id.*) Except for the declaration – which provides an almost verbatim, conclusory explanation – no other support is offered. (Ex. 2017, Stein Decl. at ¶87.) “Merely repeating an argument from the Petition in the declaration of a proposed expert does not give that argument enhanced probative value.” *Kinetic*, Paper 8 at 15.

The Board routinely denies obviousness grounds, when as here, a Petitioner does not provide any factual basis for its assertions. *See, Kinetic Technologies, Inc. v. Skyworks Solutions, Inc.*, where the Board found Petitioner’s motivation to combine arguments inadequate, as the Petition and expert declaration failed to “explain the ‘how,’ ‘what,’ and ‘why’ of the proposed combination of references.” (*Id.*) More specifically, in *Kinetic*, the Board faulted Petitioner’s assertions as they did not explain how the references could be combined, or how such a combination would yield a predictable result and further failed to explain why the ordinary artisan would have combined elements from the two references in the specific way the claimed invention does. (*Id.*) Petitioner’s obviousness Ground 2 suffers from the same deficiencies.

The Board should therefore deny Ground 2 of the petition for failing to meet

the specificity requirements of at least 37 C.F.R. §42.104(4)-(5).

a. The “why” rationale for the proposed combination is deficient

In both the Petition and Becker declaration, the “why” rationale is one sentence – to “achieve the well-known goals of eliminating the heavy bevel gear differential, therefore reducing the weight and fuel consumption of the vehicle.” (Ex. 1005, Becker Decl. ¶45.) No factual evidence is offered to support the conclusion that 1) eliminating the time-tested bevel gear differential was a “well-known goal”; or 2) eliminating the differential and replacing it with two clutches would result in weight reduction. (*Id.* ¶45.) It is not appropriate to make an assertion “where the facts asserted to be well-known are not capable of instant and unquestionable demonstration as being well-known.” M.P.E.P. §2144.03(A).

Here, factual evidence contradicts Petitioner’s unsupported assertions:

First, prior to the filing date of the ‘440 patent, driveline systems routinely utilized a differential on the drive axle to help distribute drive power between the drive wheels. (Ex. 2019, Newton Textbook at 634-635.) . . . And even today, the use of differentials is still prevalent. (Ex. 2009, 2015 Tata SAE Paper at 1; Ex. 2012, 2006 SAE Paper at 3, 6.) . . . If it was such a ‘well-known goal’ to reduce weight by substituting a clutch assembly for the differential while still maintaining the same functionality and reliability, there would be no need for differentials in current vehicles.

(Ex. 2017, Stein Decl. ¶¶88-89.)

Dr. Stein adds, “regarding Teraoka in particular, the fact that Teraoka retained a differential and *added* a single clutch is evidence that it was not such a ‘well-known goal’ to reduce weight by substituting the differential for a clutch, else Teraoka would have added another clutch instead of keeping the differential.” (*Id.* ¶89.)

Further, Mr. Becker’s deposition testimony contradicts his declaration on the issue of whether eliminating the bevel gear differential was a “well-known” goal:

Q. On or before the relevant time period here, which is May 6, 2008, was there a desire in the industry to eliminate bevel gear differentials?

A. Not by me. I don't know about everybody else.

(Ex. 2020, Becker Tr. at 184-185.)

Second, “it is not well-known or even true that substituting a differential gearing for a clutch assembly would, in fact, reduce the weight of the vehicle.”

(Ex. 2017, Stein Decl. at ¶91.)

For example, even *GKN’s own dual-clutch system* that replaces a differential has been discussed as providing desirable “torque vectoring” **at the cost of a slight addition** to the vehicle’s weight: “The beauty of GKN’s clutch system is that, *for a small weight penalty*, a car can actually ‘vector’, or infinitely juggle torque between each wheel, rather than the more simple cheating way of braking an inside wheel on a corner to load up a mechanical differential. This same logic would apply to the relevant timeframe; it would not have been well-known to one of ordinary skill in the art prior to the filing

date of the '440 patent that a replacement of a differential with a clutch(es) would reduce weight.

(Ex. 2017, Stein Decl. at ¶¶91, citing Ex. 2024, <http://www.topgear.com/car-news/frankfurt-motor-show/meet-boffins-behind-new-ford-focus-rss-revolutionary-4wd-system>, Topgear Website, emphasis added.)

Finally, the Becker declaration fails to explain why a POSA would have combined elements from the two references in the specific way the claimed invention does. No explanation is provided for why Watanabe's dual clutch system would have been combined with Teraoka's connectable secondary driveline system such that the dual clutches would operate in combination with the switch-on device to facilitate 1) coupling/uncoupling when switching from 4WD to 2WD modes and 2) controllable power distribution to each of the wheels. (Ex. 2017, Stein Decl. ¶¶92-123.)

“[I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *KSR*, 550 U.S. at 418. Under Petitioner's rationale, even if a POSA were interested in reducing the weight of the drivetrain, the POSA would likely have chosen a different modification to the drivetrain. “There are many types of ‘power-dividing units’ or ‘PDUs’ such as “open differentials and positively locked units, limited slip differentials with all kinds of torque biases,

mechanically and electronically locked differentials, viscous couplings, NoSPINs, and . . . torque-vectoring or torque-management systems.” (Ex. 2017, Stein Decl. at ¶¶98, citing Ex. 2036, Andreev Textbook at xv.) “In considering a decision to replace the differential with some other type of power-dividing unit (PDU), an engineer would be given a plethora of choices to make. Side-shaft couplings (e.g., clutches) would be one of many, many potential PDUs.” (*Id.* ¶¶99.) On this point, Petitioner’s expert, Mr. Becker, agrees. (Ex. 1005, Becker Decl. ¶¶106-107, 176-177.) Given the array of PDU’s, a more detailed rationale is required to explain why a POSA would have chosen two side-shaft couplings from the available options.

