

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Koebler et al.	
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Title:	POWER MANAGEMENT SYSTEMS AND DEVICES	

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PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES

PATENT NO. 8,972,161 PURSUANT TO 35 U.S.C. §§ 311–319,

37 C.F.R. § 42

TABLE OF CONTENTS

I.	IPR REQUIREMENTS	1
A.	Standing	1
B.	Challenge and Relief Requested.....	1
C.	Claim Construction	2
D.	Level of Ordinary Skill in the Art.....	2
II.	THE '161 PATENT.....	3
A.	Overview	3
B.	Prosecution History.....	3
III.	THE CHALLENGED CLAIMS ARE UNPATENTABLE.....	4
A.	[GROUND 1A] – Claims 1-3, 5-6, 8-15, and 17-18 are obvious over Neiss	4
1.	Neiss	4
2.	Analysis	9
B.	[GROUND 1B] – Claim 4 is obvious over Neiss-Hirasago.....	48
1.	Hirasago.....	48
2.	Neiss-Hirasago combination	49
3.	Analysis	51
C.	[GROUND 2] – Claims 1, 3, 6-10, 12-13, and 15-18 are obvious over Schramm-Clapper	52
1.	Schramm.....	52
2.	Clapper	56
3.	Schramm-Clapper combination.....	59
4.	Analysis	68
IV.	PTAB DISCRETION SHOULD NOT PRECLUDE INSTITUTION.....	95
A.	Discretionary denial under 35 U.S.C. §325(d) is not warranted	95
B.	The <i>Fintiv</i> Factors favor institution and no denial under 35 U.S.C. §314(a)	95
1.	Factor 1: Institution will enable a stay	96
2.	Factor 2: Uncertain district court schedule	97
3.	Factor 3: Early stage of parallel proceedings.....	97
4.	Factor 4: Petition raises unique issues	98
5.	Factor 5: Tesla’s involvement in the WDTX Litigation	98
6.	Factor 6: Other considerations support institution.....	99
V.	CONCLUSION AND FEES	99
VI.	MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1).....	100

A.	Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1).....	100
B.	Related Matters Under 37 C.F.R. § 42.8(b)(2).....	100
C.	Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3).....	100
D.	Service Information	101

LIST OF EXHIBITS

TESLA-1001	U.S. Patent No. 8,972,161 (“the ’161 Patent”)
TESLA-1002	Excerpts from the Prosecution History of the ’161 Patent
TESLA-1003	Declaration of Dr. Papanikolopoulos, Ph.D.
TESLA-1004	Curriculum Vitae of Dr. Papanikolopoulos, Ph.D.
TESLA-1005	U.S. Publication No. 2004/0068359 (“Neiss”)
TESLA-1006	U.S. Patent No. 6,161,072 (“Clapper”)
TESLA-1007	W. C. Morchin, “Energy management in hybrid electric vehicles,” 17th DASC. AIAA/IEEE/SAE. Digital Avionics Systems Conference. Proceedings, Bellevue, WA, USA, 1998, pp. I41/1-I41/6 vol.2 (“Morchin”)
TESLA-1008	U.S. Patent No. 6,658,344 (“Hirasago”)
TESLA-1009	U.S. Patent No. 6,005,494 (“Schramm”)
TESLA-1010	Complaint, <i>iQar Inc. v. Tesla, Inc.</i> , 1:23-cv-00694, W.D. Tex., June 20, 2023
TESLA-1011	U.S. Patent No. 6,836,719 (“Andersson”)
TESLA-1012	U.S. Patent No. 5,584,208 (“Ha”)
TESLA-1013	U.S. Patent No. 5,129,475 (“Kawano”)
TESLA-1014	U.S. Patent No. 4,225,007 (“Voges”)
TESLA-1015	Excerpt from Random House Webster’s Unabridged Dictionary, Second Edition (2001)

TESLA-1016	Excerpt from Collins English Dictionary Complete and Unabridged, Sixth Edition (2003)
TESLA-1017	Excerpt from The New Oxford American Dictionary (2001)
TESLA-1018	U.S. Patent No. 8,271,166 (“Wolf”)
TESLA-1019	Japanese Patent Pub. No. 11220807 (“Hosoda Original”)
TESLA-1020	Certified Translation of Japanese Patent Pub. No. 11220807 (“Hosoda”)
TESLA-1021	U.S. Patent No. 6,314,347 (“Kuroda”)
TESLA-1022	U.S. Patent No. 7,013,205 (“Hafner”)
TESLA-1023-1049	RESERVED
TESLA-1050	Memorandum, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (USPTO June 21, 2022) (“Director’s Guidance”)
TESLA-1051	Proof of Service of Complaint, <i>iQar Inc. v. Tesla, Inc.</i> , 1:23-cv-00694, W.D. Tex., June 23, 2023
TESLA-1052	Motion to Transfer Venue

LISTING OF CHALLENGED CLAIMS

Claim 1	
[1pre]	A method of managing a power consumption of a vehicle, comprising the steps of:
[1a]	(a) receiving a route at a computer of said vehicle;
[1b]	(b) segmenting said route into a plurality of segment destinations;
[1c]	(c) calculating a plurality of energy values consumed by said vehicle to travel said route based on a plurality of variations in a target speed of said vehicle between pairs of said segment destinations;
[1d]	(d) determining a plurality of efficient speeds that achieve a best summation of said energy values; and
[1e]	(e) notifying an operator of said vehicle about said efficient speeds to travel between each of said segment destinations.
Claim 2	
[2]	The method of claim 1, further comprising the step of: continuously calculating said efficient speeds until a final destination is reached.

Claim 3	
[3]	The method of claim 1, wherein said determining of said efficient speeds is based on (i) an aerodynamic drag of said vehicle, (ii) a rolling resistance of said vehicle and (iii) a change in potential energy of said vehicle due to a road gradient.
Claim 4	
[4]	The method of claim 1, further comprising the step of: notifying said operator of a range of said variations in said target speed.
Claim 5	
[5]	The method of claim 1, wherein said determining of said efficient speeds is based on at least one of (i) an acceleration of said vehicle to one or more of said efficient speeds and (ii) a deceleration of said vehicle to one or more of said efficient speeds.
Claim 6	
[6]	The method of claim 1, wherein said calculating of said energy values is based on a current location of said vehicle as determined by global positioning system information.

Claim 7	
[7]	The method of claim 1, wherein said calculating of said energy values is based on a plurality of speed limits between said segment destinations.
Claim 8	
[8]	The method of claim 1, further comprising the step of: calculating said target speed in response to a position of a gas pedal of said vehicle.
Claim 9	
[9]	The method of claim 1, further comprising the step of: shifting gears of an automatic transmission in said vehicle based on said efficient speeds.
Claim 10	
[10pre]	A method of managing a power consumption of a vehicle, comprising the steps of:
[10a]	(a) receiving a route at a computer of said vehicle;
[10b]	(b) segmenting said route into a plurality of segment destinations;

[10c]	(c) calculating a plurality of energy values consumed by said vehicle to travel said route based on a plurality of variations in a target speed of said vehicle between pairs of said segment destinations;
[10d]	(d) determining a plurality of efficient speeds that achieve a best summation of said energy values; and
[10e]	(e) applying power corresponding to said efficient speeds to an engine of said vehicle to travel between each of said segment destinations.
Claim 11	
[11]	The method of claim 10, further comprising the step of: continuously calculating said efficient speeds until a final destination is reached.
Claim 12	
[12]	The method of claim 10, wherein said determining of said efficient speeds is based on (i) an aerodynamic drag of said vehicle, (ii) a rolling resistance of said vehicle and (iii) a change in potential energy of said vehicle due to a road gradient.

Claim 13	
[13]	The method of claim 10, further comprising the step of: notifying an operator of the vehicle about said efficient speeds to travel between each of said segment destinations.
Claim 14	
[14]	The method of claim 10, wherein said determining of said efficient speeds is based on at least one of (i) an acceleration of said vehicle to one or more of said efficient speeds and (ii) a deceleration of said vehicle to one or more of said efficient speeds.
Claim 15	
[15]	The method of claim 10, wherein said calculating of said energy values is based on a current location of said vehicle as determined by global positioning system information.
Claim 16	
[16]	The method of claim 10, wherein said calculating of said energy values is based on a plurality of speed limits between said segment destinations.

Claim 17	
[17]	The method of claim 10, further comprising the step of: calculating said target speed in response to a position of a gas pedal of said vehicle.
Claim 18	
[18]	The method of claim 10, further comprising the step of: shifting gears of an automatic transmission in said vehicle based on said efficient speeds.

Tesla, Inc. (“Petitioner” or “Tesla”) petitions for *Inter Partes* Review (“IPR”) of claims 1-18 (“Challenged Claims”) of U.S. Patent 8,972,161 (“’161 Patent”). This Petition demonstrates at least a reasonable likelihood that Tesla will prevail as to at least one of the Challenged Claims.

I. IPR REQUIREMENTS

A. Standing

The ’161 Patent is available for IPR. This Petition is being filed within one year of service of a complaint against Tesla. TESLA-1010; TESLA-1051. Tesla is not barred/estopped from requesting this review.

B. Challenge and Relief Requested

Tesla requests an IPR of the Challenged Claims on the below grounds. Dr. Papanikolopoulos provides supporting testimony in his Declaration. TESLA-1003, ¶¶1-318.

Ground	Claim(s)	35 U.S.C. §103
1A	1-3, 5-6, 8-15, 17-18	Neiss
1B	4	Neiss-Hirasago
2	1, 3, 6-10, 12-13, 15-18	Schramm-Clapper

The ’161 Patent claims an earliest priority date of 11/17/2005. TESLA-1001, Cover. Tesla does not concede that the ’161 Patent is entitled to this priority date, but applies prior art (*e.g.*, under 35 USC §§102(a)-(b), (e)) predating this

date.

Reference	Filing Date	Publication Date
Neiss	10/4/2002	4/8/2004
Hirasago	2/15/2002	12/2/2003
Schramm	11/24/1997	12/21/1999
Clapper	1/21/1999	12/1/2000

C. Claim Construction

No claim constructions are necessary because “claim terms need only be construed” if “necessary to resolve the controversy.” *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011); TESLA-1003, ¶27. Petitioner reserves the right to respond to any constructions offered/adopted by Patent Owner or the Board. Petitioner applies prior art herein consistent with Patent Owner’s infringement allegations before the district court.

D. Level of Ordinary Skill in the Art

A person of ordinary skill in the art (“POSITA”) relating to the subject matter of the ’161 Patent as of 11/17/2005 would have had a bachelor’s degree in electrical engineering, computer engineering, mechanical engineering (including automotive engineering), civil engineering (transportation systems), physics, or a related field, and at least four years of experience (or the academic equivalent) in

the field of transportation systems. Additional education could substitute for professional experience, and *vice versa*. TESLA-1003, ¶¶1-19, 24-26; TESLA-1004.

II. THE '161 PATENT

A. Overview

The '161 Patent relates to “determin[ing] the optimal speeds to drive throughout” a route. TESLA-1001, 3:18-20. The claims recite a method of managing a vehicle’s power consumption that involves calculating energy values consumed by a vehicle to travel a route based on variations in a target speed between pairs of segment destinations, and determining efficient speeds that achieve a best summation of said energy values. *Id.*, 26:20-25; TESLA-1003, ¶¶28-29. The vehicle’s operator is notified about these efficient speeds (claim 1), or power corresponding to the efficient speeds is applied to the vehicle’s engine (claim 10).

B. Prosecution History

During prosecution, the Applicant overcame the sole nonstatutory double patenting rejection by filing a terminal disclaimer over co-pending Application. 14/206,138 and U.S. Patent 7,925,426. TESLA-1002, 25-37; TESLA-1003, ¶29. The Reasons for Allowance stated that “the prior art does not teach or make obvious calculating a plurality of energy values consumed by a vehicle to travel the

route based on a plurality of variations in vehicle target speed between pairs of segment destinations, and determining a plurality of efficient speeds [] between pairs of segment destinations.” *Id.*, 9-15.

III. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. [GROUND 1A] – Claims 1-3, 5-6, 8-15, and 17-18 are obvious over Neiss

1. Neiss¹

Neiss describes a “predictive cruise control system [that] utilizes information about the current vehicle position, as well as upcoming terrain” “to determine, as a function of position, a desired speed inside [a] speed band...to maximize fuel savings.” TESLA-1001, Abstract, [0031], FIG. 2; TESLA-1003, ¶¶30-31.

Neiss’s system “minimizes vehicle operating costs” by optimizing “a vehicle operating cost function” that is defined based on “environmental parameters, vehicle parameters, vehicle operating parameters[,] and route parameters.” *Id.*, ¶¶[0001], [0015]. As the vehicle drives, “an onboard computer iteratively calculates and stores in a memory vehicle control parameters that optimize the vehicle operating cost function for a predetermined distance...along the route

¹ Descriptions of the references and combinations thereof are incorporated into each mapping that includes citations to these references. Emphasis added throughout unless otherwise indicated.

ahead of the vehicle.” *Id.*, ¶[0015]. “The vehicle is then controlled by reading the optimized vehicle control parameters from the memory, corresponding to the current position of the vehicle.” *Id.*, TESLA-1003, ¶¶32-37.

