



GKN DEMONSTRATIVES

*JTEKT CORPORATION, PETITIONER v.
GKN AUTOMOTIVE LTD., PATENT OWNER*

*Inter Partes Review Oral Hearing,
IPR 2016-00046*

Overview

GROUND	CLAIMS	PETITIONER'S ARGUMENT
2	2 and 3	Obvious under 35 U.S.C. §103 – Teraoka in view of Watanabe
3	6 and 7	Obvious under 35 U.S.C. §103 – Teraoka in view of Burrows

Disputed Issues:

1. Whether Petitioner has provided a sufficient rationale to combine the asserted references?
 - How, What, Why
2. Whether the Ground 3 combination discloses all of the necessary limitations?

'440 Patent

The aim of the invention is therefore to further develop a drive train of the type initially specified such that **when the secondary axle is uncoupled, power loss is minimized.**

(Ex. 1001, the '440 patent, 2:53-

This task is solved according to the invention by the **switch-on mechanism and/or the side shaft couplings having at least one frictionally engaged coupling** and, when the secondary axle is uncoupled, the section of the secondary drive train located between the connection unit and the side shaft couplings is uncoupled both from the primary drive train, in particular from the primary axle, and from the secondary drive wheels.

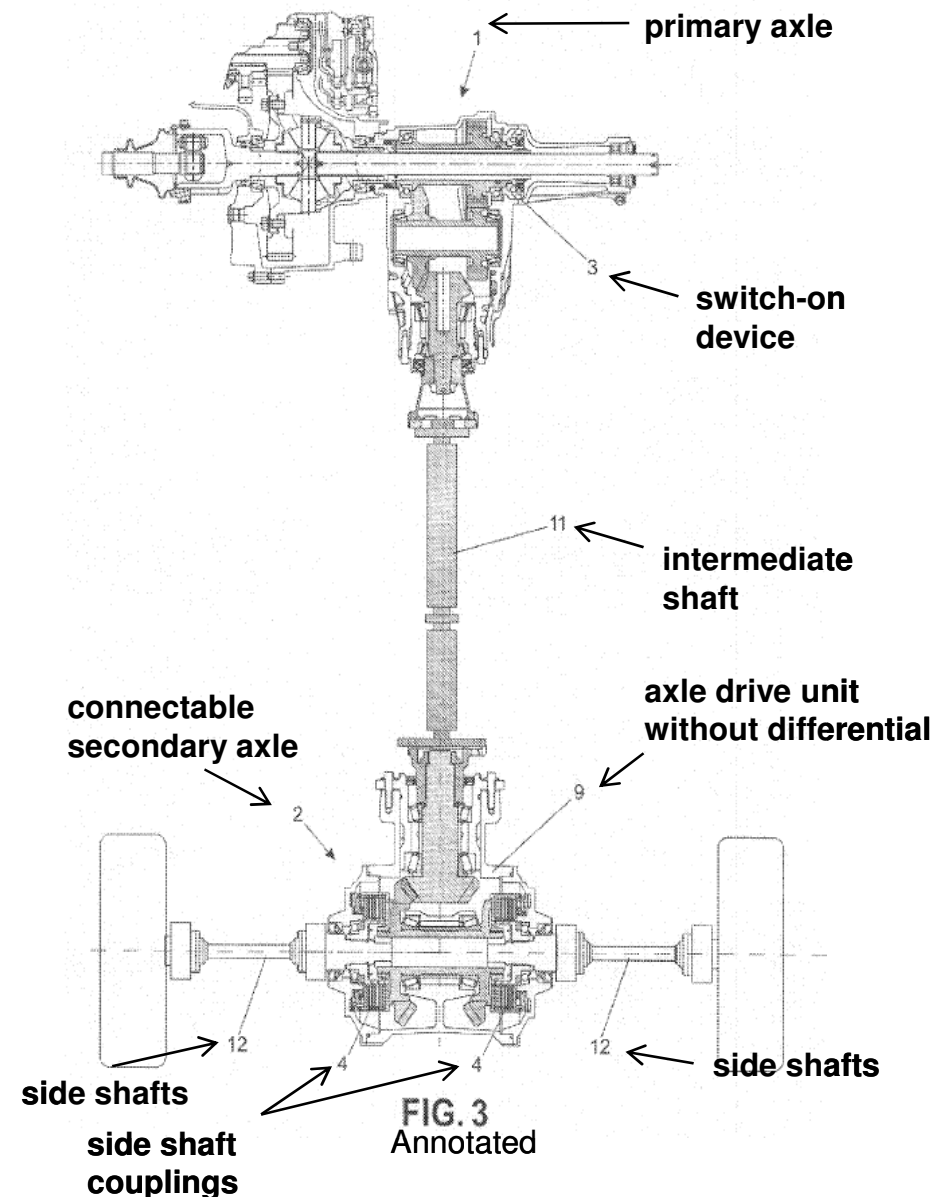
(Id at 2:66-3:6.)

This configuration of the drive train 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.)

Taken by itself, neither the side shaft couplings **4** nor the switch-on device **3** could execute the fundamental inventive idea; with respect to the invention **rather they cooperate synergistically.**

(Id. at 6:53-56.)