The control, handling and fuel economy benefits that result from a system with a switch-on device, shutdown section and a pair of clutches that function together to provide a connectable secondary drivetrain with transverse/longitudinal equalization were not recognized prior to the ‘440 Patent. (Ex. 2017, Stein Decl. ¶¶92-123.) As no single specific problem gives rise to the claimed combination, a POSA would have had little reason to incur the additional time, expense and risk of employing a dual clutch system in lieu of the conventional differential, to split drive train power in a selectively connectable system. (*Id.*) The combined functionality and benefits of this system produced results that were unexpected as of May 6, 2008. (*Id.*)

b. The “what” explanation is deficient

Two different conclusory statements are provided in the Petition and Becker Declaration to establish “what” aspects of the asserted references are combined. In a first recitation of the proposed combination, on page 19 of the Petition and page 23 of the Becker Declaration, Petitioner argues it “would have been a matter of simple substitution to replace the rear, secondary drivetrain [of Teraoka] with the rear secondary drivetrain of Watanabe.” (Petition at 19; Ex. 1005, Becker Decl. ¶45 (emphasis added).) On the same page of each filing, Petitioner and the Becker Declaration state “it would have been obvious to replace the clutch 71 and differential 25 of Teraoka with side shaft couplings on each side of the secondary axle without differential gearing in between.” (*Id.*) Under the first recitation, the drivetrain replacement would entail replacing the differential with two multiple plate clutches 89, 91, two hub members 45, 47 and two actuators 133, 135 per Fig. 1 of Watanabe. No such modification is required by the second recitation. Because the two recitations differ, an ambiguity exists regarding “what” is to be combined.

Moreover, with either recitation of the proposed combination, one or more claimed features are missing. Claim 1 defines the secondary drive train as “having a shutdown section located between the switch-on device and the at least one side shaft coupling.” Petitioner argues that Teraoka discloses the claimed “shutdown section” in its analysis of claim 1. With respect to claim 2 however, as

a rationale for combining Teraoka with Watanabe, Petitioner argues that “[i]t would have been a matter of simple substitution to replace the *rear, secondary drive train [of Teraoka] with the rear, secondary drive train of Watanabe* to yield the predictable result of reducing mass and rotating losses.” (Petition at 19.) Under this proposed combination, the result would yield no shutdown section because Watanabe does not disclose a shutdown section.

Likewise, under the second recitation of the proposed combination, in which the clutch 71 and differential 25 of Teraoka are replaced with the side shaft couplings of Watanabe, the sensors and actuators from the secondary drivetrain of Watanabe – which are needed to effectuate transverse and longitudinal equalization in claims 2 and 3 – would be missing. Claim 2 requires a drive train wherein *the side shaft couplings allow a driving power distribution without a differential gearing between the drive wheels of the secondary axle to ensure transverse compensation.* Claim 3 is directed to a drive train, wherein the two side shaft couplings ensure longitudinal compensation when coupled. As Dr. Stein explains in his declaration “the combination of Teraoka with Watanabe would be inoperable without the addition of sensors, controllers and algorithms to utilize and control the clutches. Without those, the clutches would not allow for transverse and longitudinal equalization. The drivetrain would fail.” (Ex. 2017, Stein Decl. ¶108.) Accordingly, in addition to the ambiguity regarding “what” is specifically

being combined, both recitations of the combination result in claim deficiencies.

Finally, there is no “articulated reasoning” or “rational underpinning” to support a rationale for replacing a clutch and differential (Teraoka) with side shaft couplings (Watanabe) by arguing that the replacement of *the entire secondary drive train* would be a simple substitution, especially when the reference that is used in the substitution does not have the required shutdown section. *KSR*, 550 U.S. at 418.

c. The “how” rationale is also deficient

As in *Kinetic Technologies*, the Becker declaration fails to explain how the proposed references would be combined. The Petition and Becker Declaration simply state: “[i]t would have been a matter of simple substitution to replace the rear, secondary drive train with the rear, secondary drive train of Watanabe to yield the predictable result of reducing mass and rotating losses.” (Petition at 23; Ex. 1005, Becker Decl. ¶45.) As described above, it is unclear which components of the “rear, secondary drive train” would be replaced (making it impossible to assess mechanical compatibility of the proposed combination), how this would be accomplished, and what steps would be necessary to modify a differential-based rear-axle system with one that employs two clutches let alone determine whether the steps would be well-known to one-skilled in the art. At a minimum, electrical and mechanical modifications would be required as well as modifications to the

brake and steering systems to factor in power inputs from both clutches. (Ex. 2017, Stein Decl. ¶¶92-123.) Yet, the Petition offers no explanation of “how” this would be achieved.