Neiss’s “vehicle operating cost function” (J) is defined mathematically to reflect one or more objectives, including “consum[ing] less fuel”:

$$J = \Phi + J_{\text{time}} + J_{\text{fuel}} + J_{\text{velocity}} + J_{\text{lateral}} + J_{\text{accel}} + J_{\text{penalty}}$$

TESLA-1005, ¶¶[0082]-[0126]; TESLA-1003, ¶¶33-34. The objective to minimize fuel consumption is represented as J_{fuel} :

$$J_{\text{fuel}} = \frac{1}{2} \cdot h \cdot \sum_{k=0}^{N-1} \psi v_k th_k^2, \quad (\text{Eq. 18})$$

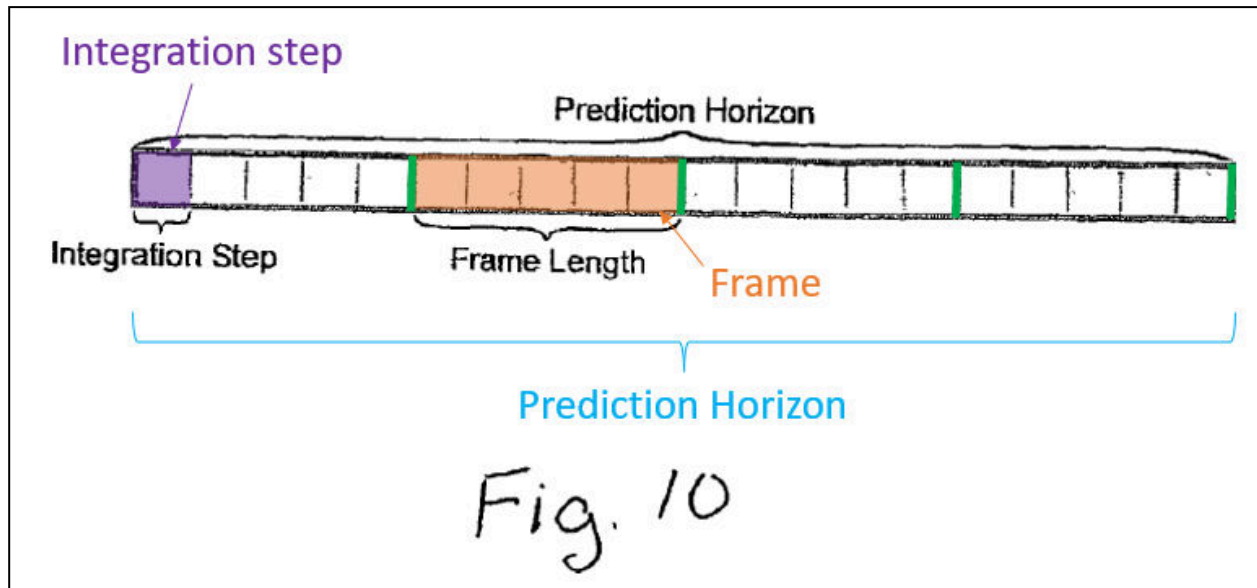
Id., ¶¶[0081]-[0082], [0097]. J_{fuel} represents a summation of the velocity v_k and control values th_k at N points in a “Prediction Horizon” along the vehicle’s route.

Id., ¶¶[0097]-[0098], [0162], [0180], claims 10-11, Abstract; TESLA-1003, ¶¶35-37.

The “Prediction Horizon” is “a predetermined distance...along the route ahead of the vehicle” and “is separated into Frames.” *Id.*, ¶¶, [0015], [0169]-[0170], FIG. 10 *infra*. Each frame corresponds to “a specified distance” to be

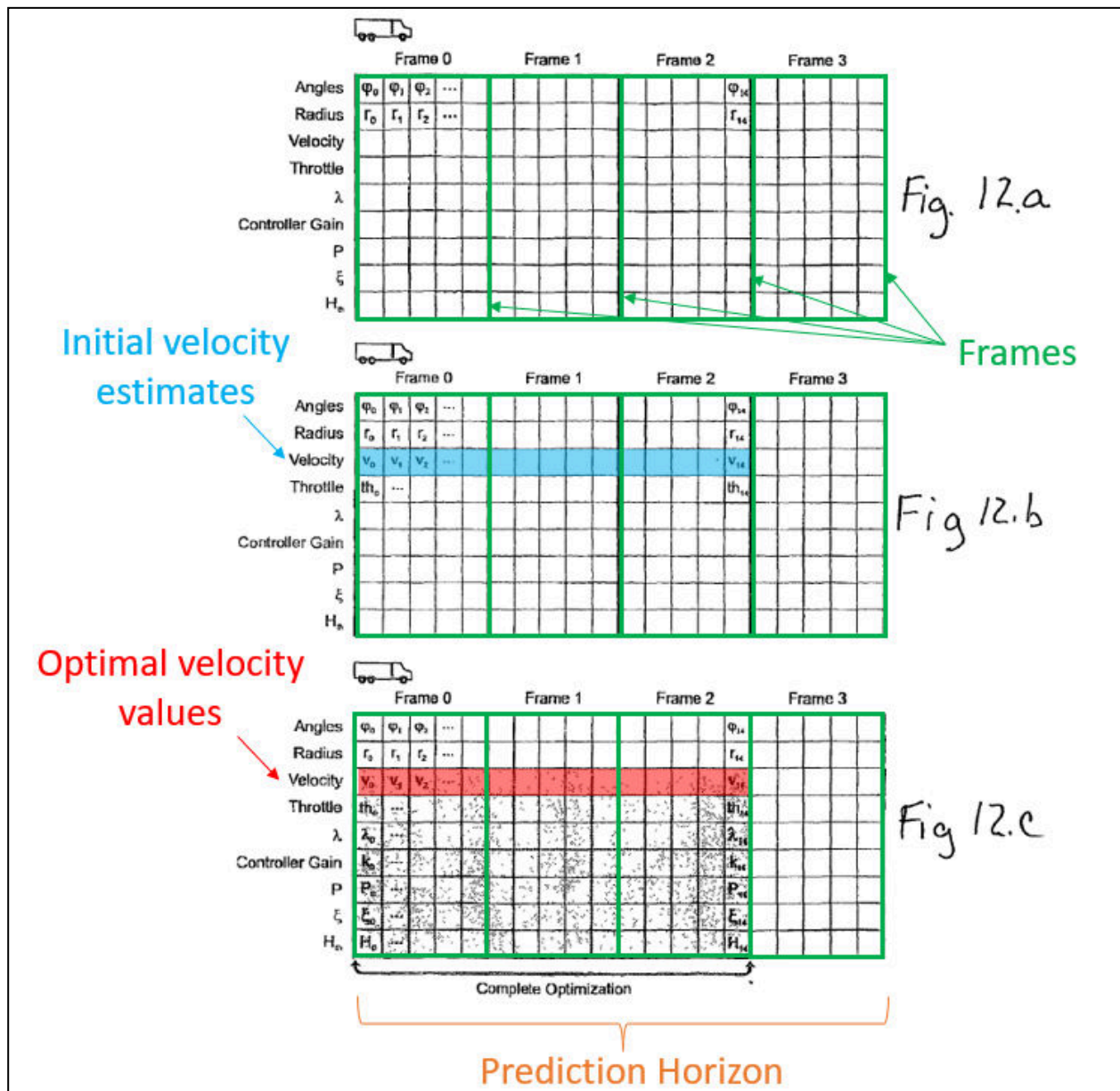
covered by the vehicle and is composed of multiple integration steps h. *Id.*;

TESLA-1003, ¶38.



TESLA-1005, FIG. 10 (annotated)

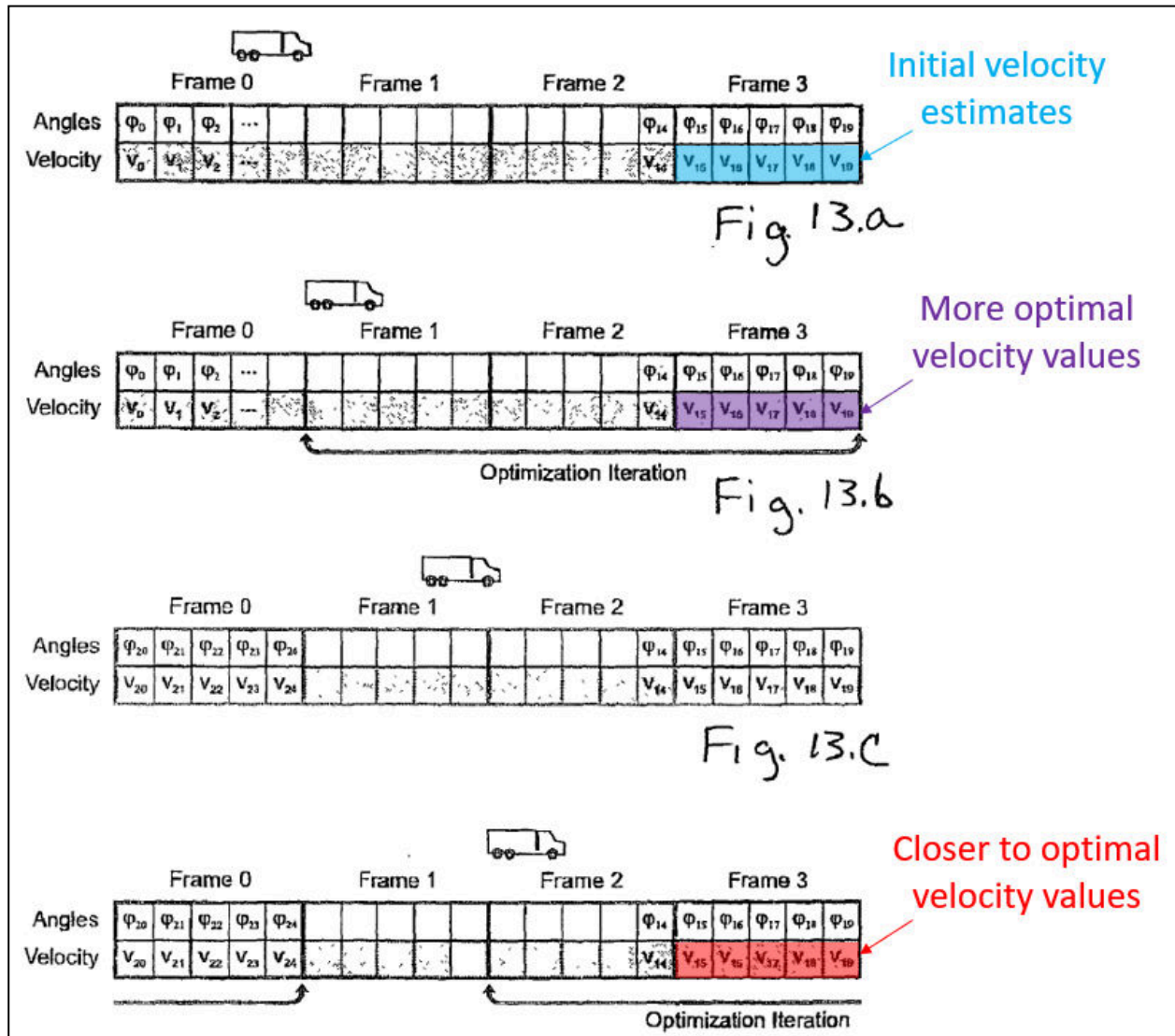
In Neiss's optimization process (and corresponding minimization of the vehicle operating cost function), initial estimates of vehicle control parameters are used to compute a first set of optimized vehicle control parameters, including vehicle speed, for frames along the Prediction Horizon. TESLA-1005, ¶¶[0015], [0171]-[0181], [0186], [0048], [0149]-[0160], [0015], [0162], FIGS. 12a-c; TESLA-1003, ¶¶39-40. The estimates and the optimized parameters are stored in a lookup table corresponding to the frames of the Prediction Horizon:



TESLA-1005, FIGS. 12a-c (annotated)

These parameters are “continuously updated and replaced by new data as the vehicle moves” from frame-to-frame, “thereby adjusting [these parameters] to reflect actual vehicle historical operating experience during the journey,” *e.g.*, using current vehicle velocity as a starting velocity for each iterative optimization.

TESLA-1005, Abstract, ¶¶[0167], [0178]-[0181], [0188]-[0191], FIGS. 13a-d (below); TESLA-1003, ¶¶41-47. With each iteration, vehicle control parameters, including velocity, are re-optimized and “approach closer to the optimal values” (red in FIG. 13d). *Id.*



TESLA-1005, FIGS. 13a-d (annotated)

As the vehicle travels, the calculated parameters for the current position are provided as inputs to a controller “which controls the vehicle to follow the calculated velocity trajectory.” *Id.*, ¶¶[0041]-[0042]; *see* ¶[0188]; TESLA-1003, ¶48.

Neiss is analogous art to the ’161 Patent: it is from the same field of endeavor (*e.g.*, vehicle navigation) and is reasonably pertinent to the problem the ’161 Patent was trying to solve (*e.g.*, how to control vehicle operation along a route). TESLA-1003, ¶49.

2. Analysis

[1pre]

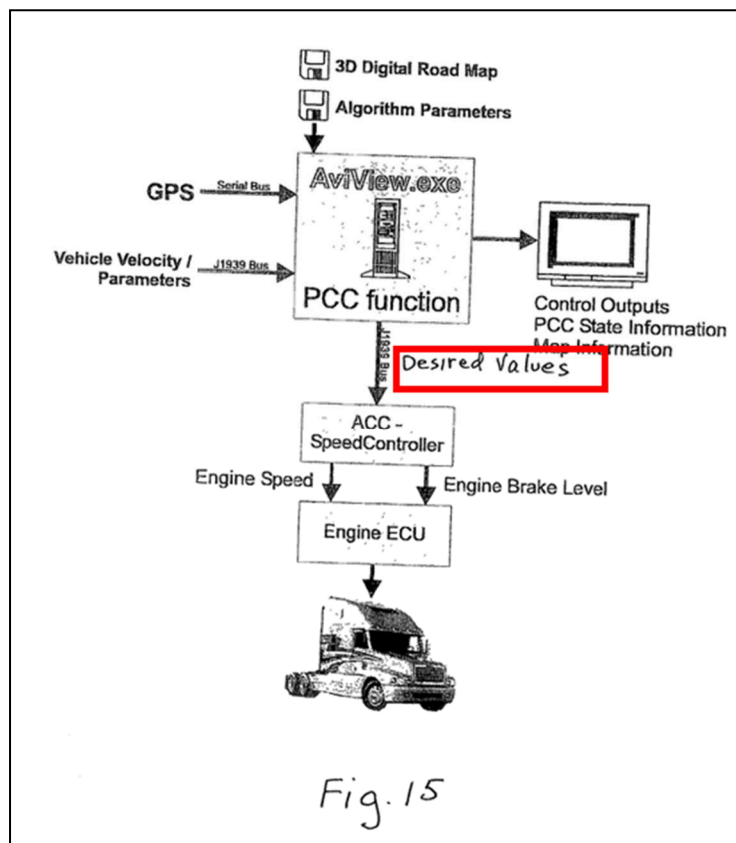
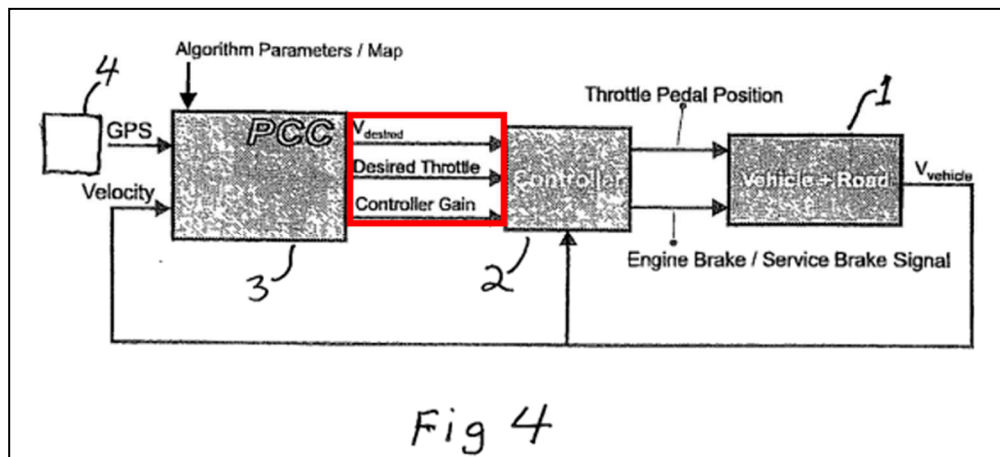
If the preamble is limiting, Neiss renders it obvious. TESLA-1003, ¶¶50-56.