Claims 1 and 2

- Claim 1 is directed to:
- [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 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.**

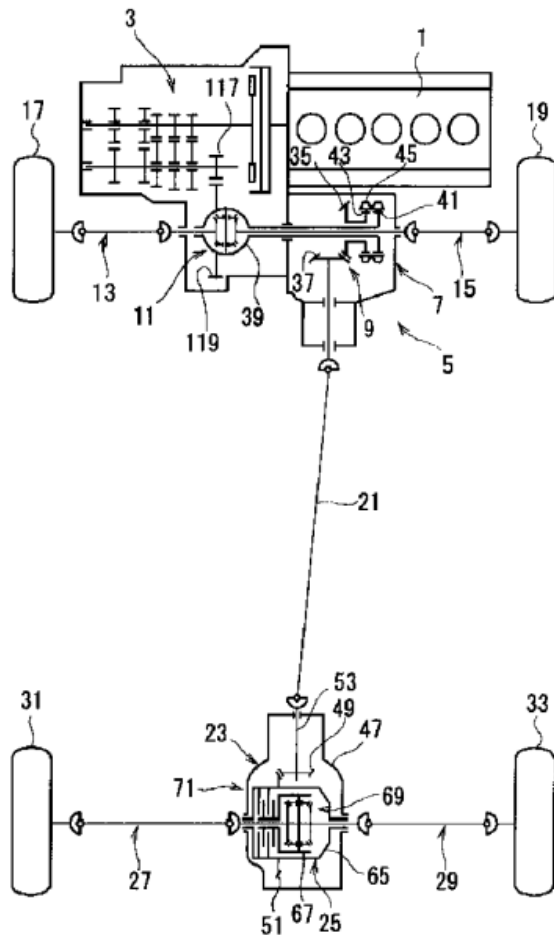
SWITCH-ON DEVICE CONNECTING SECONDARY AXLE TO PRIMARY AXLE FOR POWER TRANSFER

EXPANDED SHUTDOWN SECTION DECOUPLED FROM PRIMARY AXLE AND SECONDARY AXLE WHEELS

POWER DISTRIBUTION BY DUAL SHAFT COUPLINGS, NOT A DIFFERENTIAL, TO ENSURE TRANSVERSE COMPENSATION

(Ex. 1001, 12:11-42, annotated)

Ground 2: Teraoka and Watanabe



Teraoka, Fig. 1

[Problem] To simplify the configuration while greatly reducing the drag torque of the coupling which is uncoupled during two-wheel drive travel.

(Ex. 1002, Teraoka, at Abstract)