2. The substitution of Teraoka’s rear drivetrain with Watanabe’s is neither a simple substitution nor one that creates predictable results

Petitioner’s bare assertion that “[i]t would have been a matter of simple substitution to replace the rear, secondary drive train [of Teraoka] with the rear, secondary drive train of Watanabe to yield the predictable result of reducing mass and rotating losses” is insufficient to establish a rationale to combine the Teraoka and Watanabe references. Petitioner would have the Board believe that all components in a driveline system are interchangeable through known methods yielding nothing more than predictable results. However, replacing one power drive unit (PDU) in a driveline with another involves a multi-pronged complex set of processes to confirm the design, validation, predictability and reliability of the component change as it relates to the driveline and all interrelated vehicle systems and performance characteristics, *i.e.*, steering, braking, velocity capabilities, stability, fuel economy, traction, etc. (Ex. 2017, Stein Decl. at ¶106; Ex. 2020, Becker Dep. at 107-111.)

a. Driveline design is complex and unpredictable

As driveline expert, Dr. Vladimir Vantsevich noted in an SAE paper he

authored, “a vehicle with four drive wheels has three power dividing units. The first one is the transfer case. Two more units are installed on the front and rear axles. *See* Figure 2. As seen from this, combinations of the mechanisms and subsystems that could be employed for these three PDUs are practically uncountable.” (Ex. 2012, 2006 SAE Paper at 4; Figure 2.)

Given the complex interplay between the drivetrain system, the other vehicle systems, such as the brake, suspension and steering systems, and the myriad of subsystems for each system, every proposed driveline modification requires extensive modeling to understand the impact of the modification. (Ex. 2017, Stein Decl. ¶¶96, 106; Ex. 2020, Becker Tr. at 107-114.) Even after a particular PDU is selected, computerized virtual modeling of that PDU “is necessary to assure compliance and capabilities with the desired fuel consumption, the off road abilities, as well as the handling, stability of motion, and turnability.” (*Id.* at ¶96, citing Ex. 2012, 2006 SAE Paper at Fig. 3.) Virtual experimentation is necessary because “[t]he relationships about driveline characteristics, suspensions, tires, steer, operating conditions, driver behavior and so on, are so complicated for an [*sic*] 4WD vehicle that is [*sic*] unavoidable to design 4WD [without] considering virtual experimentation.” (*Id.*) By way of example, if we look at just handling, one of many operational properties, computer simulation models would be used to estimate longitudinal performances, lateral dynamics, fuel consumption, traction

capabilities, yaw velocity and sideslip angles to minimize the otherwise unpredictable result of a driveline component change. (Ex. 2017, Stein Decl. ¶106.) Accordingly, the impact of substituting a conventional differential with two clutches, to 1) work in conjunction with the switch-on device to facilitate a connectable secondary drivetrain; and 2) to provide the desired transverse and longitudinal equalization could not be predicted without extensive computer modeling, testing and verification. (*Id.* ¶96.)

Petitioner's expert, Mr. Becker, agrees that even after a decision is made to substitute a bevel gear differential for a dual clutch system, you need to 1) "develop a control scheme" to "monitor speed at each wheel"; 2) review "your geometry concerns . . . to make the clutches fit in whatever rear differential module you're creating"; 3) perform your stress analysis calculations; 4) conduct NVH life testing and do your modeling for NVH and friction losses; 5) conduct performance testing and 6) assess lubricant issues as they are a "more significant factor affecting clutches than a bevel gear set." (Ex. 2020, Becker Tr. at 144-145, 179-180.)

It is thus undisputed that a POSA modifying a driveline design – in this case a rear differential for two clutches – would have to evaluate how the proposed modification would impact each of the vehicle's primary systems, performance characteristics and operational properties through computer modeling, testing and verification. (*Id.*) The proposed substitution is thus anything but "simple" or

“predictable.”

While Petitioner’s expert Mr. Becker agrees that driveline design involves a complex interplay and an iterative approach, he seems to confuse the existence of a methodology that could be used to arrive at the desired substitution with the legal notion of a “simple substitution.” (Ex. 2020, Becker Tr. at 144-145.) During his deposition, in an answer that spans five pages, Mr. Becker detailed the complex design, development, verification, predictability and planning process that would be entailed to modify a driveline system including the complex modeling and verification required to understand the impact of a modification on other vehicle systems, such as suspension, braking, steering or desired vehicle characteristics such as handling or fuel economy. (Ex. 1005, Becker Decl. at ¶¶68-73.) Nonetheless, Mr. Becker conflates “simple substitution” with the existence of a procedure to implement the desired substitution:

Q. Okay. But -- so, okay, when you say "simple substitution," what is that? What does that sort of term mean to you?

A. It means it's a matter of following the typical procedures of the auto industry.

(Ex. 2020, Becker Tr. at 145.)

For a driveline design procedure, where each iteration of a component change requires complex modeling and testing to determine the impact on each vehicle system and property, resulting in a two year development period involving over

100 people—the legal notion of a “simple substitution” that yields “predictable results” does not apply. (Ex. 2017, Stein Decl. ¶¶102-109.)

b. Petitioner Glosses Over The Structure And Function Of Watanabe

Because the clutches in Watanabe have a substantially different structure and function than the clutches in Teraoka, the two cannot be “simply substituted.” In Teraoka, a single wet multi-plate clutch is arranged in a differential carrier on the rear axle so that “lubrication of the wet multi-plate clutch is easy and durability of the clutch plates can be improved.” (Ex. 1002, Teraoka at 5.) By contrast, in Watanabe, the pair of multiple plate clutches 89, 91 are configured to separately engage a cylindrical case 29 and a hub member 45, 47, such that if the tightening force of the multiple plate clutch is adjusted, differential rotation between the case and the hub member is controlled. (Ex. 1003, Watanabe at 3-4.)