As explained below, Neiss’s teachings and algorithm for minimizing vehicle fuel consumption, in the context of the ’161 Patent, correspond to ***managing the power consumption of the vehicle***.² *See* TESLA-1001, 6:17-20 (“optimizing the power supplied to the engine typically means minimizing the energy loss from the vehicle, thereby increasing fuel efficiency”), 6:25-33; TESLA-1003, ¶51, citing TESLA-1020 (TESLA-1019), ¶¶[0015], [0025], FIG. 10.

² Claim language is denoted in bold italics throughout this Petition.

Neiss's predictive cruise control (PCC) system uses "information about the current vehicle position" and "upcoming terrain...to save fuel" by minimizing a vehicle operating cost function. TESLA-1005, Abstract; *see* ¶¶[0001], [0015], [0081]-[0082]; TESLA-1003, ¶52 (citing TESLA-1005, ¶[0081]; a cost function defines a desired system operating behavior; minimizing the cost function achieves optimized operation).

The PCC system identifies "vehicle control parameters," including speed and throttle position, that "minimize[] vehicle operating costs," *e.g.*, optimize vehicle operation, "based on an analysis of vehicle operating parameters and route information" for an upcoming "route section." TESLA-1005, ¶¶[0001], [0015]. Neiss's optimization algorithm seeks to reduce fuel consumption by computing vehicle control parameters that minimize a vehicle operating cost function, which is expressed "as a function of vehicle speed, road gradient, and throttle position." TESLA-1005, ¶¶[0082]-[0082], [0014], [0004], claims 1, 10; TESLA-1003, ¶53. These optimized parameters are subsequently used to control the vehicle, *e.g.*, by controlling fuel injection or throttle angle of the engine. *See* TESLA-1005, ¶¶[0015] ("The vehicle is then controlled by reading the optimized vehicle control parameters from the memory"), [0014], claim 1, [0042]; FIGS. 4 and 15, *infra*; TESLA-1003, ¶¶54-55.



TESLA-1005, FIGS. 4, 15 (annotated)

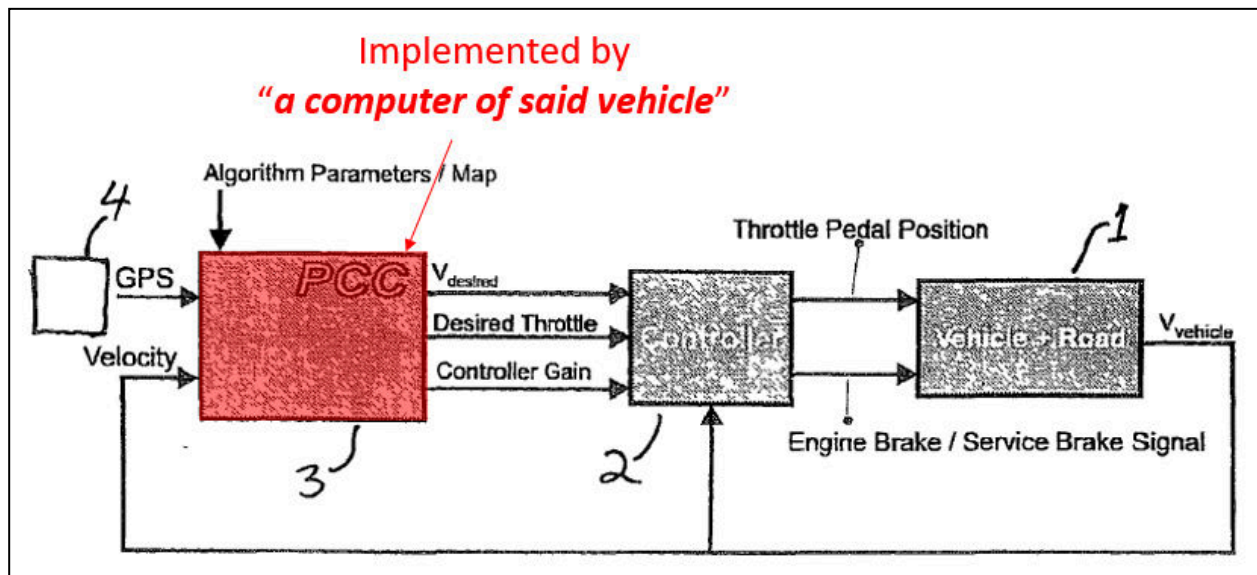
Thus, computing optimal vehicle control parameters that allow the vehicle to “consume less fuel,” and subsequent vehicle control according to those parameters, correspond to *managing the power consumption of the vehicle*, e.g., because

parameters that minimize fuel consumption are used to control vehicle operation.

TESLA-1003, ¶56.

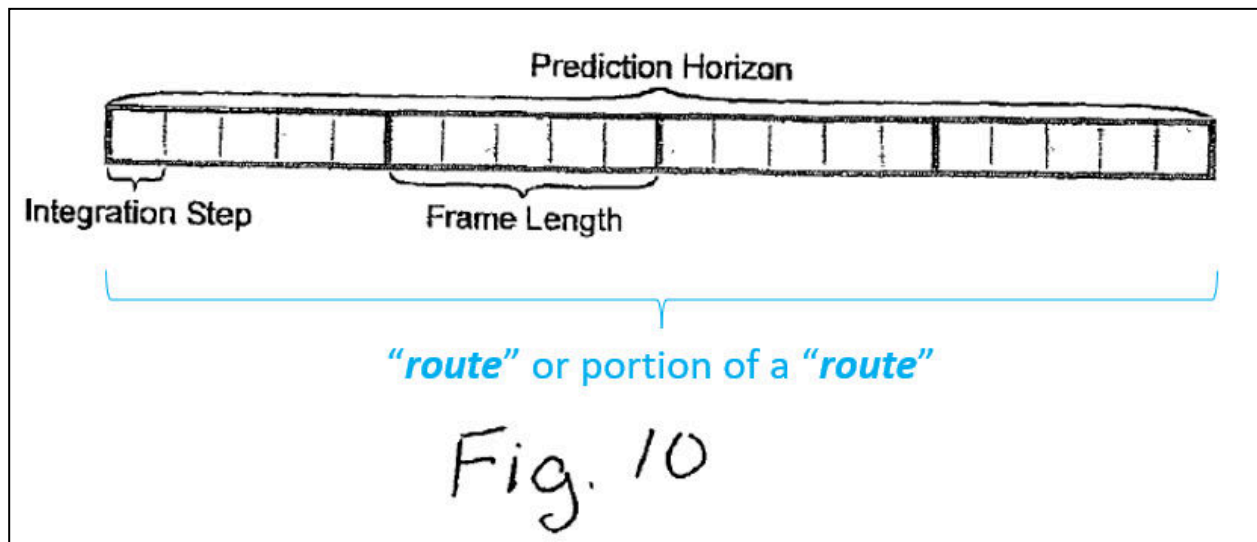
[1a]

Neiss discloses an onboard computer (*a computer of said vehicle*) including memory and a data processor. *See* TESLA-1005, Abstract (“an onboard computer iteratively calculates and stores in a memory vehicle control parameters that optimize the vehicle operating cost function”), [0015], [0034], [0037]-[0041], [0044] (describing the PCC block as computing the optimal vehicle control parameters), FIGS. 4, 15 (showing/describing PCC block implemented at the vehicle), Claim 15 (describing a data processor to calculate optimum vehicle control parameters and memory for storing road map and a lookup table including the calculated optimal vehicle control parameters); TESLA-1003, ¶¶57-59 (Neiss’s PCC block is part of onboard computer given both are described as performing/executing the optimization algorithm).



TESLA-1005, FIG. 4 (annotated)

Neiss's optimization algorithm "iteratively calculat[es]...vehicle control parameters that optimize/minimize the vehicle operating cost function for a predetermined distance (referred to as a Prediction Horizon) along the route ahead of the vehicle." TESLA-1005, ¶[0015]; see ¶¶[0001] (performing optimization for "a route section ahead of the vehicle"), [0049], Abstract, Claim 1; TESLA-1003, ¶60.



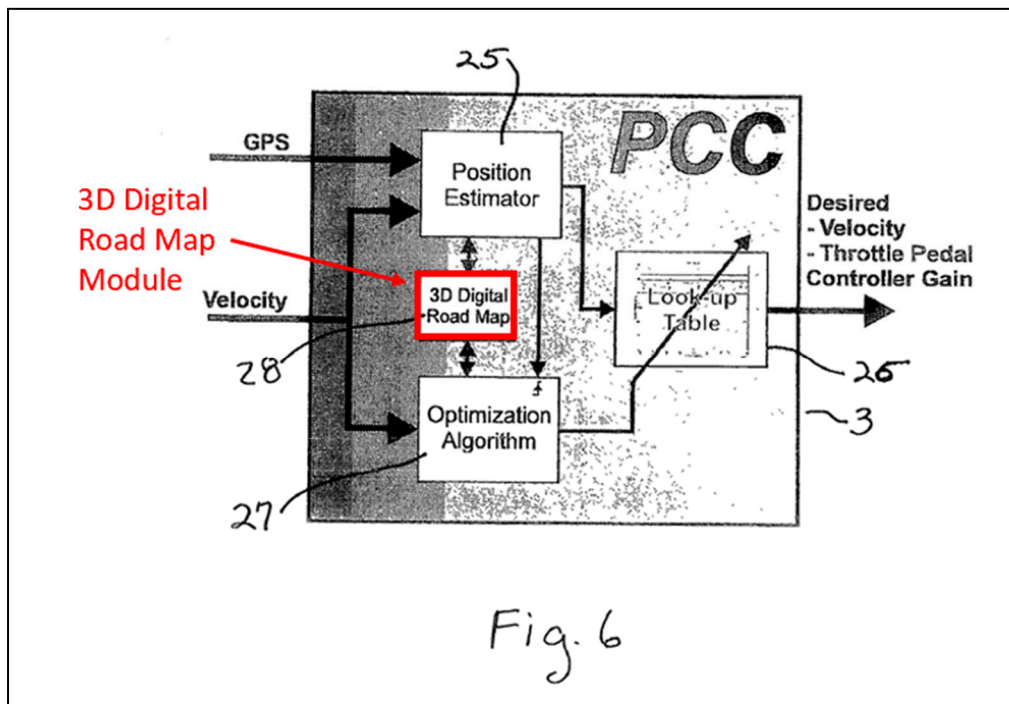
TESLA-1005, FIG. 10 (annotated)

The Prediction Horizon (blue *supra*) corresponds to **a route** because it constitutes a path traveled by the vehicle. TESLA-1003, ¶61.

Alternatively/additionally, Neiss's optimization operations are performed iteratively for portions of an overall route ahead of the vehicle as the vehicle travels the overall **route** between a starting point and a final destination. TESLA-1005, Abstract, ¶¶[0001], [0015]; TESLA-1003, ¶61.

Neiss teaches **receiving a route** (e.g., receiving either the immediate Prediction Horizon or the overall route) **at a computer of said vehicle** (Neiss's onboard computer). TESLA-1003, ¶¶62-67.

In particular, Neiss's PCC block (implemented on the onboard computer) includes a "3D Digital Road Map." TESLA-1004, Abstract, ¶¶[0004]-[0005], [0014]-[0015], [0049], [0179], FIG. 6 (*infra*); TESLA-1003, ¶63.



TESLA-1005, FIG. 6 (annotated)

As the vehicle travels a “particular route,” the PCC block accesses information about the route ahead of the vehicle using this map. TESLA-1004, [0049] (“3D Digital Road Map 28: The Optimization Algorithm [of the PCC]...uses information read from the digital map to determine the gradient angles and curve radii of the upcoming road”), [0004] (“the current vehicle position may be determined...and information about the upcoming terrain can be taken from a three-dimensional digital road map”), [0014]-[0015], [0049], [0179], claim 15; TESLA-1003, ¶¶64-65.

Thus, current vehicle position is used to query the map to identify the area “along the route” ahead of the vehicle (Prediction Horizon) and access information

therefrom about the Prediction Horizon (*e.g.*, “gradient angles and curve radii for the upcoming road”) that is used by the optimization algorithm to “determine, as a function of position, a desired speed.” TESLA-1005, [0014]-[0015], [0031], [0049], [0162], [0179], claim 15, TESLA-1003, ¶65.

Neiss’s algorithm operates “iteratively” to identify subsequent Prediction Horizons (as the vehicle continues driving) and accesses road information about each Prediction Horizon from the map, which are then used for the iterative optimizations. TESLA-1005, [0012], [0014], [0031], [0045]-[0048], [0163], [0167], [0181], [0186], [0190], FIGS. 12a-c, FIGS. 13a-d; TESLA-1003, ¶66.

From these disclosures, a POSITA would have understood that the onboard computer (which implements Neiss’s PCC block) *receiv[es] a route* because Neiss’s optimization algorithm (1) uses the digital road map to identify (*receive*) each Prediction Horizon ahead of the vehicle (a *route* or a portion of a *route*) and (2) performs optimization using information about this route (*e.g.*, road curvature, gradient information). TESLA-1003, ¶67.

If it is determined that the present limitation requires receiving an *entire* route (*e.g.*, an end-to-end route between a starting point and a final destination) *at once*, it would be obvious to modify Neiss so that its onboard computer receives the entire route at once, instead of receiving it iteratively. TESLA-1003, ¶¶68-72.

A POSITA would have been motivated to modify Neiss in this manner for the following reasons. **First**, receiving the entire route at once would be computationally efficient because it would enable quicker computations on upcoming route segments/frames. TESLA-1003, ¶70. **Second**, a vehicle onboard computer receiving an entire end-to-end route (*e.g.*, from external map applications) was well-known in the context of vehicle control systems, and enabled receipt of accurate routes, *e.g.*, accounting for real-time road/traffic conditions (TESLA-1003, ¶71 (citing TESLA-1021, 1:42-43)). Thus, modifying Neiss's onboard computer to receive the route would have been an application of known techniques (an onboard computer of a cruise control system receiving a route) to a known system (an onboard computer implementing a predictive cruise control system that processes information about the route) to yield predictable results (*e.g.*, an onboard computer receiving an entire route for which optimizations/analytic operations are performed). *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421 (2007); MPEP 2143; TESLA-1003, ¶71.