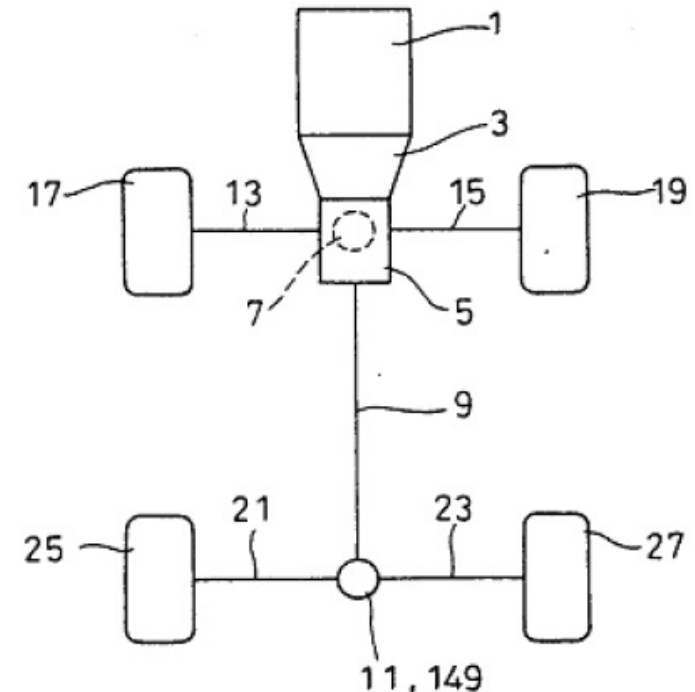


FIG. 2

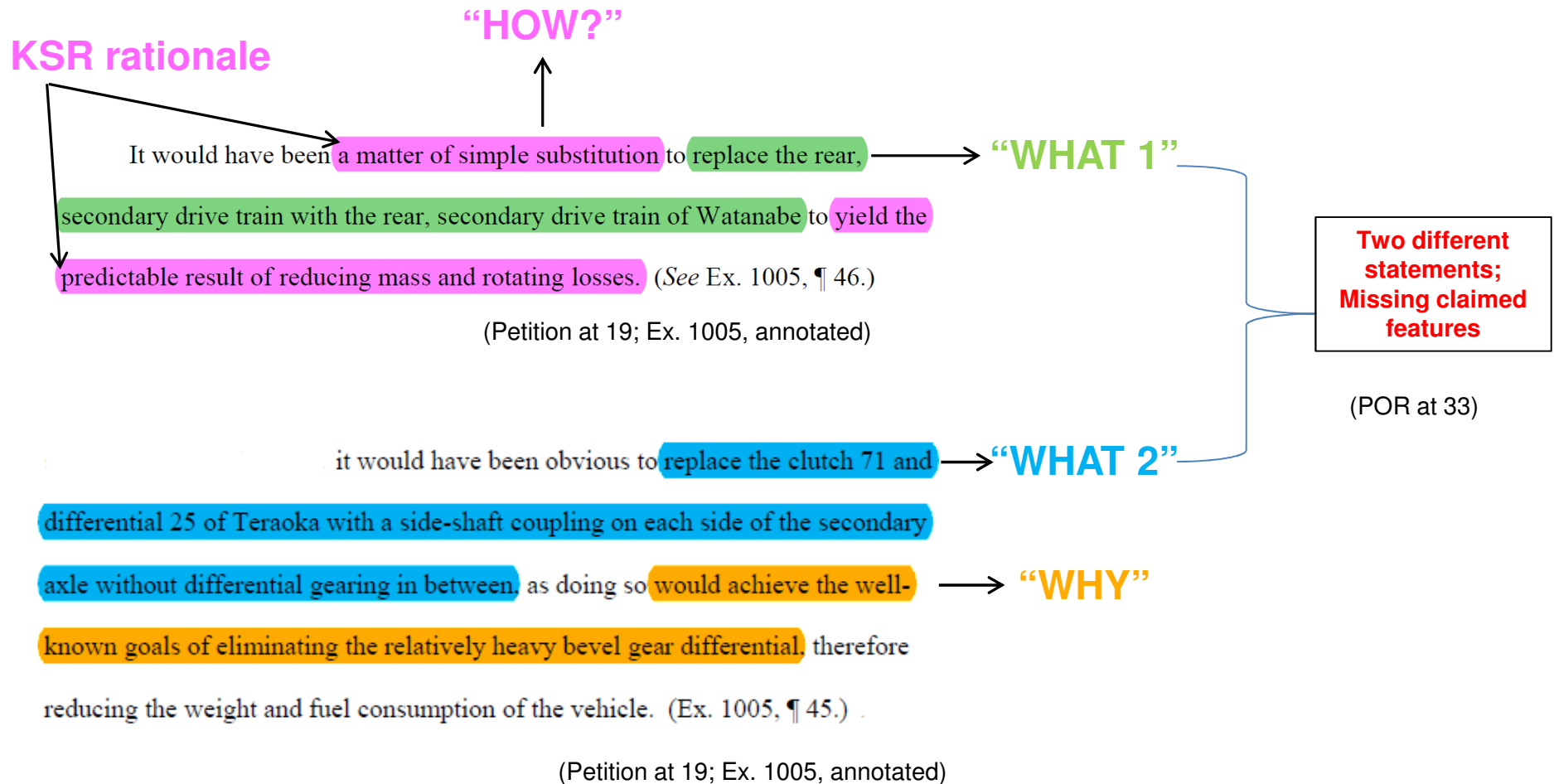
(Ex. 1003, Watanabe, Fig. 2)

(Problems to be Solved by the Invention)

Hence, the present invention has as an object to provide a power transmission device in which friction plates do not suffer from lack of lubrication, seizing, or the like.

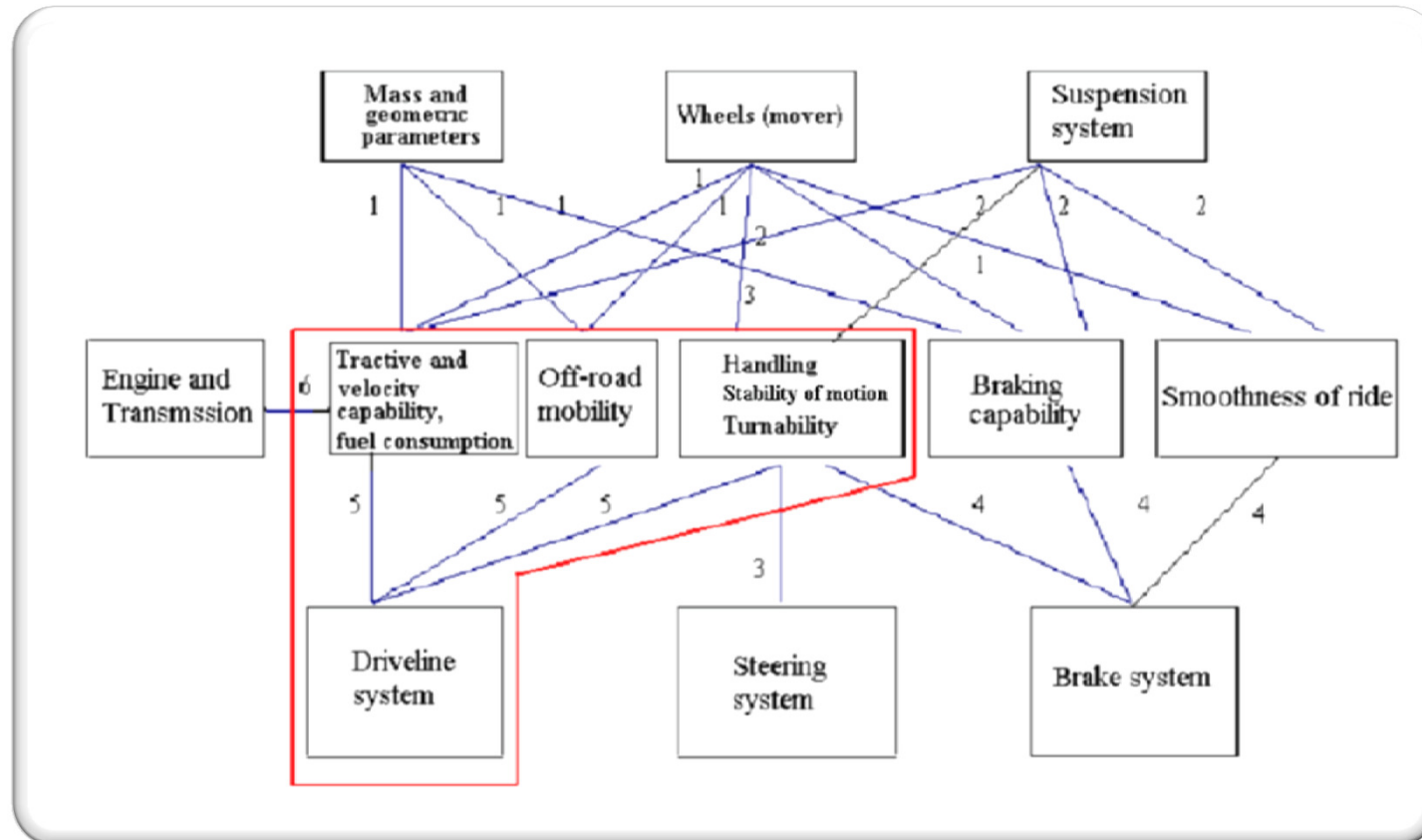
(Ex. 1003, Watanabe, at 2)