As a result of this difference in structure, Watanabe’s two clutch mechanism can be used to adjust “the distribution ratio of the drive power between the rear wheels” and more specifically to selectively apply a yawing moment to either of the rear wheels or adjust the size of the yawing moment during cornering to improve steering characteristics. (Ex. 1003, Watanabe at 4-5.) On the other hand, Teraoka’s clutches fail to provide any drive power control between the rear wheels. (Ex. 1002, Teraoka at 6, 9; Ex. 2017, Stein Decl. ¶120.) Petitioner’s “simple substitution” boilerplate fails to provide the necessary rational underpinning given

the disparate structure and function of the components to be modified. *See, Zimmer Holdings, Inc. et al. v. Bonutti Skeletal Innovations LLC*, IPR2014-01078, Paper 17 at 20 (PTAB Oct. 30, 2014).

3. In the driveline area, the design is dictated by the problem to be solved; a POSA concerned with reducing drag rotation would not look to Watanabe

As detailed above, because the driveline is central to much of the vehicle's functions, small variations lead to significant impacts across the vehicle's systems. Driveline design changes are thus made with a keen focus on the problem to be solved. As Dr. Stein explains "[t]he process of designing a driveline is problem-solution oriented, in order to achieve the desired performance for that the particular vehicle's manufacturer is seeking, given a set of road conditions, terrain conditions, and modes of operation relevant to their customers." (Ex. 2017, Stein Decl. ¶122.) This problem-oriented approach is undisputed. (Ex. 2017, Stein Decl. ¶122; Ex. 2020, Becker Tr. at 98-101.)

Both parties agree that Teraoka is directed to the problem of simplifying the driveline "configuration while greatly reducing the drag torque of the coupling which is uncoupled during two-wheel drive travel" leading to "wear, vibration, noise, etc. of the various parts as well as affecting fuel efficiency due to energy loss." (Ex. 1002, Teraoka at [0017, 0020]; See Ex. 2017, Stein Decl. ¶110; Ex. 2020, Becker Tr. at 147-148.) It is further undisputed that Teraoka solves this

problem with the combination of a switch-on device and shutdown section. (Ex. 2017, Stein Decl. ¶111; Ex. 2020, Becker Tr. at 147-148.)

While Watanabe describes a 4WD vehicle, it is not directed to the resulting problems of complex configuration, power loss, drag reduction or fuel efficiency. (Ex. 2017, Stein Decl. ¶113.) Watanabe is directed to improving “lubrication, seizing or the like” of the clutches. (Ex. 1003, Watanabe at 2.) Petitioner’s expert admits that Watanabe is directed to a different problem: “Watanabe all by itself compared to Teraoka all by itself, Watanabe because it can be used in the front, the rear or any place isn’t necessarily for fuel economy it’s for this control.” (Ex. 2020, Becker Tr. at 174.)

“While a prior art reference may support any finding apparent to a person of ordinary skill in the art, prior art references that address different problems may not, depending on the art and circumstances, support an inference that the skilled artisan would consult both of them simultaneously.” See *Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1334 (Fed. Cir. 2013) citing *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1366 (Fed. Cir. 2012) (emphasis added.). Here, given the intensely problem-driven approach to driveline design, it stands to reason that a POSA looking to further the goals of Teraoka would not consult the Watanabe reference. (Ex. 2017, Stein Decl. ¶¶113-14.)

4. The proposed combination is inoperable for Teraoka's intended purpose

Moreover, the combination of Teraoka and Watanabe would frustrate Teraoka's intended purpose of simplifying the configuration, reducing drag loss and improving fuel efficiency. Teraoka incorporates a single clutch 71 within the differential housing to achieve "greater compactness of the whole device." (Ex. 2017, Stein Decl. ¶117.) "Substituting Teraoka's differential design with Watanabe's dual clutch design would likely require more space to accommodate the dual clutch system." (*Id.*) The substitution of two clutches and the associated actuators would also "likely be heavier." (*Id.*)

A recent publication regarding GKN's dual-clutch, Twinster product, that embodies the '440 patent invention, provides that "[t]he beauty of GKN's clutch system is that, *for a small weight penalty*, a car can actually 'vector', or infinitely juggle torque between each wheel." (Ex. 2024, Topgear website, emphasis added.) "One of ordinary skill in the art would therefore not be motivated to replace the differential design of Teraoka with the dual clutch design of Watanabe due to packaging and weight concerns." (Ex. 2017, Stein Decl. ¶118.)

Additionally, the demands on a dual clutch system on both in-line motion and turns would require greater modulation and thus reduce fuel efficiency—steering a POSA away from the Watanabe reference. (*Id.* ¶119.)

Long-standing Federal Circuit precedent dictates that combining references

in a way that renders them inoperable for their intended purpose is not a proper way to prove obviousness. *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984).

5. The proffered combination suffers from hindsight bias

Mr. Becker's analysis is rooted in the premise that the bevel gear differential must be eliminated:

Q. [W]hat would lead a person of skill in the art to start off with Teraoka and then pull in disclosure from Watanabe? What – what prompts that?

* * *

A. Several things. **First you have to have the concept that you want to eliminate your differential gearing.** When you do that, you then are looking at what you're doing for an alternative differential system. You would then potentially apply Watanabe. You may apply torsion. You may apply a [] roader system.

Q. I'm sorry, let me back up so why would one want to eliminate the - the bevel differential gearing system?

A. You're probably looking for an alternative and that alternative may be an alternative control schema or potentially you're looking for a weight savings. There may be a weight savings in eliminating the differential housing in bevel gears.

(Ex. 2020, Becker Tr. at 174-175.)

However, the invention must be viewed not after the blueprint has been drawn by the inventor, but as it would have been perceived in the state of the art

that existed at the time the invention was made. *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1138 (Fed. Cir. 1985).