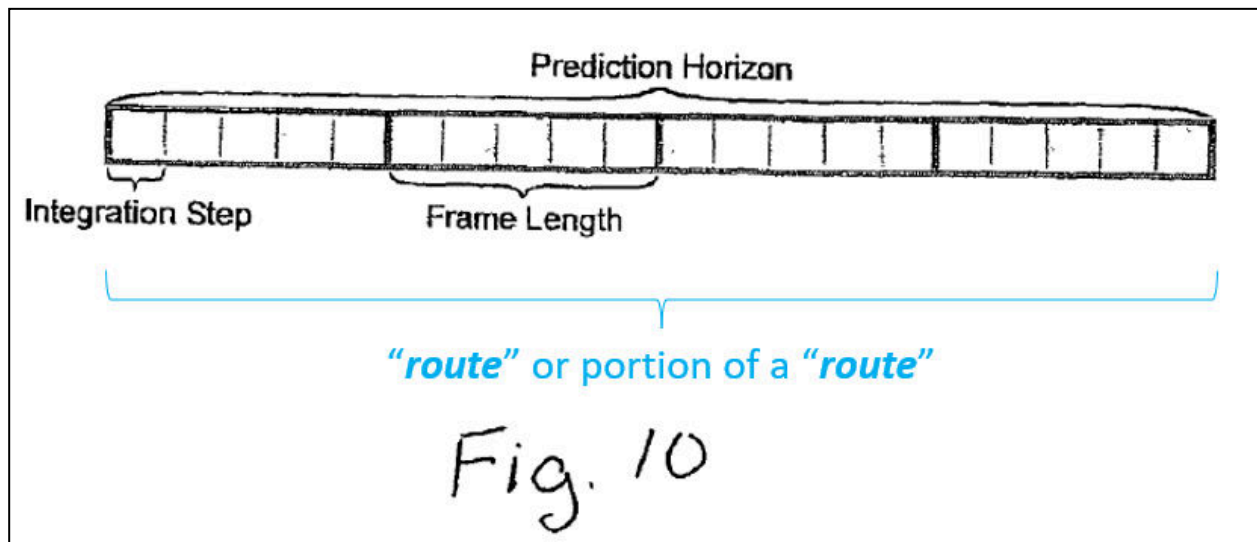
A POSITA would have also had a reasonable expectation of success in configuring Neiss in this manner because (1) it was well-known and conventional for vehicle computers to receive routes from map applications (TESLA-1003, ¶72), (2) Neiss already includes a digital map storing information about routes (TESLA-1005, [0049], [0031], Abstract), and (3) Neiss's optimization algorithm already

obtains/receives information about the route ahead of the vehicle (*see id.*).
TESLA-1003, ¶72. Thus, it would have been straightforward and within a
POSITA's skillset to configure Neiss's map application (*e.g.*, 3D Digital Road
Map) with conventional routing logic enabling identification of the entire route and
to enable Neiss's onboard computer (and its associated optimization algorithm) to
receive the entire route from the map application (*e.g.*, using the same mechanism
by which the optimization algorithm already communicates with the 3D Digital
Road Map). TESLA-1003, ¶72.

[1b]

The '161 Patent's specification does not use the phrase "segment
destination." *See generally* TESLA-1001. Moreover, the specification describes
segmenting a route into segments (not segment destinations, as claimed). *See id.*,
13:44-50. In view of the specification, [1b] encompasses segmenting a route into a
plurality of segments, each having an endpoint/destination. TESLA-1003, ¶¶73-
74.

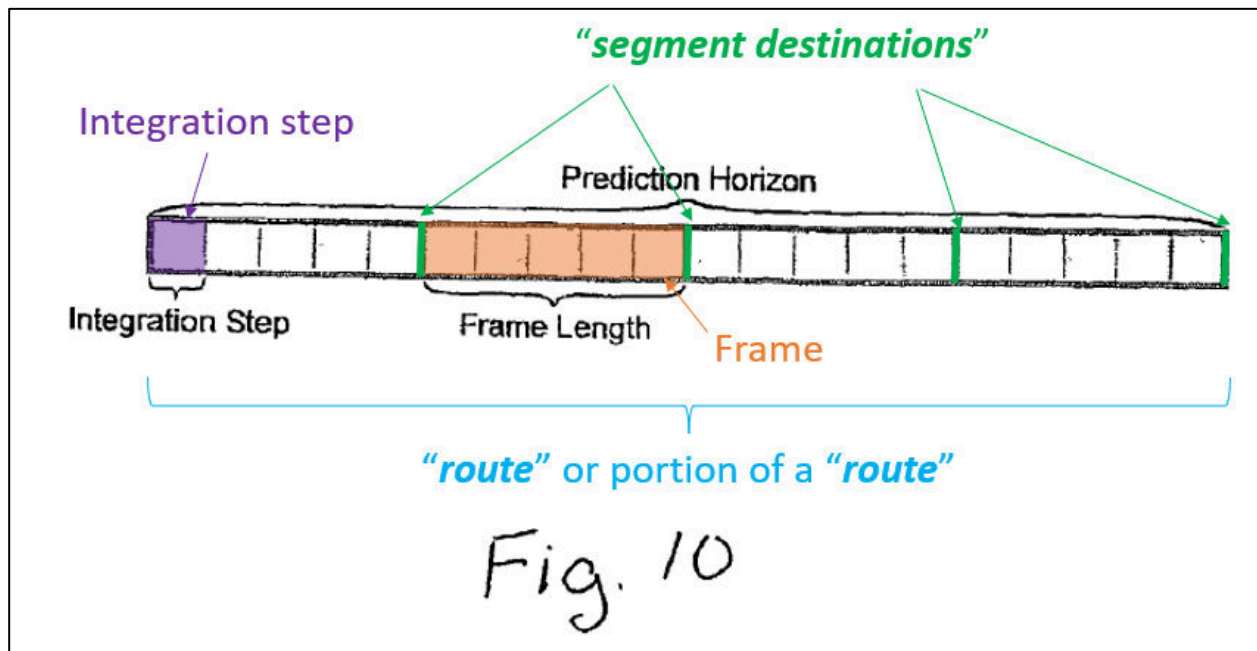
Similarly, Neiss discloses segmenting the route into segments (frames), each
having an endpoint/destination. *See* TESLA-1005, [0170], FIG. 10 (*infra*);
TESLA-1003, ¶75.



TESLA-1005, FIG. 10 (annotated)

The *route* corresponds to Neiss's Prediction Horizon or alternatively, to successive Prediction Horizons from starting point to final destination. See [1a], *supra*; TESLA-1005, ¶[0047]; TESLA-1003, ¶¶76-77.

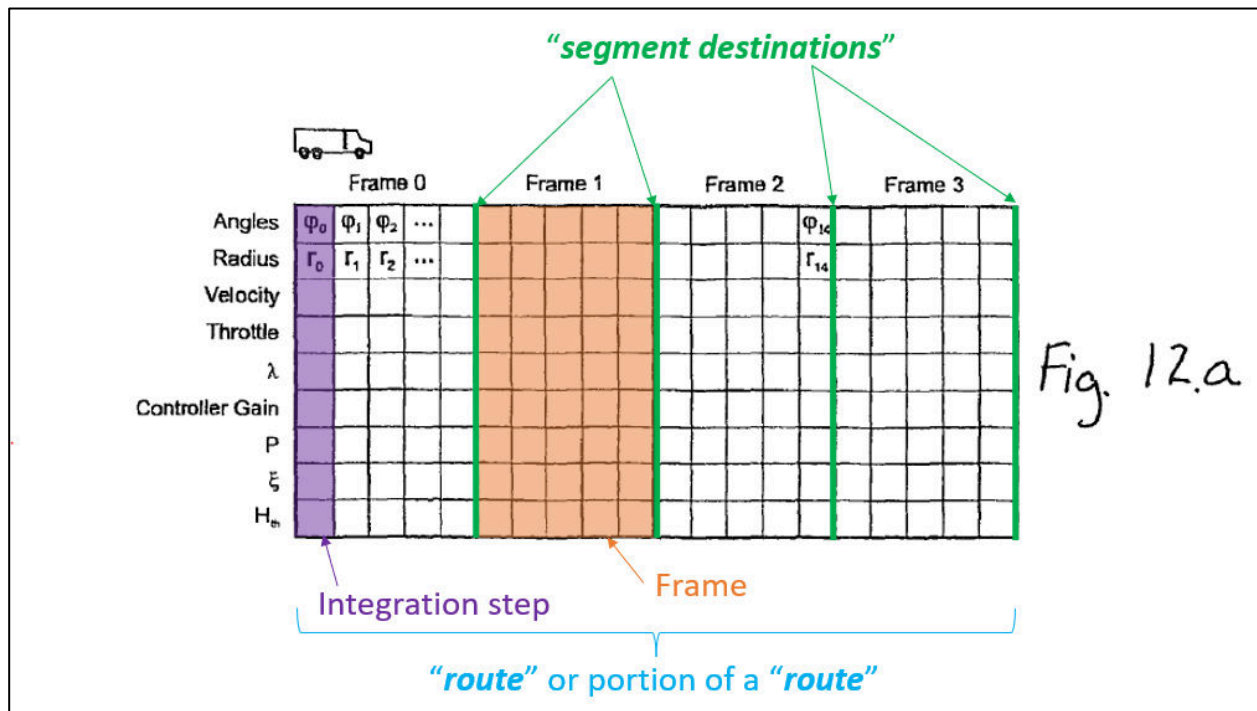
Each Prediction Horizon (the route or a subset thereof) "is separated into Frames." TESLA-1005, ¶[0170]; see ¶[0192], FIG. 10, *infra*; TESLA-1003, ¶78. Each frame (one in orange *infra*) is "a specified distance," *i.e.*, a segment of the route. TESLA-1005, ¶[0169]. Each frame is composed of multiple "integration steps" (one in purple), each corresponding to a "small distance[]" along its frame. *Id.*, ¶¶[0162], [0170]; TESLA-1003, ¶78. Each frame's endpoint corresponds to a *segment destination* (green) because it is the end (destination) of a frame/segment. TESLA-1003, ¶78.



TESLA-1005, FIG. 10 (annotated)

Each Prediction Horizon ahead of the vehicle (*route*) is thus *segment[ed]...into a plurality of segment destinations* because each Prediction Horizon is composed of multiple frames (*segments*), each having a respective endpoint (*segment destinations*). See TESLA-1003, ¶79 (citing TESLA-1005, ¶¶[0169]-[0170], [0192]).

In particular, Neiss's optimization algorithm uses a lookup table "having a capacity that corresponds to the length (in frames and integration steps) of the Prediction Horizon." TESLA-1005, ¶[0171]; see Claim 18, FIGS. 12a(*infra*)-c, FIGS. 13a-13d. The locations in the lookup table corresponding to frame endpoints likewise correspond to the *segment destinations*. TESLA-1003, ¶80.



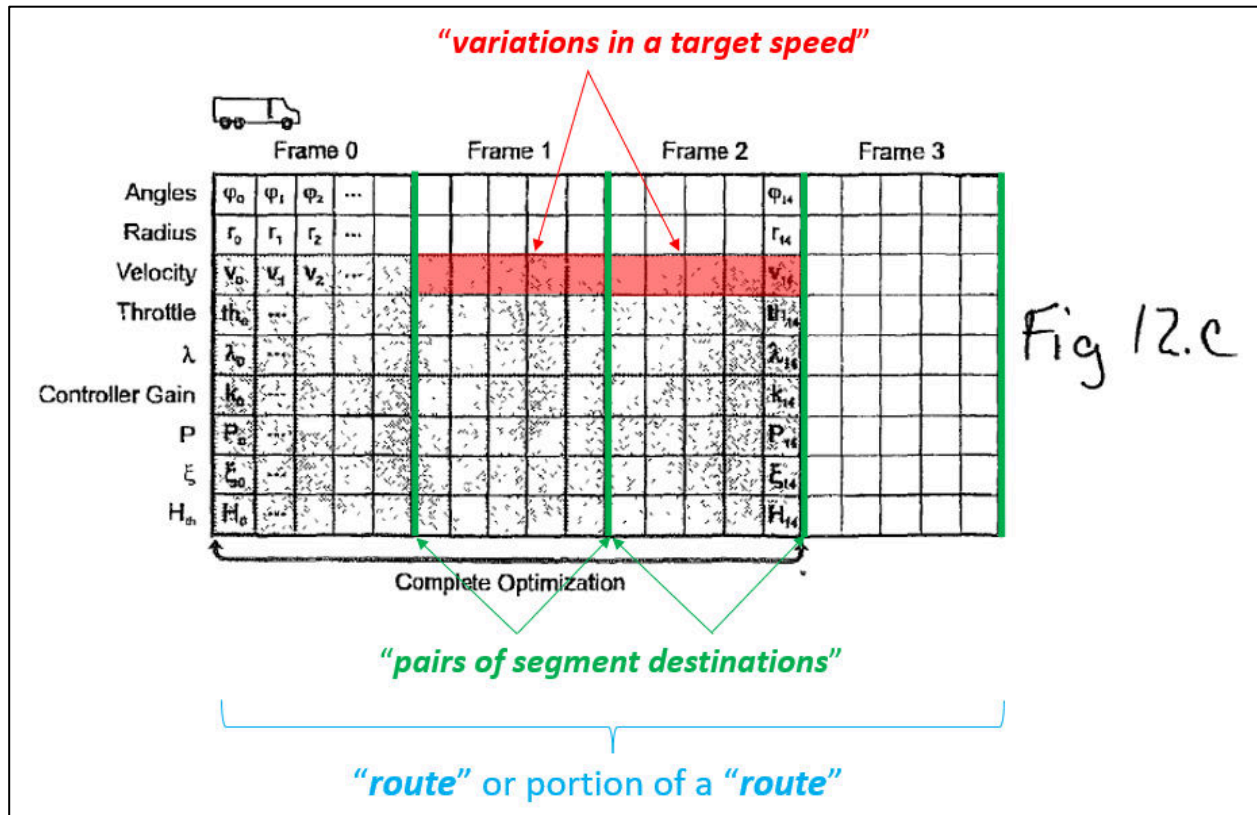
TESLA-1005, FIG. 12a (annotated)

[1c]