Ground 2: Rationale to Combine



“How?”/“How” the Combination Yields A “Predictable Result”?

POR28, 35-36



independent Claim 1 of the '440 patent merely requires a four

wheel drive system that includes at least one side shaft coupling. Claims 2 and 3 merely recite a combination of well-known alternative components that are joined in a conventional manner.

35. 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., at ¶35)

(Ex. 2012, Fig. 3, 2006 SAE Paper, at 4)

“HOW?”

(Petition at 19)

I was trying to distinguish between the lengthy and complicated process that engineers go through to take a concept and through modeling and simulation and testing find out how this device behaves. Sometimes we call that predicting how the device behaves, but it's not predictable before you do the simulation as to what the results are going to be; that's why you do the testing, that's why you do the simulation.

(Ex. 1012, Stein Dep., at 99:7-14)

PREDICTABLE RESULT?

Ground 2: “Why” Is Deficient

(POR at 29-32)

“WHY”

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?

would achieve the well-

known goals of eliminating the relatively heavy bevel gear differential.

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

(Petition at 19)

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.

(Ex. 2020, Becker Tr., at 184:21-185:2)

not well-known or even true that substituting a

(Ex. 2017, Stein Decl., at ¶89)

differential gearing for a clutch assembly would, in fact, reduce the weight of the vehicle. 89. And even today, the use of differentials is still prevalent.

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.

(Ex. 2017, Stein Decl. at ¶91, citing Ex. 2024)

Rational Underpinning?

(POR at 36-40)