Mr. Becker has used the ‘440 invention as a roadmap for his obviousness conclusions, reading into the prior art the teachings of the invention in issue. No factual testimony is provided to support the assertion that eliminating the heavy bevel gear differential was a “well-known goal” during the relevant May, 2008 timeframe. Further, the fact that bevel gear differentials are widely used even today, cuts against Mr. Becker’s unsupported opinions. (Ex. 2017, Stein Decl. ¶¶121-123.) Mr. Becker’s obviousness analysis is based on litigation-driven, after the fact testimony that is forbidden. *Cheese System v. Tetrapak*, 725 F.3d 1341 (Fed. Cir. 2013); *Mintz v. Dietz and Watson*, 679 F.3d 1372 (Fed. Cir. 2012).

It is improper to base a conclusion of obviousness upon facts gleaned only through hindsight. To draw on hindsight knowledge of the patented invention, when the prior art does not contain or suggest that knowledge, is to use the invention as a template for its own reconstruction – an illogical and inappropriate process by which to determine patentability. *Sensonic Inc. v. Aerosonic Corp.*, 81 F.3d 1566, 1570 (Fed. Cir. 1996), citing *W.L. Gore & Assoc. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983).

For these reasons, Petitioner’s Ground 2 obviousness assertion is deficient.

VIII. PATENTABILITY ANALYSIS-GROUND 3 BASED ON AN OBVIOUSNESS COMBINATION OF TERAOKA AND BURROWS AGAINST CLAIMS 6 AND 7 IS DEFICIENT

A. Overview of Burrows

The Burrows patent provides at least three multi-step control strategies to transition from 2WD to 4WD. (Ex. 1004, Burrows at 9-10; *see also* Ex. 2017, Stein Decl. ¶¶126-130.) The first of these strategies is a two-step embodiment for use with friction clutches, where the non-rotating parts of the secondary drive system are engaged and the system waits for them to be brought up to speed. (*Id.*) Once the correct speed is reached a second step is employed to engage the primary drive train with the secondary drive while the vehicle is moving. (*Id.*) This promotes smooth engagement as perceived by the driver:

Changing from two wheel to four wheel drive is controlled so that [1] the auxiliary drive line 21 is reconnected to either the engine 11 or the second pair of wheels, typically the rear wheels 14, 15, to rotate at least part of the auxiliary drive line 21 for a sufficient time period prior to [2] fully reconnecting it to provide drive torque to the rear wheels 14, 15. Thus transition to engagement of four wheel drive occurs in two stages, reducing any acceleration jerk perceived by the driver.

(Ex. 1004, Burrows, Abstract.)

A second multi-step control strategy is employed for embodiments with a dog clutch:

A control strategy for operation of a dog clutch for a dynamic change in two wheel drive mode causes [1] the clutch 22 to spin-up the auxiliary driveline 21 to the best estimated synchronization speed for connection to the rear wheels 14, 15. The clutch 22 would then [2] disengage quickly whilst simultaneously the synchronizer device would [3] smoothly engage the dog clutch. The clutch 22 then [4] re-engages quickly.

(*Id.* at 12.)

Finally, a third control strategy is taught for “off road” embodiments monitoring an array of vehicle operating conditions and wanting to enter 4WD more rapidly and automatically. In this “off-road” mode, one clutch is engaged to keep driveline 21 spun up continually and a second clutch is engaged when needed. The controller in Burrows can “predict when four wheel drive should be engaged and . . . automatically spin-up the auxiliary driveline 21 ready for automatic connection into four wheel drive mode.” (*Id.* at 10.)

While the Burrows patent teaches several synchronization mechanisms for 4WD engagement, it is not directed to the issue of power loss or decoupling the secondary driveline from the primary driveline.

B. Dependent Claims 6 and 7

Claims 6 and 7 depend from independent claim 1 and add the following limitations:

6. The drive train as claimed in claim 5, wherein **a speed synchronization** in the switch-on mechanism of the power transmission gearbox for the establishment of **a positive lock** is supported by the at least one side shaft couplings.

7. The drive train as claimed in claim 6, wherein **the at least one side shaft couplings is formed by a frictionally engaged multiple disc clutch**, whereby the friction plates connected in a torque-proof way to the secondary drive wheels cooperate as inner plates with an inner plate carrier and whereby the friction plates located on the drive train-side of the vehicle cooperate with an outer plate carrier as outer plates.

(Ex. 1001, '440 Patent, Claims 6 and 7 (emphasis added).)

C. Ground 3 is deficient against claims 6 and 7 because petitioner's rationale to combine Teraoka and Burrows is conclusory and lacks sufficient rationale

Petitioner relies on the teachings of Burrows to satisfy the *speed synchronization* limitations in claims 6 and 7. (Petition at 22-23.)

1. No reasonable basis is provided for why a POSA would have been motivated to combine Teraoka and Burrows

Petitioner's conclusory arguments are insufficient to establish a rationale to combine Teraoka and Burrows. Indeed, Petitioner fails to advance any reasonable basis for why a POSA would have looked to Burrows to solve the problems identified in the '440 Patent, namely power and fuel economy losses and the reduction of system complexity/cost when a selectively connectable 4WD system

operates in 2WD mode. The Burrows invention relates to drivelines “in particular for motor vehicles such as all-terrain vehicles.” (Ex. 1004, Burrows at 5, emphasis added.) More specifically, Burrows is directed to a multi-stage control strategy that reduces “acceleration jerk perceived by the driver” during the transition to four wheel drive. (Ex. 1004, Burrows, Abstract.)