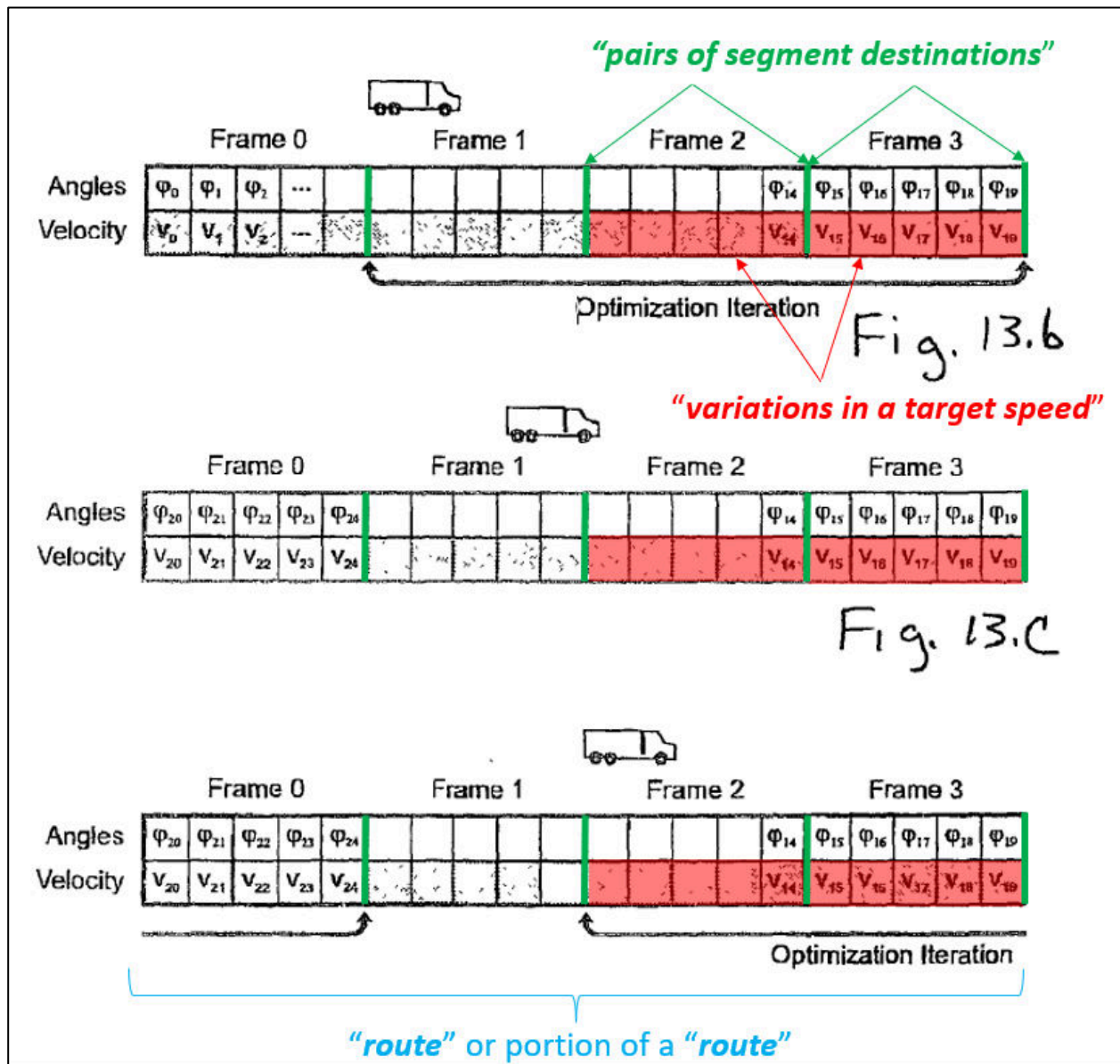
Neiss's determined speeds at locations within each frame correspond to variations in a target speed between pairs of segment destinations

Neiss's iterative optimization determines vehicle control parameters, including speeds, along the Prediction Horizon that minimize the overall cost function. See TESLA-1005, [0015], claim 1, claim 13. For each iteration, this optimization yields speeds for the N locations (integration steps) of the frames in the Prediction Horizon. See TESLA-1005, [0180], [0190]-[0191], FIG. 12c (*infra*), FIGS. 13b-d (*infra*). These per-location speeds determined in each

iteration (some in red *infra*) correspond to *variations in a target speed of said vehicle between pairs of said segment destinations*, discussed *infra*. TESLA-1003, ¶¶81-87.



TESLA-1005, FIG. 12c (annotated)



TESLA-1005, FIGS. 13b-13d (annotated)

Neiss's overall cost function, J , incorporates the cost function, $J_{velocity}$, which targets the objective that "[t]he vehicle should attempt to maintain a specified velocity (Set Speed)." TESLA-1005, [0083]; *see* [0100] ("To reduce drifts from the desired Set Speed, $v_{desired}$, a[] term for the cost function is $J_{velocity}$ "), claim 3,

claim 12, [0126]; TESLA-1003, ¶84. This “Set Speed” corresponds to *a target speed of the vehicle* because it is the specified (target) speed for vehicle operation. TESLA-1003, ¶84. The overall cost function, J , further constrains the speed to remain within a speed band—specified by “an upper limit” and “a lower velocity limit”—via its inclusion of the cost function $J_{penalty}$. TESLA-1005, [0084]; *see* [0103] (“the objective is to keep the velocity within certain limits”), [0104], claim 8, claim 12; TESLA-1003, ¶84.

Through $J_{velocity}$ and $J_{penalty}$, the determined per-location speeds along the Prediction Horizon that optimize the overall cost function, J , are constrained to be between upper and lower limits around the Set Speed (*target speed*). TESLA-1003, ¶85. These determined speeds vary by location (*e.g.*, for each integration step along the Prediction Horizon), and thus they correspond to *variations in the target speed of the vehicle*. *See* TESLA-1005, [0031] (“Forward-looking terrain information is used to determine, as a function of position, a desired speed inside the speed band...to maximize fuel savings”), Eq. 30; TESLA-1003, ¶85.

These determined speeds (*variations in target speed*) are *between pairs of segment destinations*. TESLA-1003, ¶86. Adjacent pairs of segment destinations define a frame, with each frame composed of multiple integration steps. *See* [1b], *supra*; TESLA-1005, [0162], [0169]-[0170], FIG. 10, FIGS. 12a-12c, FIGS. 13a-13d (*supra*); TESLA-1003, ¶86. Also, illustrated *supra* in FIGS. 12c and 13b-d,

within each optimization iteration, a speed is determined for each location (each integration step), and thus multiple vehicle speeds (*a plurality of variations in a target speed*) are determined for each frame, *e.g.*, *between each pair of segment destinations*. See TESLA-1005, [0180] (“several optimization iterations are applied on the memory range described above until the algorithm has converged and thus the values are optimal”), [0185]-[0186], [0190]-[0191], FIG. 12c, FIGS. 13b-d; TESLA-1003, ¶86.

For instance, FIG. 13b, *supra*, depicts the outcome of a first “optimization iteration,” from which five vehicle speeds v_{15} - v_{19} (red) are determined between the pair of segment destinations (green) defining frame 3; other speeds are determined between pairs of segment destinations defining the other frames. TESLA-1005, [0190]; TESLA-1003, ¶87. Speeds calculated during subsequent iterations are depicted in FIGS. 13c-d. See TESLA-1005, [0191]. TESLA-1003, ¶87. Similarly, FIG. 12c, *supra*, illustrates the outcome of “several optimization iterations,” from which speeds (red) are determined for the integration steps of the multiple frames. TESLA-1005, [0180]. Across the multiple frames of the Prediction Horizon, the speeds (*variations in target speed*) determined during a single optimization iteration thus correspond to *variations in target speed between pairs of segment destinations*, *e.g.*, between pairs of segment destinations defining the Prediction Horizon’s frames. TESLA-1003, ¶87.

The values of Neiss's cost functions collectively correspond to energy values consumed by the vehicle to travel the route

As discussed *infra*, the value of Neiss's cost function J_{fuel} and/or the value of L (an element of Neiss's overall cost function J), calculated for the locations in each frame of the Prediction Horizon, correspond to a **plurality of energy values consumed by said vehicle to travel said route**. TESLA-1003, ¶¶88-94.

First, Neiss's cost function J_{fuel} represents the vehicle's "fuel consumption" as it traverses the Prediction Horizon, *e.g.*, energy **consumed by the vehicle to travel said route**. TESLA-1005, [0093]; *see* [0082], [0126]-[0130], Eq. 29; *see* TESLA-1001, 1:40-42; TESLA-1003, ¶91. J_{fuel} is a function of velocity v_k and throttle position th_k for each of N locations (integration steps) along the Prediction Horizon:

"energy value"
at location k


$$J_{fuel} = \frac{1}{2} \cdot h \cdot \sum_{k=0}^{N-1} S\psi v_k th_k^2,$$

(Eq. 18)

See TESLA-1005, claim 10, [0093]-[0098]; TESLA-1003, ¶91. The J_{fuel} value at each location (pink *supra*) represents fuel (energy) consumption at that location, *e.g.*, corresponds to **an energy value consumed by the vehicle** at that location. TESLA-1003, ¶92. The J_{fuel} values for all locations along the Prediction Horizon

collectively correspond to *a plurality of energy values consumed by said vehicle to travel said route* (the Prediction Horizon). *Id.*; TESLA-1003, ¶¶92-93.

Second, J_{fuel} is added together with other individual cost functions to give the overall cost function J :

$$J = \Phi + J_{time} + J_{fuel} + J_{velocity} + J_{lateral} + J_{accel} + J_{penalty}$$

See TESLA-1005, [0080]-[0087],[0126]-[0130]; TESLA-1003, ¶¶88-89, 94. The individual cost functions can be expressed collectively as the summation of the value of a function, L , for each of N locations along the Prediction Horizon:

*“energy value”
at location k*



$$J = \Phi(v_N) + \sum_{k=0}^{N-1} L(s_k, v(s_k), th(s_k)) \rightarrow \min \quad (\text{Eq. 30})$$

See TESLA-1005, [0126]-[0132]; TESLA-1003, ¶¶90, 94. The L value at each location alternatively/additionally corresponds to *an energy value consumed by said vehicle* at that location, because L incorporates the J_{fuel} expression for fuel (energy) consumption at that location. TESLA-1003, ¶94.

Alternatively/additionally, each location's L value corresponds to *an energy value* because L , like J_{fuel} , is a function of velocity $v(s_k)$ and throttle position $th(s_k)$, both

of which affect energy consumption, as indicated by J_{fuel} 's dependence on these parameters. *See* TESLA-1005, [0093]-[0098]; TESLA-1003, ¶94. The L values for locations along the Prediction Horizon collectively correspond to ***a plurality of energy values consumed by said vehicle to travel said route*** (Prediction Horizon). TESLA-1003, ¶94.

Energy values are calculated based on variations in target speed

To optimize Neiss's overall cost function, "several optimization iterations are applied," and with each iteration, "velocity, throttle and controller gain" are calculated for each location in the Prediction Horizon. TESLA-1005, [0180], [0185]-[0186]; *see* [0162]-[0163], [0177], [0190], claim 1; TESLA-1003, ¶95.

The L value at each location (***energy value***) is ***calculated*** based on these parameters: "operating cost function provides an analytic calculation of vehicle operating cost based on said parameters." TESLA-1005, claim 13; TESLA-1003, ¶96. The L value is ***calculated*** because it is specified mathematically by calculation of velocity ($v(s_k)$) and throttle ($th(s_k)$):

$$J = \Phi(v_N) + \sum_{k=0}^{N-1} L(s_k, v(s_k), th(s_k)) \rightarrow \min \quad (\text{Eq. 30})$$

See TESLA-1005, [0171] (“values for vehicle velocity, throttle position and controller gain calculated as described previously” are stored in memory with “variables needed for the calculation of the optimization algorithm”); TESLA-1003, ¶96; TESLA-1015, 3 (defining “calculate” as “to determine or ascertain by mathematical methods; compute”); TESLA-1016, 3 (defining “calculate” as “to solve (one or more problems) by a mathematical procedure; compute”); TESLA-1017, 3 (defining “calculate” as “determine (the amount or number of something) mathematically”).

Similarly, J_{fuel} at each location (alternatively/additionally an **energy value**) is **calculated** because it is specified mathematically by calculation of velocity (v_k) and throttle (th_k) (TESLA-1003, ¶97):

$$J_{fuel} = \frac{1}{2} \cdot h \cdot \sum_{k=0}^{N-1} S \psi v_k t h_k^2, \quad (\text{Eq. 18})$$

“energy value”
at location k

Moreover, the L and J_{fuel} values for locations along the Prediction Horizon (*a plurality of energy values consumed by said vehicle to travel said route*) are calculated *based on a plurality of variations in a target speed*, as expressed in the equations below. TESLA-1003, ¶98.

$$J = \Phi(v_N) + \sum_{k=0}^{N-1} L(s_k, v(s_k), th(s_k)) \rightarrow \min \quad (\text{Eq. 30})$$

“energy value”
at location k

“variations in a target speed”

$$J_{fuel} = \frac{1}{2} \cdot h \cdot \sum_{k=0}^{N-1} S \psi v_k t h_k^2, \quad (\text{Eq. 18})$$

“energy value”
at location k

“variations in a target speed”

Specifically, for each iteration, multiple speeds (*a plurality of variations in a target speed*) are determined *between pairs of segment destinations*, e.g., a

speed is calculated for each location for the Prediction Horizon's frames, discussed *supra*. See TESLA-1005, [0162], [0169]-[0170], FIG. 10, FIGS. 12a-12c, FIGS. 13a-13d. The L and J_{fuel} values for each location are determined mathematically (***calculating an energy value***) based on the corresponding speed, also discussed *supra*. TESLA-1003, ¶99.

Thus, determining the L and/or J_{fuel} values for the locations along the Prediction Horizon based on the calculated speeds corresponds to ***calculating a plurality of energy values consumed by said vehicle to travel said route*** (the L and/or J_{fuel} values for the N locations along the Prediction Horizon) ***based on a plurality of variations in a target speed of said vehicle between pairs of segment destinations*** (the per-location speeds). TESLA-1003, ¶100.

[1d]

The cost function, J , is a summation, over the N locations along the Prediction Horizon, of the L values (***energy values***; see [1c], *supra*), e.g., a ***summation of said energy values***:

$$J = \Phi(v_N) + \sum_{k=0}^{N-1} L(s_k, v(s_k), th(s_k)) \rightarrow \min \quad (\text{Eq. 30})$$

“*energy value*”
at location k

“*summation of energy values*”

TESLA-1005, [0132]; TESLA-1003, ¶¶101-102.

Neiss’s optimization aims to “minimize vehicle operating ‘costs,” *e.g.*, to minimize the overall cost function J (the *summation of said energy values*).

TESLA-1005, [0132]; *see* [0127], [0161], [0001], [0081], claim 1, claim 13,

[0169]-[0171], [0177]-[0187], [0189]-[0191]; TESLA-1003, ¶103. Minimizing J

(a summation of energy values) corresponds to identifying the speed (v_k) and

throttle (th_k) for each location along the Prediction Horizon that result in a

minimum (*best*) summation, *e.g.*, that *achieve a best summation of said energy*

values. TESLA-1003, ¶103. This minimum summation corresponds to a *best*

summation because a minimized cost function J reflects “minimize[d] vehicle

operating ‘costs’” that achieve the objectives specified by the individual cost

functions incorporated into the overall cost function J . TESLA-1005, [0132]; *see*

[0126]; TESLA-1003, ¶103. For instance, minimization of J (a *best summation of*

said energy values) addresses the objective that “[t]he vehicle should consume less fuel.” TESLA-1003, [0082]; *see* [0031]; TESLA-1003, ¶103.