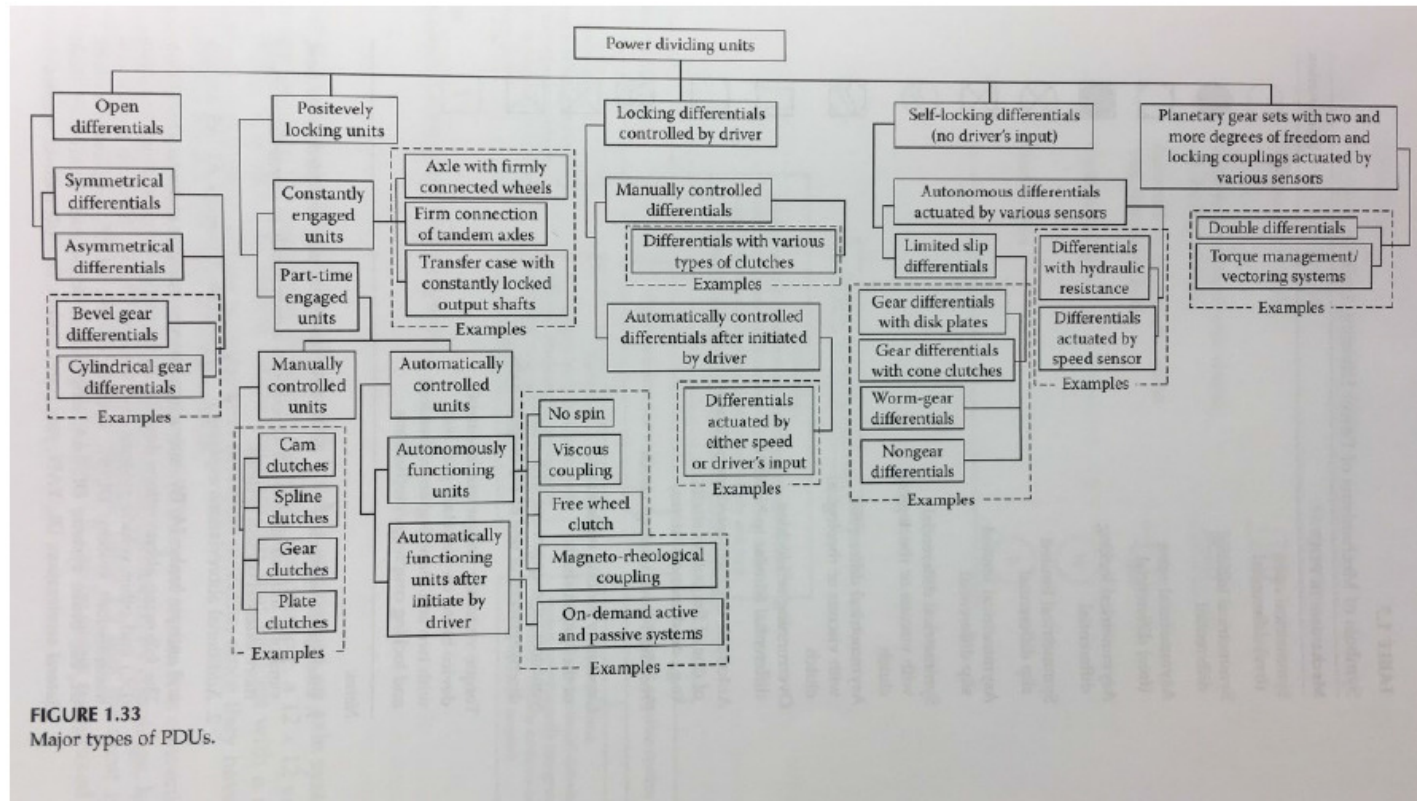


FIGURE 1.33
Major types of PDUs.

(Ex. 2036, Andreev Book, at 37)

a vehicle with four drive wheels has three power-dividing units: the first one is in the transfer case, two more units are installed on the front and rear axles (see Fig. 2). As seen from this, combinations of mechanisms and subsystems that could be employed for these three PDUs are practically uncountable.

(Ex. 2012, 2006 SAE Paper, at 4)

106. Looking at just one effect of a change in the PDU of the vehicle – handling – it becomes clear that driveline components and control strategies cannot be mixed and matched in a “predictable” way. To understand the impact on handling of a change in the PDU, computer simulation models would be used to estimate longitudinal performances, lateral dynamics and fuel consumption of the car with the new PDU component.

(Ex. 2017, Stein Decl., at ¶106)

Hindsight capability vs. rationale to combine

Q. And so in your experience, how long does that sort of -- if there's a ground-up design that's being worked on for a driveline system, how long would that take?

A. The whole process?

Q. Yes.

A. To what point?

Q. I guess to where it's ready to go into a vehicle, completing testing and validation.

A. Sure. Our current design cycles are usually in the two-year range.

Q. Okay. And that again would entail this group of 100-plus people that you were referring to?

A. Yeah, that's just on the OEM side. That's not talking about suppliers.

(Ex. 2020, Becker Tr., at 59:11-60:3)

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 145:7-22)

Ground 2: Teraoka's Intended Purpose

without requiring an intermittent mechanism such as a 2-4 switching mechanism, the 2-4 switching mechanism is unneeded

(Ex. 1003, Watanabe, at 4)

[Problem to be solved by the invention] However, 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 at [0012])

Q. How so? Okay. So how would Watanabe render Teraoka inoperable for the purpose of reducing drag?

A. So --

Q. Are you saying that it would be slightly less fuel efficient?

A. The torque vectoring type of dual clutch mechanisms, in fact, do have additional losses associated with them, and I don't think somebody who was trying to make the kind of reduction in drag that Teraoka was doing by changing the position of the clutch that is basically an on/off clutch would go to a radically different concept with the two clutch rear end unit that Watanabe talks about, which are intended to have the clutches dragging all the time when you are trying to vector the torque. It seems completely at odds with the intended purpose that Teraoka had with his invention.

Ex. 1012, Stein Dep., at 112:10-25

Ground 3: Claims 6 and 7 - Teraoka and Burrows

[Problem] To simplify the configuration while greatly reducing the drag torque of the coupling which is uncoupled during two-wheel drive travel.

(Ex. 1002, Teraoka, at Abstract)

The present invention seeks to provide a four wheel drive system in which the reconnection between two wheel drive mode and four wheel drive mode may be made while the vehicle being driven. This may be termed "dynamic driveline reconnect". However, a problem with dynamic driveline reconnection is that the reconnection may be felt by the driver as an unacceptable jerk, i.e. a spasmodic acceleration. The invention also seeks to minimise any acceleration forces acting on the driver during the reconnection.

(Ex. 1004, Burrows, at 5-6)

What is clear from the basic design principles is that many factors influence the final design of any given vehicle. The designer starts by asking what operational performance factors are desired under what mode of operation, for what type of terrain, and for what type of vehicle.

(Ex. 2017, Stein Decl., at ¶98)

One of ordinary skill in the art, tasked with attempting to synchronize the speeds of the two-four switching mechanism of Teraoka, would not turn to a control strategy specifically designed for all-terrain conditions, as doing so would add complexity in the controls that is not needed and not justifiable.

(Ex. 2017, Stein Decl., at ¶141)

Ground 3: Rationale to Combine

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; Ex. 1005)

→ “WHY”

Use of a known technique to improve similar devices in the same way may support a conclusion of obviousness. (*KSR Int'l Co. v. Teleflex Inc.*, (KSR), 550 U.S. 398, 418 (2007).) 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; Ex. 1005)

→ “WHAT”

“HOW?”

Ground 3: The “How”, “Why” Rationales are Deficient

146. However, the Becker Declaration never identifies which of the at least three multi-stage synchronizer mechanisms taught in Burrows would be suitable for combination with Teraoka, or 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. 2017, Stein Decl., at ¶146)

→ “WHAT”

→ “HOW?”