In relation to conventional 4WD vehicles, the terrain demands encountered by all-wheel terrain vehicles (“ATVs”) – and the myriad issues common to ATVs such as “acceleration jerks” – fundamentally alter the driveline design criteria and acceptable tradeoffs, *i.e.*, weight and fuel economy considerations. (Ex. 2012, 2006 SAE paper at 4.) Becker agrees: “off road mobility impacts driveline systems and design” and considerations that are relevant to a passenger vehicle such as “on-road performance, smoothness, roughness, none of those things are really considered with the ATV generally.” (Ex. 2020, Becker Tr. at 11-112, 1988.) Because both the operational properties and acceptable system tradeoffs vary so greatly, a POSA designing a driveline to minimize power and fuel economy losses for conventional 4WD applications would not look to a reference directed to minimizing acceleration jerks for an ATV. (Ex. 2017, Stein Decl. ¶¶131-141.)

Specifically, Burrows teaches that the synchronization process be done *quickly* in order to rapidly switch to 4WD to account for the rapid, often frequent changes in terrain realized by the all-terrain vehicle: the clutch 22 is used to “spin-

up the auxiliary driveline 21 to the best synchronisation [*sic*] speed” before engaging the dog clutch in the differential, then the clutch 22 “*disengage[s] quickly*” while the synchronizer device engages the dog clutch, and after which the “clutch 22 then re-engages *quickly*.” (Ex. 1004, Burrows at 8:7-11.) As Dr. Stein explains, “[t]ransitioning from 2WD to 4WD as quickly as possible can be done at the expense of undesirable fuel usage. . . . Since Teraoka strives to maximize fuel economy of its driveline system, one skilled in the art would have been discouraged from taking steps that would, in fact, degrade fuel economy,” contrary to the intended purpose of Teraoka. (Ex. 2017, Stein Decl. ¶¶155-156.) Becker also notes that in Burrows “as you connect four-wheel drive, as you spin that up, that’s going to be a power loss. It’s going to cause drag on the vehicle” – contrary to the purpose of Teraoka. (Ex. 2020, Becker Tr. at 197.)

Similarly, Burrows use of a dog clutch frustrates Teraoka’s purpose of reducing drag torque: “Since the dog clutch used in the two-four switching mechanism, unlike a friction clutch such as a multi-plate clutch, does not produce drag torque, it is especially well suited for the present invention, the object of which is to reduce drag torque.” (Ex. 1002, Teraoka at [0037]; Ex. 2017, Stein Decl. ¶¶147-150.)

As its sole basis for the proposed combination, Petitioner relies on yet another unsubstantiated assertion that “it was well known in the art that positively

connected gearing (e.g. a dog clutch) requires speed synchronization of the input and output sides to reduce wear and prevent failure.” (Petition at 22-23.) Neither the Petition nor the Becker declaration offer any underlying facts or data to substantiate the allegedly “well-known” goal. “[W]here the facts asserted to be well-known are not capable of instant and unquestionable demonstration as being well-known” they are entitled to no weight. M.P.E.P. §2144.03(A).

As with the Ground 2 combination, the Ground 3 combination of Teraoka and Burrows is predicated on hindsight bias. “Understanding that the process to design a driveline suited for a passenger vehicle such as Teraoka takes a significant amount of development, synthesizing, and testing, one of ordinary skill in the art would not reasonably have been led to implement the synchronization technique of the ATV of Burrows without having the benefit of GKN’s claims to use as a guide.” (Ex. 2017, Stein Decl. ¶¶151-157.) “One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.” *In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992).

2. Petitioner’s boilerplate “known technique” statement fails to explain the combination and how it would be achieved

Petitioner offers no specifics as to which of the at least three speed synchronizer mechanisms taught in Burrows would be incorporated, let alone how

the mechanism would be combined with the Teraoka configuration. The petition simply states that a known technique to improve similar devices in the same way supports obviousness: “it would have been obvious to one of ordinary skill in the art to synchronize the switching mechanism 7 of Teraoka using the clutch mechanism 71 connected by propeller shaft 21, as taught by Burrows, to perform synchronization without the use of additional equipment.” (Petition at 23.)

Notably, Burrows teaches three distinct synchronizer mechanisms. In the basic 2-stage synchronization method, the transition from 4WD to 2WD

is controlled so that the auxiliary drive line 21 is reconnected to either the engine 11 or the second pair of wheels, typically the rear wheels 14, 15, to rotate at least part of the auxiliary drive line 21 for a sufficient time period prior to fully reconnecting it to provide drive torque to the rear wheels 14, 15. Thus transition to engagement of four wheel drive occurs in two stages, reducing any acceleration jerk perceived by the driver.

(Ex. 1004, Burrows, Abstract (emphasis added).)

According to Burrows, in order to “spin-up the auxiliary driveline 21 to the correct rotation speed . . . the first clutch connection should be engaged with the driveline for a minimum time period before the second clutch connection is completed. This time period is related to the speed of the vehicle.” (Ex. 1004, Burrows at 11.) When the driveline structure includes a dog clutch, Burrows recommends a separate four-stage synchronization method. (*Id.* at 10.)

By contrast, in Teraoka “[t]he controller simultaneously couples the two-four switching mechanism 7 and clutch mechanism 71 when switching from two-wheel drive state to four-wheel drive state and simultaneously uncouples them when switching from four-wheel drive state to two-wheel drive state.” (Ex. 1002, Teraoka at [0072] (emphasis added).)