Minimization of J reflects the objective that “[t]he vehicle should consume less fuel,” *e.g.*, as expressed by the cost function J_{fuel} . TESLA-1005, [0082].

Minimizing J thus corresponds to minimizing J_{fuel} (subject to constraints of other relevant cost functions). TESLA-1005, [0082]; TESLA-1003, ¶104. J_{fuel} is a summation of the J_{fuel} value for each of the N locations of the Prediction Horizon (*energy values*; *see* [1c], *supra*), *e.g.*, J_{fuel} cost function corresponds to *a summation of said energy values*:

$$J_{fuel} = \frac{1}{2} \cdot h \cdot \sum_{k=0}^{N-1} S\psi v_k th_k^2, \quad (\text{Eq. 18})$$

“summation of energy values”

TESLA-1003, ¶104. Thus, minimizing J_{fuel} (achieved through identification of the speed (v_k) and throttle (th_k) values that minimize the overall cost function J , discussed *supra*) corresponds to minimizing the summation defining J_{fuel} , *e.g.*, *achieving a best summation of said energy value*. TESLA-1003, ¶104. For instance, the minimum summation corresponds to a *best summation* because a

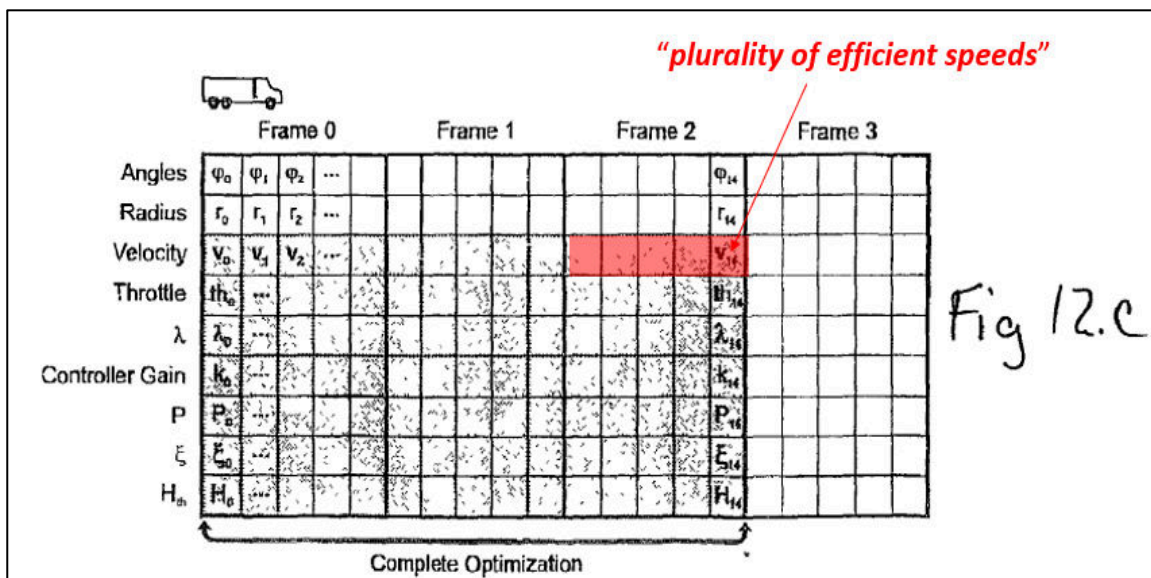
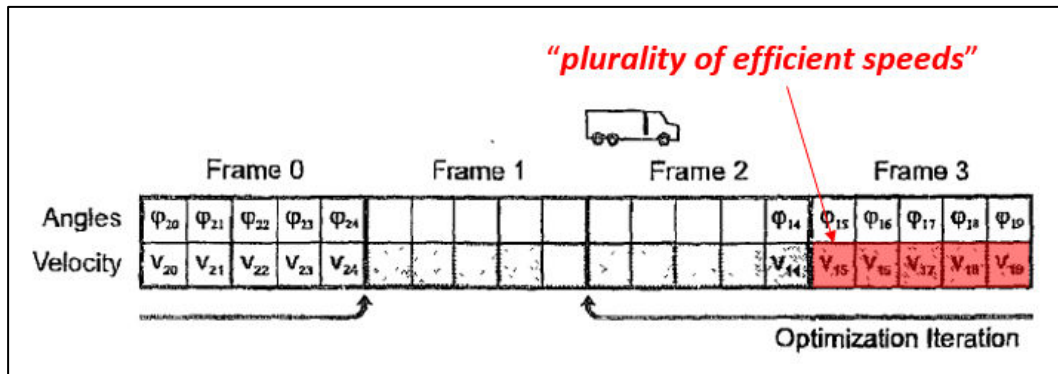
minimized J_{fuel} cost function achieves the objective that “[t]he vehicle should consume less fuel.” TESLA-1005, [0082]; TESLA-1003, ¶104.

Neiss’s iterative optimization calculates “optimal velocity, throttle pedal positions, and controller gain series” for each location along the Prediction Horizon. TESLA-1005, [0162]; TESLA-1003, ¶105. After one or more iterations, the calculated values “approach closer to the optimal values,” e.g., minimize the overall cost function J . TESLA-1005, [0191]; see [0162]-[0163], claim 1, [0171], [0185]-[0186], [0190].

These “closer to [] optimal” speeds correspond to ***a plurality of efficient speeds*** (e.g., the optimized speed for each location along the Prediction Horizon) ***that achieve a best summation of said energy values*** (e.g., that minimize the overall cost function, J and the individual cost function J_{fuel}). TESLA-1005, [0191]; TESLA-1003, ¶106. For instance, these speeds correspond to ***efficient speeds*** because they achieve the objective that “[t]he vehicle should consume less fuel.” TESLA-1005, [0082]; see [0031] (“determine...a desired speed...to maximize fuel savings”); TESLA-1003, ¶106. These ***efficient speeds*** are ***determined*** via iterative execution of Neiss’s optimization. See TESLA-1005, [0178]-[0191]; TESLA-1003, ¶106.

For instance, the per-location speeds FIGS. 13d and 12c (red below) correspond to some of these ***plurality of efficient speeds*** because they are “closer

to the optimal” speeds calculated (*determined*) via multiple “optimization iterations.” TESLA-1005, [0191], [0180], [0185]-[0186]; TESLA-1003, ¶¶107-108.



TESLA-1005, FIGS. 13d, 12c (annotated)

[1e]

Neiss’s “vehicle is [] controlled by reading the optimized vehicle control parameters from the memory, corresponding to the” vehicle’s “current position.”

TESLA-1005, [0014]-[0015], claim 1, [0042]. That is, the vehicle is controlled to drive the identified optimized speed (*efficient speed*) for each current location of the vehicle. See TESLA-1005, [0015]; TESLA-1003, ¶¶109-110. Over the entire route, the vehicle is thus controlled to travel at the efficient speeds at the locations along the route corresponding to the locations within each frame (*said efficient speeds to travel between each of said segment destinations*). TESLA-1003, ¶110.

Speedometers were conventional components of vehicles; as such, a POSITA would have found it obvious for Neiss's vehicle to have a speedometer, e.g., for display of the vehicle's current speed. TESLA-1003, ¶¶111-113, citing TESLA-1008, FIG. 3C; TESLA-1012, 2:44-45; TESLA-1006, FIG. 4. Displaying the vehicle's current speed corresponds to *notifying an operator of the vehicle* about the current speed. Because the current speed corresponds to the optimized speed for the vehicle's current position (*efficient speed*), this notification, along the Prediction Horizon's segments/frames, thus corresponds to *notifying an operator about said efficient speeds*. TESLA-1003, ¶111.

A POSITA would have found it obvious to implement a speedometer for displaying current vehicle speed (*efficient speed*). TESLA-1003, ¶¶112-117.

First, dashboard displays (including speedometers) for displaying current speed were conventional and common. TESLA-1003, ¶113, citing TESLA-1008, FIG. 3C; TESLA-1012, 2:44-45; TESLA-1006, FIG. 4. A POSITA would have

been motivated to implement a speedometer because this configuration is merely the application of known techniques (displaying current speed on a dashboard/speedometer display) to a known system (Neiss's vehicle) to yield predictable results (a vehicle with a speedometer for displaying current speed). *See KSR*, 550 U.S. at 415-421; MPEP 2143; TESLA-1003, ¶113.

Second, displaying current speed provides the driver with valuable information about vehicle operation, *e.g.*, allowing the driver to override the cruise control for safety or legal reasons, or for reasons of convenience (*e.g.*, comfort/efficiency). TESLA-1003, ¶¶114-115.

Third, displaying current vehicle speed was a known technique applied to a known device (a vehicle implementing Neiss's predictive cruise control) ready for improvement (*e.g.*, because Neiss does not explicitly disclose that the speeds are displayed, which is advantageous as discussed *supra*). *See KSR*, 550 U.S. at 415-421; MPEP 2143; TESLA-1003, ¶116.

A POSITA would have expected success in pursuing this implementation because it involves common techniques and devices, *e.g.*, dashboard display of current speeds, which are conventional and predictable, and present no unexpected results. TESLA-1003, ¶117.

Alternatively/additionally, a POSITA would have been motivated to display the determined efficient speed for an upcoming location as the vehicle travels

along the Prediction Horizon (*notify an operator about said efficient speeds*), given that this implementation makes use of available data in a straightforward way and given that display of speeds for upcoming route sections was well-known. TESLA-1003, ¶118 (citing, e.g., TESLA-1011, 2:35-39, 4:2-5).

[2]

Neiss's calculation of optimal parameters, including vehicle velocity, to optimize the cost function (*calculating said efficient speeds*; see [1d]) occurs "continuously...as the vehicle (and hence the Prediction Horizon) moves along," e.g., *continuously calculating said efficient speeds*. TESLA-1005, [0015], [0012], [0163]-[0167], [0009]-[0010], [0169], [0190]-[0191]; TESLA-1003, ¶¶119-120. Given these disclosures, a POSITA would have understood, or otherwise found it obvious, for the calculation to continue *until a final destination is reached*. TESLA-1003, ¶¶120-126.

First, a POSITA would have found this to be obvious continuing Neiss's iterative calculation throughout the vehicle's entire trip, e.g., *until a final destination is reached*, allows reaping the benefits of calculating optimal parameters that achieve a target objective, for the entire trip. TESLA-1003, ¶122; TESLA-1005, [0012].

Second, continuous calculation throughout the trip (until a final destination is reached) also flexibly allows for recalculation to address changes in conditions, *e.g.*, if there is “a slower vehicle driving ahead” or if the driver wishes to “change the route while driving.” TESLA-1005, [0165], [0167]; TESLA-1003, ¶123.

Third, this implementation is merely the application of known techniques (calculation of operating parameters until a final destination is reached) to a known system (Neiss’s system for ongoing parameter calculation) to yield predictable results (a system for ongoing calculation of operating parameters until a final destination is reached). *See KSR*, 550 U.S. at 415-421; MPEP 2143; TESLA-1003, ¶124.

Fourth, this implementation is one of only a small number of conventional implementations for such calculation: calculation until a final destination is reached, or calculation that ends prior to the destination being reached. *See KSR*, 550 U.S. at 415-421; TESLA-1003, ¶125.

A POSITA would have expected success because this implementation involves common techniques and devices—namely, extending Neiss’s full iterative optimization functionality throughout the trip—that are conventional, predictable, and present no unexpected results given their consistency with Neiss’s teachings. TESLA-1003, ¶126.

[3]

Neiss's overall cost function "is based on a mathematical model of vehicle dynamics" that includes the factor F_i representing "longitudinal forces affecting vehicle operation." TESLA-1005, claims 5-6; *see* [0050]; TESLA-1003, ¶¶127-128. ***Determining said efficient speeds*** is based on the overall cost function, and thus is based on this mathematical model. *See* [1d], *supra*; TESLA-1003, ¶129.

F_i includes "forces exerted by the vehicle engine, vehicle brakes, and drag, and forces exerted by road gradient and friction," and therefore this mathematical model (and thus ***determining said efficient speeds***) is based on drag (***aerodynamic drag of said vehicle***), forces exerted by road gradient (***change in potential energy of said vehicle due to a road gradient***), and friction (***rolling resistance of said vehicle***). TESLA-1005, claim 7; *see* [0054]-[0058] (listing "the forces that act on" a vehicle, including F_{roll} , which is based on the "friction coefficient of the street...[and] the grade of the street" (***rolling resistance, change in potential energy due to a road gradient***); F_{grade} , which is "[t]he force caused by the gravity" (***change in potential energy due to a road gradient***); and "turbulent friction," which is based on "the density of the air, ...the surface area of the vehicle...[and] velocity" (***an aerodynamic drag***)); TESLA-1003, ¶¶130, 132.

Alternatively/additionally, Neiss's "cost function includes vehicle fuel consumption as a function of vehicle speed, road gradient, and throttle position,"

and thus *determining said efficient speeds* using this function is based on road gradient (*a change in potential energy of said vehicle due to a road gradient*).

TESLA-1005, claim 10; TESLA-1003, ¶¶131-132.

[5]

Neiss's optimization (and thus *determining said efficient speeds*; *see* [1d], *supra*) accounts for vehicle acceleration/deceleration. TESLA-1003, ¶¶133-135.