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.

→ “WHY”

(Ex. 2017, Stein Decl., at ¶157)

Ground 3: Teaching Away

[0034] Furthermore, unlike a dog clutch, a coupling constructed using a wet multi-plate clutch does not require a synchronizer mechanism, eliminating the need to allow for the volume of the synchronizer mechanism.

(Ex. 1002, Teraoka at [0034])

150. I understand that because the proposed modification of Teraoka with Burrows would render the reference inoperable for its purpose—reducing drag—the proposed obviousness combination lacks a motivation to combine.

(Ex. 2017, Stein Decl., at ¶150)

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

(Ex. 1002, Teraoka, at [0037])

Secondary considerations

“can be the
most probative evidence of non-obviousness in the record,
and enables the ... court to avert the trap of hindsight.”

(*Crocs, Inc. v. ITC*, 598 F.3d 1294, 1310 (Fed. Cir. 2010.))

Prima facie case of nexus by patentee; Rebuttable presumption by challenger

Although GKN points to purported industry praise for the

Twinstar, none of the exhibits attribute their “praise” specifically to the

features of claims 2–3 (two side shaft couplings and achieving

longitudinal and transverse compensation without a differential) and 6–

(Reply at 23.)

The GKN system will be featured on Cadillac’s newest SUV, the XT5, that goes on sale next spring, but with an added benefit. It will be able to disconnect the rear wheels entirely in certain circumstances to boost fuel economy on the open road. “As 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, Kuczera says. The GKN system is expected to be available on other GM products with all wheel drive in the years to come.

(Ex. 2029, Gas 2.org Article, at 2)

Secondary considerations- industry praise

All-wheel drive isn't just for the snow belt anymore.

That's the gist of the pitch that will come from Buick when the redesigned 2017 LaCrosse sedan comes out next summer. It's one of several new General Motors models that will get a "twin clutch" awd system from British supplier GKN Driveline.

"This has a real performance element to it, with big benefits on acceleration and cornering," LaCrosse Marketing Manager Doug Osterhoff said in a recent interview.

Most awd systems for front-wheel-drive vehicles use a clutch at the front axle that controls the amount of torque that flows to the rear wheels. A differential typically is used to split the torque between the rear wheels.

GKN's twin-clutch system instead uses two electronically controlled clutch packs in the center of the rear driveline module that can control torque between the axles, sending 100 percent of torque to the front, or back, as needed based on driving conditions.

**DUAL SHAFT COUPLINGS TO ENSURE LONGITUDINAL AND
TRANVERSE COMPENSATION; WITHOUT A DIFFERENTIAL**

That ability to seamlessly shift torque between the rear wheels offers improved ride and handling and other characteristics that traditional awd systems don't, says Ray Kuczera, GKN's vice president of global product technology. The two-clutch setup is similar to GKN-sourced awd systems used on the Range Rover Evoque crossover and the Ford Focus RS performance model.

The system on the XT5 adds another feature: the ability to disconnect the awd system completely when the vehicle is in Tour mode, which saves fuel.

**SWITCH-ON DEVICE; EXPANDED SHUTDOWN
SECTION DECOUPLED FROM PRIMARY AXLE AND
SECONDARY AXLE WHEELS**

(Ex. 2028, Autonews Article at 1-2.)(annotated)

Secondary considerations- industry praise

In August, Land Rover introduced the 2014 Range Rover Evoque, equipped with several new technologies which, combined, can lower fuel consumption by up to 11.4% and reduce CO₂ emissions by up to 9.5%.

DUAL SHAFT COUPLINGS TO ENSURE LONGITUDINAL COMPENSATION

The GKN all-wheel drive system reacts to the driving environment and driver intention by automatically disconnecting the major rotating driveline components to reduce losses. Traction and driving stability are optimized by the active torque biasing feature offering advanced control on the distribution of the torque between the front and rear wheels.

In addition to the disconnect function the GKN Twinstar also acts as an electronic differential combining drive vectoring and limited slip differential technology for active torque biasing.

**SWITCH-ON DEVICE;
EXPANDED SHUTDOWN SECTION DECOUPLED FROM PRIMARY AXLE AND SECONDARY AXLE
WHEELS; SYNCHRONIZER ON PRIMARY AXLE**

The GKN All-Wheel Drive System includes a GKN power transfer unit (PTU), linked to the transmission's final drive differential, containing a synchronizer and brake to disconnect the all-wheel drive system upstream of the PTU hypoid gears.

At the rear of the system, the GKN Twinstar rear drive module (RDM) drives each rear wheel via an independent wet multi-plate clutch. These clutches can disconnect the all-wheel drive system downstream of the RDM hypoid gears.

(Ex. 2031, Green Car Congress Article at 1-2.)

DUAL SHAFT COUPLINGS TO ENSURE TRANVERSE COMPENSATION

Secondary considerations-unexpected results

General Motors will introduce a new dual clutch all wheel drive system built by British supplier GKN Driveline on the new 2017 Buick LaCrosse. The system adds two electronically controlled clutches to the rear axle in place of the traditional mechanical differential. The arrangements lets the car's onboard computer determine how much, if any, of the engine's power is transmitted to each rear wheel.

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. Ex. 2029, Gas2.org Article 1-2.)