The Petition, however, never identifies which of the three multi-stage synchronizer mechanisms taught in Burrows would be suitable for combination with Teraoka. Given the lack of specificity, the Patent Owner must make assumptions to understand and respond to the Petition. Where Petitioner’s argument does not identify which specific elements of each system are to be combined, the Board has denied Petitioner’s unpatentability challenges as lacking “an articulated reasoning with rational underpinnings.” *Google, Inc. v. EveryMD.com LLC*, IPR2014-0347, Paper 9 at 26 (May 22, 2014).

Further, Petitioner never explains how any of the multi-stage synchronization processes taught in Burrows could be integrated with Teraoka’s existing driveline – which is not directed to ATV applications—and what other modifications would need to be made thereafter. (Ex. 1217, Stein Decl. ¶¶142-146.) Teraoka’s simultaneous coupling of the two-four mechanism and clutch mechanism is not readily substitutable with Burrows’ teaching of a multi-stage coupling process without significant system and controller modifications. (*Id.*) The

Petition, however, is silent as to what modifications would be needed and whether such modifications were within the knowledge of one skilled in the art during the relevant time frame. Petitioner's cursory discussion of Burrows and limited citations fail to provide the requisite rational underpinning needed to "support the legal conclusion of obviousness." *KSR Int'l Co v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007) citing *In re Kahn*, 440 F.3d at 988.

Moreover, where the suggested combination would require "a change in the basic principle under which the primary reference was designed to operate" then the teachings of the references are not sufficient to render the claims *prima facie* obvious. M.P.E.P. §2143.01(V); *In re Ratti*, 270 F.2d 810 (CCPA 1959). Here, as the suggested combination would require the simultaneous coupling system in Teraoka to be modified to a multi-stage speed synchronization mechanism – the suggested obviousness combination is impermissible.

For these reasons, Petitioner's Ground 3 obviousness assertion is deficient.

IX. OBJECTIVE INDICIA SUPPORTS NONOBVIOUSNESS

Objective indicia, such as unexpected results, commercial success, praise by others and long-felt need, "can be the most probative evidence of non-obviousness in the record, and enable the court to avert the trap of hindsight." *Crocs, Inc. v. ITC*, 598 F.3d 1294, 1310 (Fed. Cir. 2010). These objective criteria "turn back the clock and place the claims in the context that led to their invention." *Mintz v. Dietz*

and Watson, 679 F.3d 1372 (Fed. Cir. 2012). As such, the Federal Circuit requires consideration of these objective indicia because they “provide objective evidence of how the patented device is viewed in the marketplace, by those directly interested in the product.” *Id.* at 1378 (citing *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1391 (Fed. Cir. 1988) and *Spectralytics, Inc. v. Cordis Corp.*, 649 F.3d 1336, 1344 (Fed. Cir. 2011).)

GKN’s dual-clutch driveline system with a shutdown section and disconnectable secondary axle, known by the name of “Twinstar,” embodies the ‘440 patented invention. (Ex. 2017, Stein Decl. ¶¶158-166.) Objective evidence regarding how Twinstar has been received by the auto industry is thus relevant to establish nonobviousness of the ‘440 patented invention.

Industry praise for the Twinstar driveline notably touts claimed features of the ‘440 invention. (*Id.*) One article entitled “*General Motors Will Introduce Dual Clutch AWD On More Cars*” explains that the GKN Driveline on the Buick Lacrosse “adds two electronically controlled clutches to the rear axle in place of the traditional mechanical differential.” (*Id.* at 162; citing <http://gas2.org/2015/12/23/general-motors-will-introduce-dual-clutch-awd-on-more-cars/>, “Gas2.org Article”, Exhibit 2029) Per the article, “this arrangement lets the car’s onboard computer determine how much, if any, of the engine’s power is transmitted to each rear wheel.” (Ex. 2029, Gas2.org Article at 1.) The article

quotes GM Lacrosse's Marketing Manager who states that the system "has a real performance element to it, with big benefits on acceleration and cornering." (*Id.*) Unexpected results are also identified: "the electronic dual clutch enables what is known today as 'torque vectoring,' a way to not only send power to a wheel with traction but also enhance cornering ability by delivering more power to the outside wheel, which helps the car turn." (*Id.*) As explained in a GKN press release, this is accomplished by a "twin clutch system" that enables application of "torque to one or both wheels independently, enabling the vehicle's dynamic torque vectoring functions across its entire speed range." (Ex. 2026, "GKN Twinstar press release," <http://www.gkn.com/frankfurt/news-and-Media/Pages/GKN-supplies-innovative-AWD-system-to-Ford-Focus-RS.aspx>.)

The benefits of implementing the Twinstar dual-clutch mechanism into controllably connectable AWD vehicles is also noted in the article: the Twinstar can "disconnect the rear wheels entirely in certain circumstances to boost fuel economy on the open road," and so "[a]s OEMs get more and more worried about saving fuel, having these twin clutches is the most efficient way to disconnect the rear while still being able to offer all wheel drive to customers who need it." (Gas2.org Article, Exhibit 2029 at 2.) "Through the introduction of the combination of a shutdown section and a switching mechanism in the driveline, the disconnect function helps boost fuel economy." (Ex. 2017, Stein Decl. ¶162.)

The Twinstar system was first introduced in the Range Rover Evoque vehicle, and since then has expanded to the Buick LaCrosse, Cadillac XT5, the GMC Acadia and several other GM vehicles. (*See, generally*, Ex. 2028, “Autonews article,” <http://www.autonews.com/article/20151221/RETAIL/312219981/gm-seeks-a-market-beyond--the-snow-belt-for-awd-models>; *see also* Ex. 2031, Green Car Congress Article at 1.) The success of the program is planning to spread to other GM vehicles as well – the Twinstar system has been/is slated for introduction in 24 vehicle launches between 2015-2019. (Ex. 2017, Stein Decl. ¶¶160, 164; *citing* Ex. 2031, Green Car Congress Article at 1-2.) The Twinstar’s ability to simultaneously provide a product that assists with fuel economy losses in 4WD vehicles while enhancing driveability and handling – addresses a long-felt but unmet need in the industry. (Ex. 2017, Stein Decl. ¶¶158-165.)