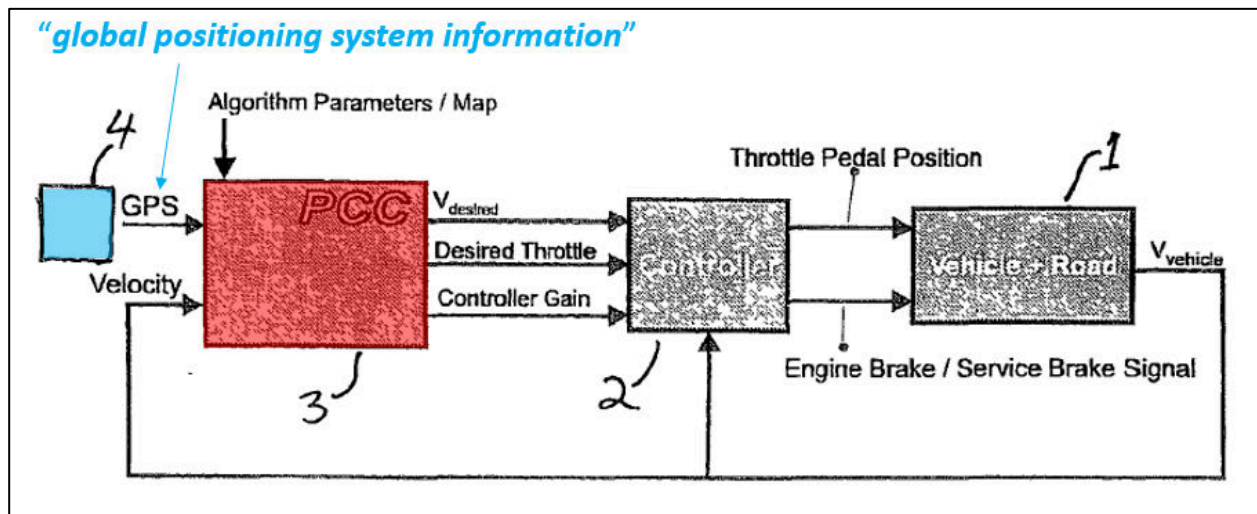
Specifically, "[t]he accelerating or decelerating force caused by the motor is calculated...from the engine torque." TESLA-1005, [0061]. This force is incorporated into the vehicle's motion equation, which is a constraint in the optimization process. *See* TESLA-1005, [0051], [0059], [0131]-[0133]; TESLA-1003, ¶134.

A POSITA would have understood that when the optimized speeds (*efficient speeds*; *see* [1d], *supra*) for two adjacent locations differ, the vehicle accelerates or decelerates when moving from one location to the next. TESLA-1003, ¶135. This acceleration/deceleration is accounted for in Neiss's optimization process through its reliance on the vehicle's motion, *e.g.*, the optimization (*determining said efficient speeds*; *see* [1d], *supra*) is *based on an acceleration and/or deceleration of the vehicle to an efficient speed*. TESLA-1005, [0061]; TESLA-1003, ¶135.

[6]

Determining L for the multiple locations along the Prediction Horizon corresponds to *calculating said energy values*. See [1d], *supra*. The Prediction Horizon is “the route ahead of the vehicle,” *e.g.*, ahead of *a current location of said vehicle*. TESLA-1005, [0015]; *see* [0047], [0162], claim 1, Abstract, TESLA-1003, ¶137. That is, determining the L values (*calculating said energy values*) is based on speeds along the Prediction Horizon, which is based on the *current location of said vehicle, e.g., calculating said energy values is based on a current location of said vehicle*. TESLA-1003, ¶137.

Moreover, the *current location of said vehicle is determined by global positioning system information*. TESLA-1003, ¶138. Neiss’s cruise control system receives “information about the current position of the vehicle” from a “Global Positioning System 4,” *blue infra*. TESLA-1005, [0034]-[0035]; *see* [0014], [0046], claim 4, [0004], FIG. 6, FIG. 15; TESLA-1003, ¶138.



TESLA-1005, FIG. 4 (annotated)

[8]

Neiss describes that “[w]hen vehicle velocity drifts significantly from the velocity stored in the look-up table for the current position,” the optimization is re-executed “taking the current velocity into account.” TESLA-1005, [0167]; TESLA-1003, ¶¶139-140. A POSITA would have found it obvious (as discussed *infra*) that the “Set Speed” (**target speed**; see [1c], *supra*) for the re-optimization is based on the vehicle’s current speed. TESLA-1005, [0083]; TESLA-1003, ¶140.

The vehicle’s current speed is achieved by driver interaction with the gas pedal. TESLA-1003, ¶141. Thus, the **target speed** (which is based on current speed) is based on driver interaction with the gas pedal, *e.g.*, **in response to a position of the gas pedal**. *Id.* Furthermore, the target speed is **calculated** because based on a new desired speed as specified responsive to driver interaction with the

gas pedal, a new numerical value for the actual speed (*i.e.*, a new *target speed*) of the vehicle is computed. *Id.*

A POSITA would have been motivated to set the *target speed* based on the vehicle's current speed (*in response to a position of the gas pedal*) when re-optimization is performed. TESLA-1003, ¶¶142-146.

First, a POSITA would have recognized that when the current velocity “drifts significantly from the velocity stored in the look-up table for the current position,” the current velocity may no longer be optimal. TESLA-1005, [0167]; TESLA-1003, ¶143. When such a deviation occurs, a POSITA would have been motivated to re-optimize operating parameters, setting the target speed based on current velocity, to restore optimal operation given actual conditions. TESLA-1003, ¶143.

Second, this implementation is merely the application of known techniques (setting cruise control target speed based on current speed) to a known system (Neiss's predictive cruise control system) ready for improvement (*e.g.*, while Neiss indicates that a re-optimization may occur, it does not explicitly describe the specifics of the re-optimization) to yield predictable results (a predictive cruise control system that uses current speed as the target speed). *See KSR*, 550 U.S. at 415-421; MPEP 2143; TESLA-1003, ¶¶144-145.

A POSITA would have expected success because this implementation is consistent with Neiss's teachings of how to account for actual speeds, and makes use of known data (current speed, and expressions defining operating cost functions) in a predictable way (according to Neiss's optimization algorithms). TESLA-1003, ¶146; TESLA-1005, [0167].

[9]

Neiss's cruise control controls the vehicle to travel at the optimized speed corresponding to the vehicle's current position (*efficient speeds*). See [1e], *supra*; TESLA-1005, [0014]-[0015], [0042]; TESLA-1003, ¶¶147-148. As discussed here, a POSITA would have understood this control to include *shifting gears of an automatic transmission in said vehicle based on said efficient speeds*, e.g., to achieve the efficient speed corresponding to each current position. TESLA-1003, ¶148.

Neiss's vehicle is powered by "fuel injection to the motor," e.g., by internal combustion. TESLA-1005, [0039]; TESLA-1003, ¶149. A POSITA would have understood such vehicle to have *a transmission*, which was a standard feature of internal combustion vehicles. See TESLA-1003, ¶149, citing TESLA-1012, 1:6-7; TESLA-1018, [0004]. Moreover, a POSITA would have found it obvious for this transmission to be an *automatic transmission*, e.g., because of advantages and

widespread adoption of automatic transmissions, and given that automatic transmission is one of a small number of conventional and predictable implementations for vehicle transmissions (*e.g.*, manual or automatic). TESLA-1003, ¶¶149-150, citing TESLA-1018, [0003]-[0004], TESLA-1012, 6:27-35KSR, 550 U.S. at 415-421. Furthermore, a POSITA would have found it obvious for the cruise control to *shift gears* of the automatic transmission given that this is standard functionality. TESLA-1003, ¶150, citing TESLA-1013, 2:35-45.

A POSITA would have therefore understood or found obvious that Neiss's predictive cruise control system would *shift gears of the automatic transmission* to control the vehicle to travel at the efficient speed for each current location of its travel, *e.g.*, shifts gears *based on the efficient speeds*. TESLA-1003, ¶151.

[10pre]-[10d]

See [1pre]-[1d]; TESLA-1003, ¶152.

[10e]

Neiss's system controls the vehicle "by reading the optimized vehicle control parameters from the memory," corresponding to the vehicle's current position. TESLA-1005, [0014]-[0015], claim 1, [0042]. These "vehicle control parameters" include the optimized speed and throttle position for each location

along the Prediction Horizon (*said efficient speeds to travel between each of said segment destinations*). TESLA-1005, [0015]; *see* FIGS. 4, 15; TESLA-1003, ¶¶153-154. That is, Neiss's system controls the vehicle to travel at the optimized speed corresponding to the vehicle's current position (*efficient speeds*) as the vehicle traverses the Prediction Horizon. TESLA-1003, ¶154.

Specifically, the vehicle control is implemented by converting "desired vehicle speed...to a desired engine speed," and providing "a command signal...to the engine" which then achieves this speed "via its own controller or using a separate adaptive cruise controller." TESLA-1005, [0041]-[0042]. For instance, "[i]n the case of a diesel engine, the engine determines how much fuel to inject" to achieve a target speed (*e.g.*, the *efficient speed* for each current position), *e.g.*, *power is applied corresponding to said efficient speeds*. TESLA-1005, [0042]; TESLA-1003, ¶155. Alternatively, "if the system is implemented with a gasoline engine, the command could actually be a throttle angle," which controls applied power to achieve a target speed (*e.g.*, the *efficient speed* for each current position), *e.g.*, *power is applied corresponding to said efficient speeds*. TESLA-1005, [0042]; *see* [0034]; TESLA-1003, ¶155.

[11]-[12]

See [2]-[3]; TESLA-1003, ¶¶156-157.

[13]

See [1e]; TESLA-1003, ¶158.

[14]-[15]

See [5]-[6]; TESLA-1003, ¶¶159-160.

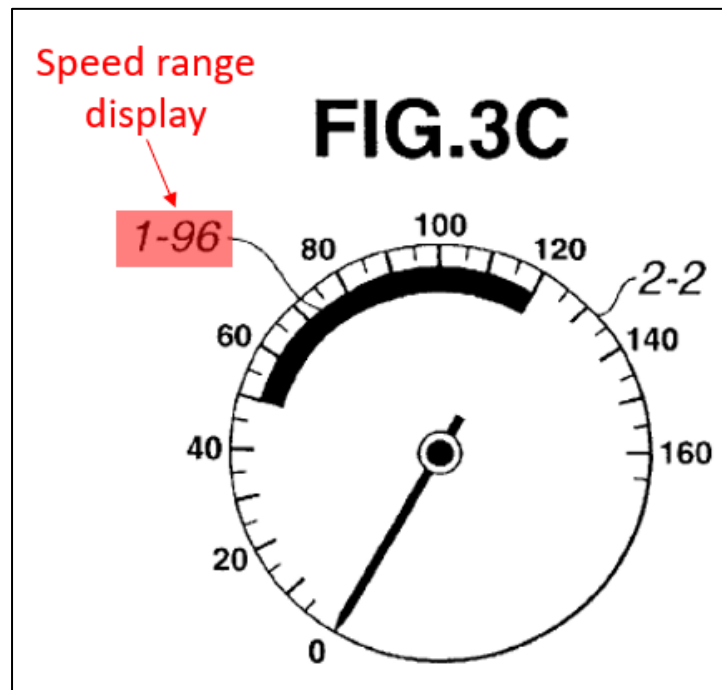
[17]-[18]

See [8]-[9]; TESLA-1003, ¶¶161-162.

B. [GROUND 1B] – Claim 4 is obvious over Neiss-Hirasago

1. Hirasago

Hirasago describes a “cruise control for keeping a vehicle speed at a set speed.” TESLA-1008, 1:6-9. A speedometer has a “speed range display section” that displays “a present vehicle speed” and “a set-condition speed range.” *Id.*, 1:30-38, 6:31-33, FIG. 3C (*infra*); TESLA-1003, ¶¶163-164.



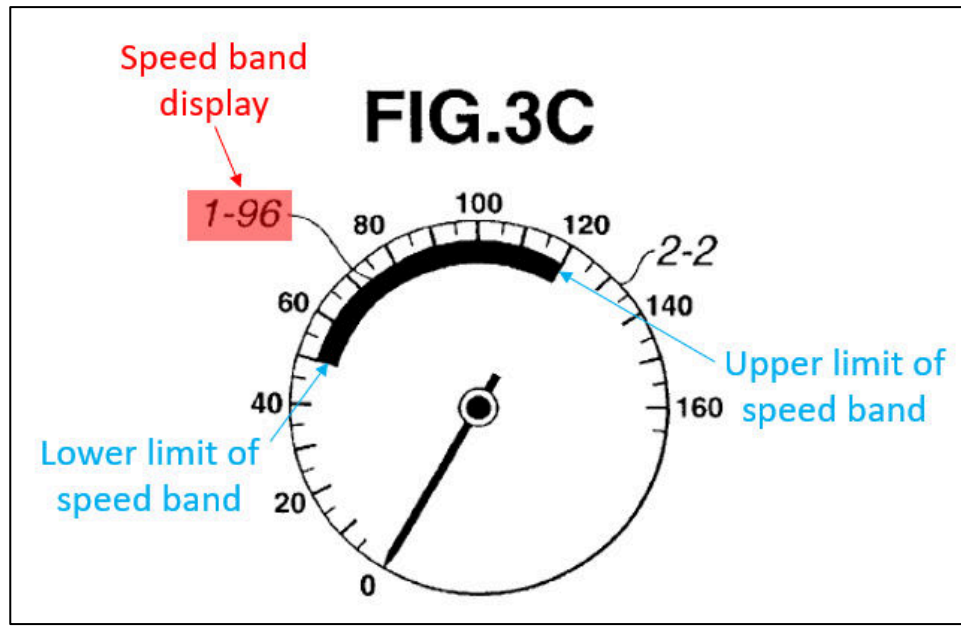
Except from TESLA-1008, FIG. 3C (annotated)

Hirasago is analogous art to the '161 Patent: it is from the same field of endeavor (*e.g.*, vehicle navigation) and is reasonably pertinent to the problem the '161 Patent was trying to solve (*e.g.*, how to control vehicle operation along a route). TESLA-1003, ¶165.

2. Neiss-Hirasago combination

Neiss-Hirasago renders obvious notifying a driver (*e.g.*, via display on a speedometer) about the range of per-location speeds determined during the optimization process. TESLA-1003, ¶166. Neiss's optimization process ensures that vehicle speed remains within a "speed band." TESLA-1005, [0031], [0084]. In Neiss-Hirasago, this speed band is displayed on the speedometer based on

Hirasago's teachings of displaying speed ranges, *e.g.*, illustrated *infra*. See
TESLA-1008, 1:37-38, 6:31-33, FIG. 3C; TESLA-1003, ¶167.



Neiss-Hirasago composite figure based on Hirasago, FIG. 3C³

A POSITA would have been motivated to display the speed band in the
combination vehicle. TESLA-1003, ¶¶168-172.

First, displaying the speed band provides information enabling the driver to
decide whether to override the cruise control. TESLA-1003, ¶169.

³ This figure, and other composite figures herein, illustrates an exemplary
configuration that a POSITA would have found obvious. Other, similar
configurations also would have been obvious for similar reasons discussed herein.

Second, this combination is merely the application of known techniques (display of a speed band) to a known system (a vehicle implementing predictive cruise control) ready for improvement (by displaying the speed band) to yield predictable results (a vehicle in which a cruise control speed band is displayed). *See KSR*, 550 U.S. at 415-421; TESLA-1003, ¶¶170-171.