"The first car to get our 'Twinstar' clutch packs was the Range Rover Evoque," GKN vice-president Ray Kuczera explains. "But since [car makers] have seen the 918 and watched the film of Ken Block drifting the Focus RS, pretty much every major manufacturer has been in touch. Since the Evoque, we have had lots of interest. Volkswagen, for instance, is very interested, even to benchmark their own system."

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.

Ex. 2024, Topgear Website at 2

JTEKT's New Matter

Accordingly, Patent Owner provides the following List, referring to page and line number of the Reply brief, that exceed the proper scope of a reply brief:

- Page 6, line 14 (starting at Section B) through page 7, line 3 ← **Larger Shutdown Section
New Argument**
- Page 8, line 5 through page 9, line 10 ← **Larger Shutdown Section
New Argument**
- Page 10, lines 7 through 16 (sentence starting “Read fairly. . .” and ending with the citation to Ex. 1008, para. 17) ← **Torque Vectoring
New Argument**
- Page 11, lines 6 through 17 ← **Torque Vectoring
New Argument**
- Page 12, line 1 through page 14, line 9 ← **Obvious to Try
New Argument**
- Page 17, line 11 (starting at Section A) through page 18, line 12 ← **New Shutdown Section
Argument**
- Page 4, line 9-Page 5, line 5

Ground 2: Claims 2 and 3

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.



**DUAL SHAFT COUPLINGS TO ENSURE
LONGITUDINAL COMPENSATION**

(Ex. 1001, 440' Patent, at 12:37-48)

Ground 3: Claims 6 and 7

4. The drive train as claimed in claim 1, wherein the switch-on device comprises a positively working power transmission gearing having an angular gear working via cogged wheels.

5. The drive train as claimed in claim 4, wherein the switch-on device is arranged on the primary axle and the secondary drive train output is, when the secondary drive train is connected to the primary axle, engaged to the primary drive train by the switch-on mechanism.

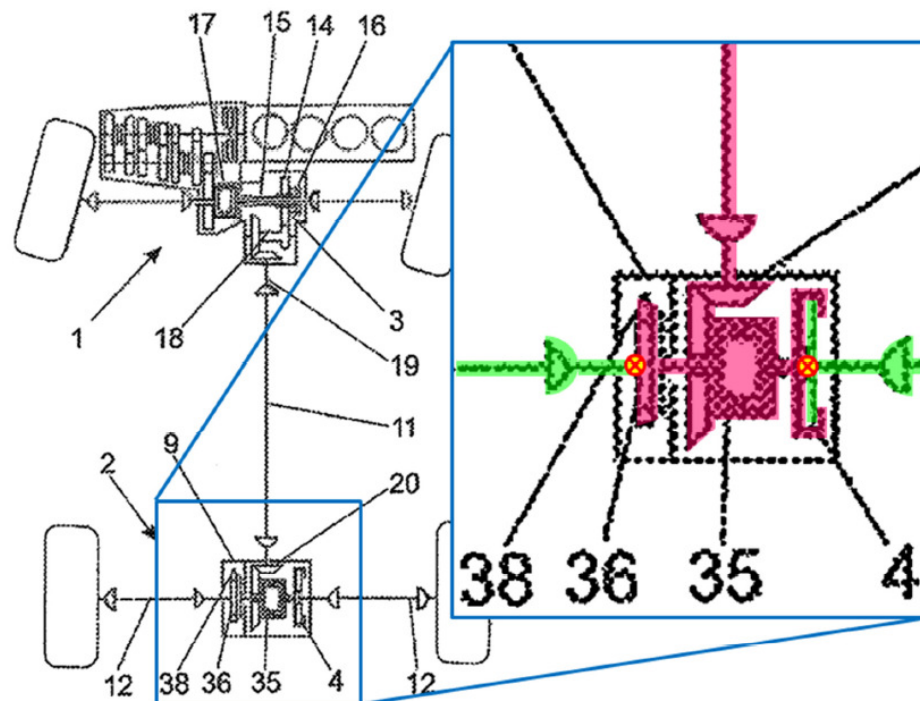
6. The drive train as claimed in claim 5, wherein a speed synchronization in the switch-on mechanism of the power transmission gearbox for the establishment of a positive lock is supported by the at least one side shaft couplings.

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.