Apart from industry praise, the Twinstar technology has received industry awards. GKN received a 1st place 2016 Pace award to GKN for its collaborative work with Ford on the development of the torque vectoring capability for Twinstar. *See*, Ex. 2030, “PR Newswire Awards Article,” <http://www.prnewswire.com/news-releases/gkn-driveline-honored-with-two-automotive-news-pace-awards-00249970.html#continue-jump>. The Automotive News PACE Award, bestowed for more than 20 years, is acknowledged around the world as the industry benchmark for

automotive supplier innovation.” (Ex. 2030, PR Newswire Awards Article.) The Twinstar technology was also nominated for another Automotive News PACE Innovation Award in 2016. (See, Ex. 2032, <http://www.autonews.com/section/pace#prettyPhoto>, “AutoNews Awards article” at 3.)

Additionally, the combination of the frictionally-engaged side shaft couplings with the switch-on mechanism for shutting down a portion of the driveline in 2WD mode has been praised in the industry for being part of “several new technologies which, combined, can lower fuel consumption by up to 11.4% and reduce CO2 emissions by up to 9.5%” in the 2014 Range Rover Evoque. (Ex. 2031, <http://www.greencarcongress.com/2013/09/20130905-gkn.html>; Ex. 2035, <http://ae-plus.com/news/land-rover-introduces-on-demand-all-wheel-drive>.) This combination also allows a switch between 2WD and 4WD to occur within a mere 300 milliseconds, limiting the amount of time for any transitional power losses. (*Id.*) And, the on-demand all-wheel drive feature has been praised for its ability to “cut system parasitic losses by around 75% on the test cycle by decoupling the rear axle.” (Ex. 2035, Land Rover AE News article at 1.)

“This commercial success and long-felt need in the industry is possible due to the hardware and structure of the Twinstar GKN device,” which is the subject of the ‘440 patent. (Ex. 2017, Stein Decl. ¶¶158-166.) The implementation of the dual-clutch mechanism instead of a differential, coupled with the ability to switch

between 2WD and 4WD modes, has fueled this unexpected commercial success. (*Id.*) Even Petitioner's expert agrees that torque vectoring was facilitated by the introduction of dual clutch pack actuation systems. (Ex. 2020, Becker Tr. at 81-82.) The objective indicia underscores the nonobviousness of the Challenged Claims: "the lack of motivation to combine either the Watanabe or Burrows references with Teraoka establishes non-obviousness, this conclusion is further bolstered by the presence of industry praise and commercial success for the claimed invention." (Ex. 2017, Stein Decl. ¶¶158-166.)

X. ANOMALIES WITH THE BECKER TESTIMONY

Because Petitioner relies on Mr. Becker's declaration as support for its Petition, GKN must bring to the Board's attention certain anomalies with the Becker testimony. First, during his deposition, Mr. Becker revealed that through the course of his expert engagement he engaged in a "peer review process," discussing the various patents, merits of each section and language of the report, etc. with two peer reviewers that also work with Mr. Becker at Robson Forensic. (Ex. 2020, Becker Tr. at 43-47.) Second, Mr. Becker admitted that but for an occasional citation difference, the claim charts in the Petition and Declaration are "effectively the same." (*Id.* at 190-194.) Indeed, the claim charts and rationale to combine assertions in both the Petition and Becker Declaration are substantively identical. Third, when forced to explain the lack of difference between the Petition

and Declaration, Mr. Becker ultimately acknowledged that he didn't "prepare" the claim charts, but rather simply "agreed to them." (*Id.* at 192-193.) Fourth, when asked what areas Mr. Becker considers himself an expert in, Mr. Becker responds by stating that he "would consider [him]self an expert in mechanical engineering" which includes "general mechanical engineering stuff." (*Id.* at 78-79.) Mr. Becker then listed several fields that he considers himself an expert in, including driveline systems, powertrain systems, steering, braking, bumpers, structure photogrammetry, acoustics, white water kayaking, materials failure analysis." (*Id.*) Finally, Mr. Becker's testimony regarding motivation to combine evidences a mistaken understanding that the claimed invention is to be used as a blueprint for an obviousness combination. (*Id.* at 144-147.)

XI. CONCLUSION

As Petitioner has failed to satisfy its burden, Patent Owner respectfully requests that the Board confirm the patentability of claims 2, 3, 6 and 7 of the '440 Patent.

Respectfully submitted,

Dated: June 16, 2016

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that the foregoing **PATENT OWNER'S RESPONSE TO PETITION FOR *INTER PARTES* REVIEW UNDER 37 C.F.R. §42.107**, including any attachments and exhibits, was served in its entirety on **June 16, 2016**, upon the following parties by electronic mail at cpdocketBaker@oblon.com:

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CERTIFICATE OF COMPLIANCE PURSUANT TO 37 C.F.R. §42.24

This paper complies with the type-volume limitation of 37 C.F.R. §42.24. The paper contains 13,112 words, excluding the parts of the paper exempted by §42.24(a).

This paper also complies with the typeface requirements of 37 C.F.R. §42.6(a)(ii) and the type style requirements of §42.6(a)(iii)&(iv).

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