**SPEED
SYNCHRONIZATION
IN THE SWITCH-ON
MECHANISM**

The '440 patent- power loss

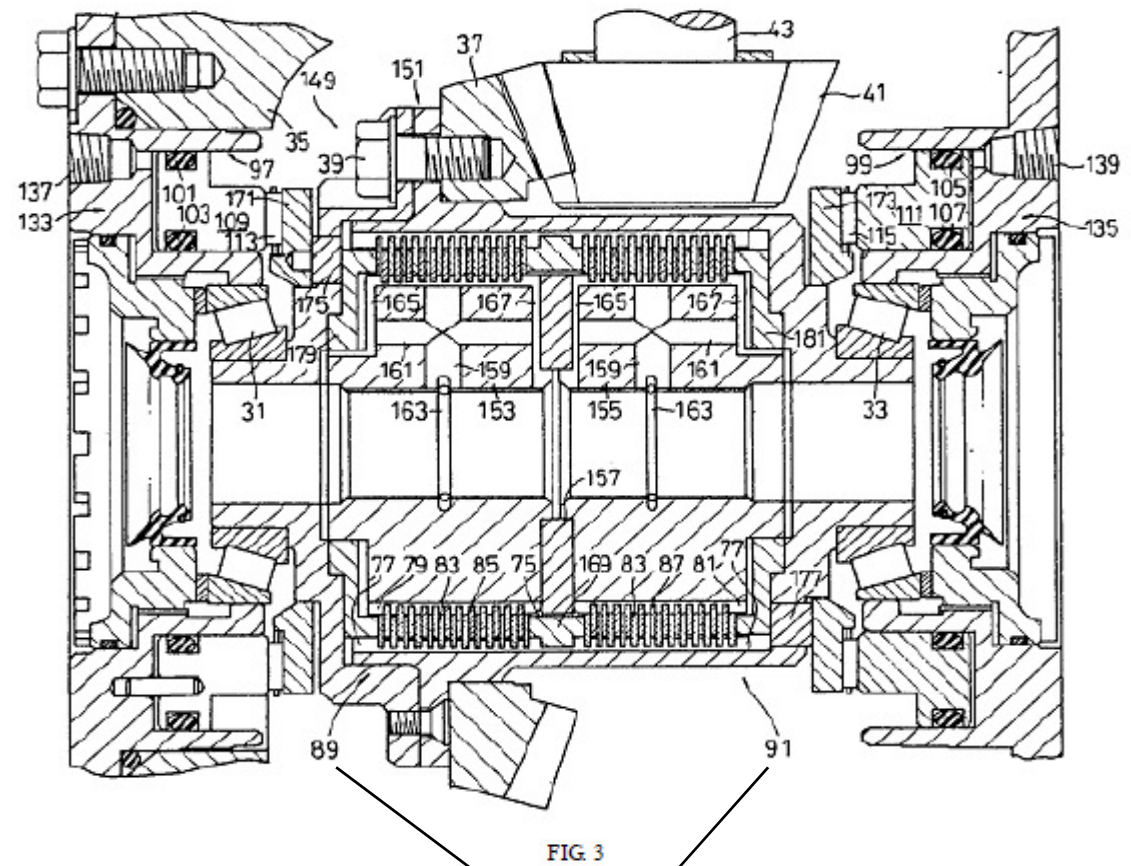
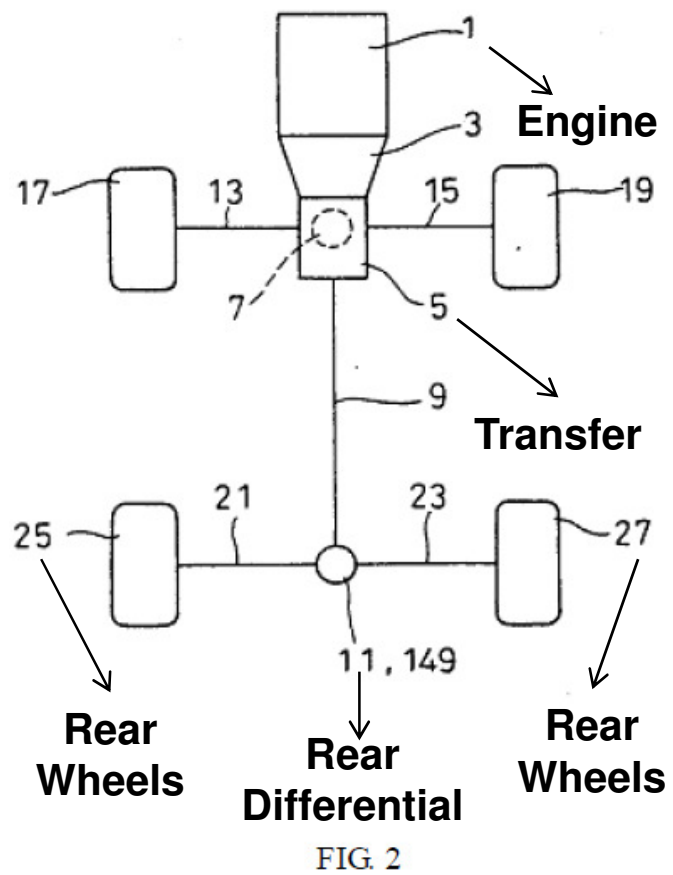


Ex. 1001, '440 Patent, Fig. 12 (annotated)

When the vehicle is in 2WD, the system has rotating components (shaded green) that continue to rotate, as well as stopped components (shaded pink) that can be stopped even while the vehicle travels. A torque decoupling location in the clutch mechanism 71 is also marked

(Ex. 2017, Stein Decl., at ¶77)

Watanabe



Multiple Plate Clutches

(Ex. 1003, Watanabe, Fig. 2 & 3)(annotated)

Ground 2 - “WHY”

Moreover, reducing weight and cost are recognized and implicit goals in virtually all manufacturing. (Reply at 4.)

89. And even today, the use of differentials is still prevalent. (Ex. 2009, 2015 Tata SAW at 1; Ex. 2012, 2006 SAE Paper at 3, 6.) And yet even with public demand for (and federal regulations requiring) increased fuel efficiency, differentials still exist in current vehicles. *Id.* 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. And, 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. (Ex. 2017, Stein Decl., at ¶89)

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned hereby certifies that on November 25, 2016, a complete and entire copy of **Patent Owner's Demonstratives**, were served on the counsel of record for the Petitioner via electronic mail as follows:

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