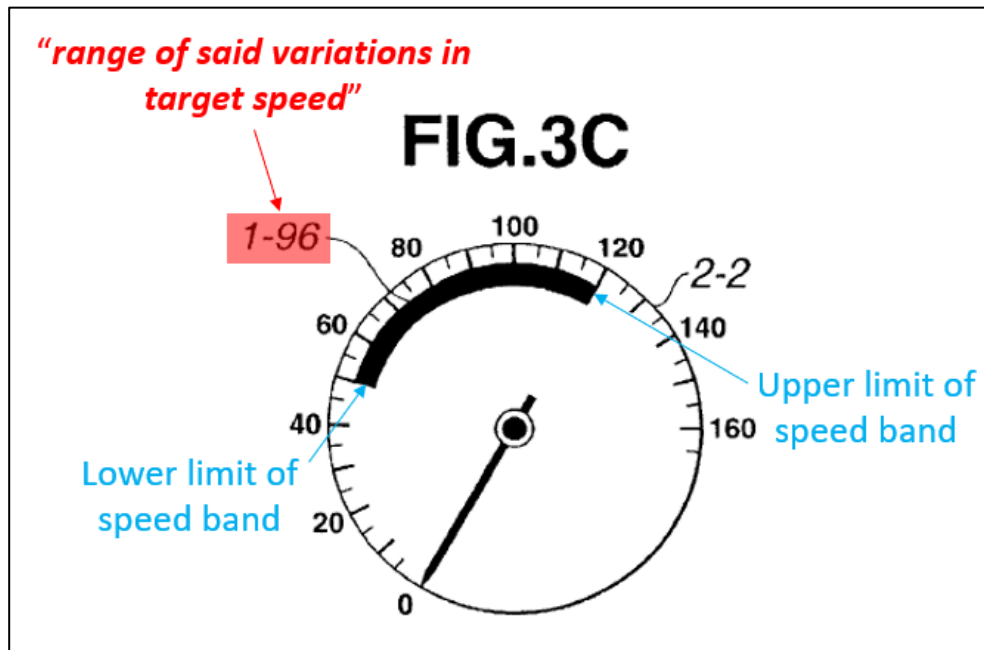
A POSITA would have had a reasonable expectation of success because Hirasago teaches the viability of displaying a cruise control speed band, and because implementation involves common techniques and devices implemented in a straightforward, conventional, and predictable way, *e.g.*, display of speed band information (information already present in Neiss’s system) on a speedometer (a conventional, commonly-used device). *See* TESLA-1008, 1:37-38, 6:31-33, FIG. 3C; TESLA-1003, ¶172.

3. Analysis

[4]

In Neiss-Hirasago, per-location speeds (*variations in said target speed*; *see* [1c], *supra*) are determined subject to a constraint that they fall within a “speed band.” TESLA-1005, [0031], [0084], [0103]- [0104], claims 8, 12. This speed band defines the range of values for the per-location speeds, *e.g.*, *a range of said variations in said target speed*. TESLA-1003, ¶¶173-174.

In Neiss-Hirasago, illustrated *infra*, the speed band is displayed on the vehicle's speedometer (which ***notifies said operator of a range of said variations in target speed***)) based on Hirasago's teachings of displaying speed bands. See TESLA-1008, 1:37-38, 6:31-33, FIG. 3C; TESLA-1003, ¶175.

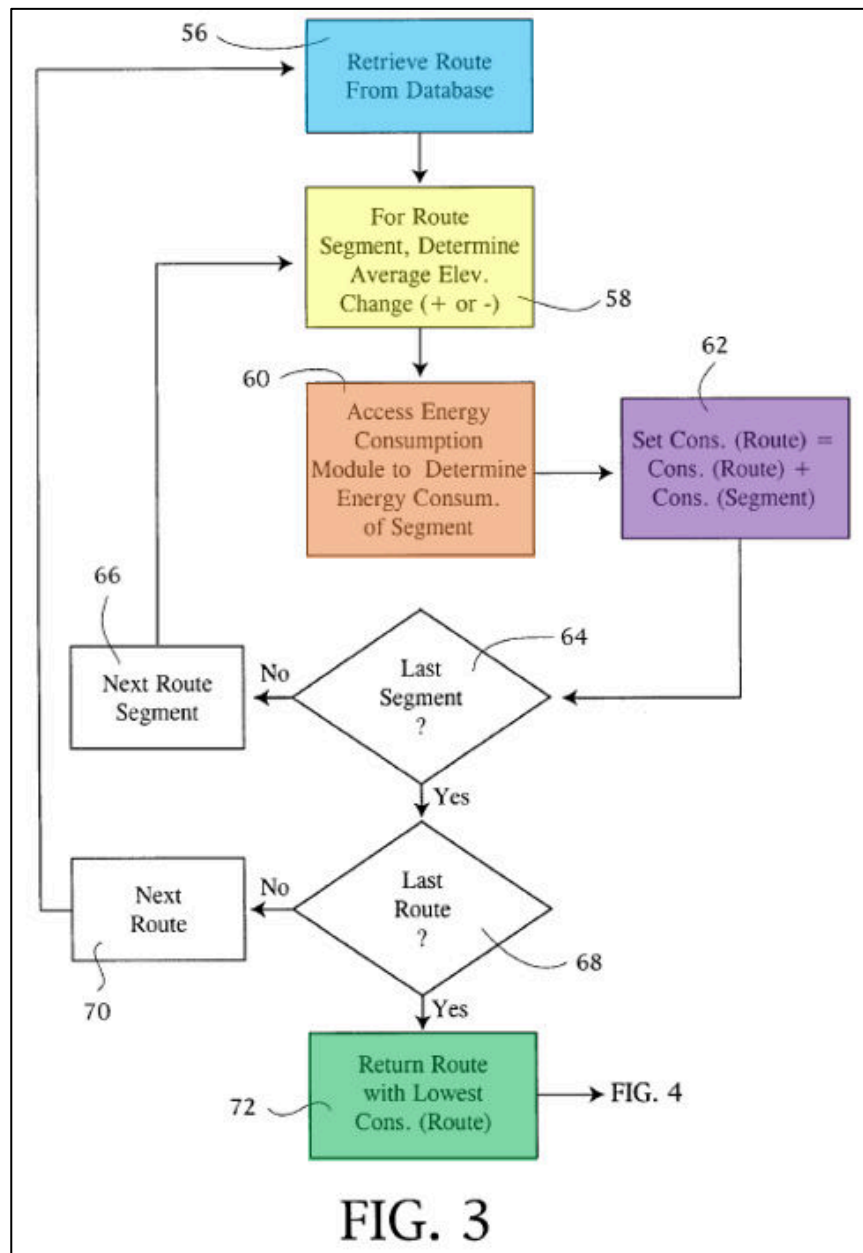


Neiss-Hirasago

C. [GROUND 2] – Claims 1, 3, 6-10, 12-13, and 15-18 are obvious over Schramm-Clapper

1. Schramm

Schramm describes “determining an energy-optimum route...between an origin and a destination” at a desired speed. TESLA-1009, Abstract; *see* 2:15-21, 5:1-20, FIG. 3, *infra*; TESLA-1003, ¶¶176-177.



TESLA-1009, FIG. 3 (annotated)

Schramm's vehicle computer retrieves a route composed of "contiguous route segments" between origin and destination (blue *supra*). See TESLA-1009, 5:21-24, 5:32-35. The computer determines "the average elevation change" for each segment (yellow) and "determine[s] the energy consumption" for "vehicle 12

to traverse the route segment under test at the [desired] speed (orange).” *Id.*, 5:41-48. The energy consumption values for the route segments are summed to determine the route’s total energy consumption (purple). *Id.*, 6:11-22; TESLA-1003, ¶¶178-179. This process is repeated for multiple possible routes between origin and destination, and “the route with the lowest overall energy consumption” is identified as optimal (green). *Id.*, 6:30-31; TESLA-1003, ¶¶180, 188.

Energy consumption values are determined (orange in FIG. 3) using “an energy consumption table.” TESLA-1009, 5:45-53; *see* FIG. 6, *infra*; TESLA-1003, ¶181.

	Segment Δ Elev. (Aug.)	Speed values			Δ Elev. Factors, For Speech =			
		1	2	3				
Elevation values (base energy consumption)	-x	.8	.8	1	.	.	.	.
	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.
	0	1	1.01	.	.	.	.	.
	1	1.01	1.02	.	.	.	.	.
	2	1.02	1.03	.	.	.	.	.
	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.
	+x	n	m	k	.	.	.	.

TESLA-1009, FIG. 6 (annotated)⁴

This table's rows "represent average elevational changes" for a segment; columns "represent[] the [vehicle's] desired speed" "along the route segment." *Id.*, 5:53-63. Entries in the table (highlighted red/green) are energy consumption values representing "energy consumption units" for respective speed/elevation combinations. *See* TESLA-1009, 6:3-5, 7:16-22; TESLA-1003, ¶182-185. The

⁴ The phrase "For Speech" is understood to be a typographical error that should have read "For Speed." *See* TESLA-1009, 5:61-63; TESLA-1003, ¶181.

energy consumption values are empirically calculated based on actual vehicle performance. *See* TESLA-1009, 6:5-7, 7:17-50, FIG. 5; TESLA-1003, ¶¶189-190.

Determining each segment's energy consumption value is performed "by selecting," from the FIG. 6 table, "the energy consumption value in the row corresponding to the [segment's] average elevation change...and the column corresponding to" the desired average speed. TESLA-1009, 5:64-6:2. The energy consumption values for all segments of a route are added together, giving the route's total energy consumption. *See id.*, 6:11-16; TESLA-1003, ¶186.

The identified "energy-optimum route" is displayed to the driver. *See* TESLA-1009, Abstract. Optionally, the vehicle computer can determine whether the vehicle "has sufficient energy to travel" the entire route at the desired speed, and communicate this to the driver. *Id.*, 6:44-58; TESLA-1003, ¶187.

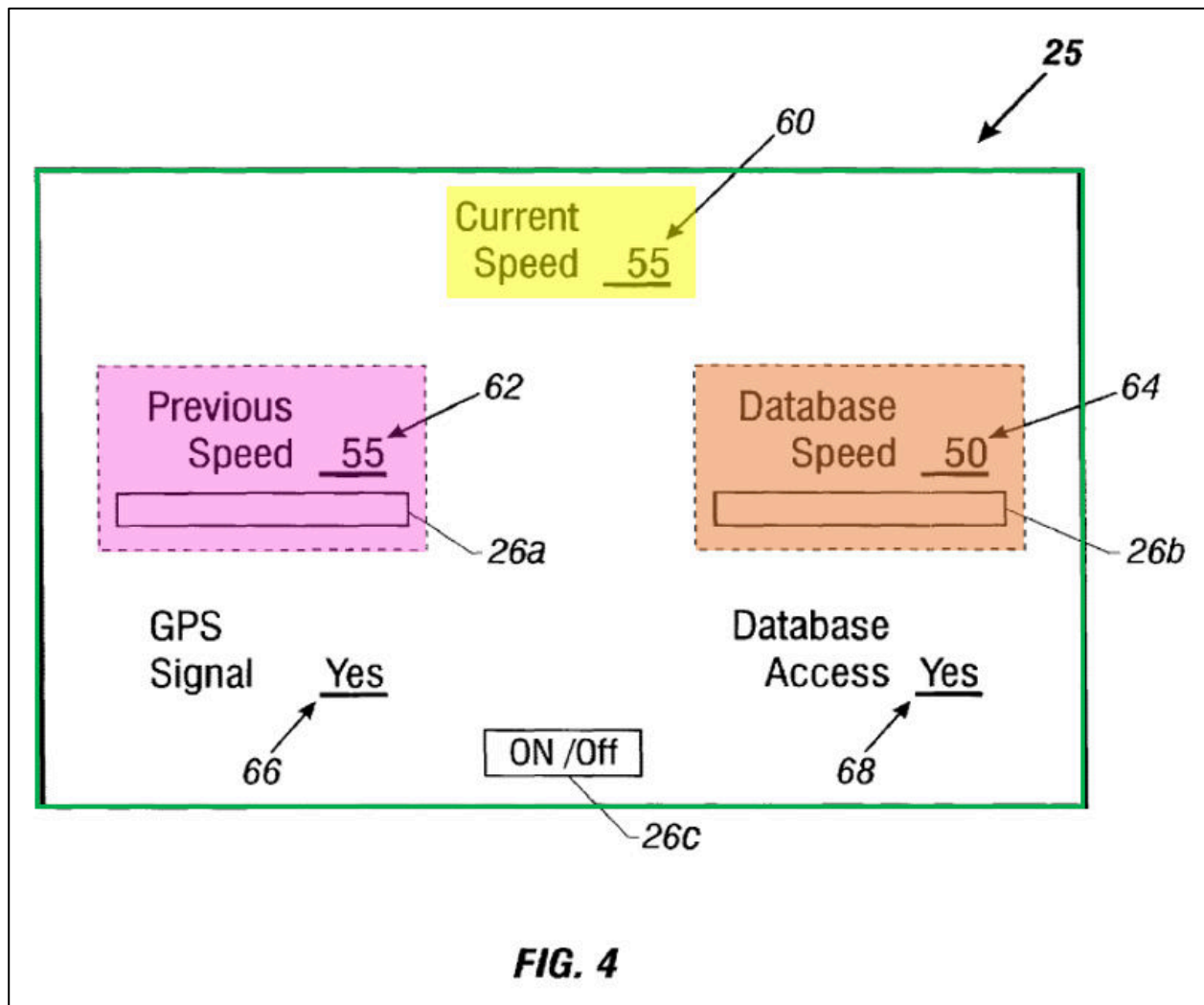
Schramm is analogous art to the '161 Patent: it is from the same field of endeavor (*e.g.*, vehicle navigation) and is reasonably pertinent to the problem the '161 Patent was trying to solve (*e.g.*, how to control vehicle operation along a route). TESLA-1003, ¶191.

2. Clapper

Clapper describes an "automatic cruise control" that compares the vehicle's "current position" to database entries specifying past "speeds used at given

locations.” *Id.*, 1:43-64, 2:52-56; *see* FIG. 3. If the current position matches a database entry, vehicle speed is set per “the existing speed from prior trips.” *Id.*, 2:55-56. If not, the vehicle speed is set to a stored speed limit value for the current location. *Id.*, 3:13-20; TESLA-1003, ¶¶192-194.

Clapper describes displaying “the current actual speed” at 60, yellow *infra*, “[t]he speed from the memory” at 62, pink (*e.g.*, the driver’s “speed from prior trips,”), and the “speed suggested from a database” at 64, orange (*e.g.*, a “speed limit”). TESLA-1006, 3:28-42; 2:8-56, FIGS. 1, 4; TESLA-1003, ¶¶195-196.



TESLA-1006, FIG. 4 (annotated)

Clapper is analogous art to the '161 Patent: it is from the same field of endeavor (*e.g.*, vehicle navigation) and is reasonably pertinent to the problem the '161 Patent was trying to solve (*e.g.*, how to control vehicle operation along a route). TESLA-1003, ¶197.

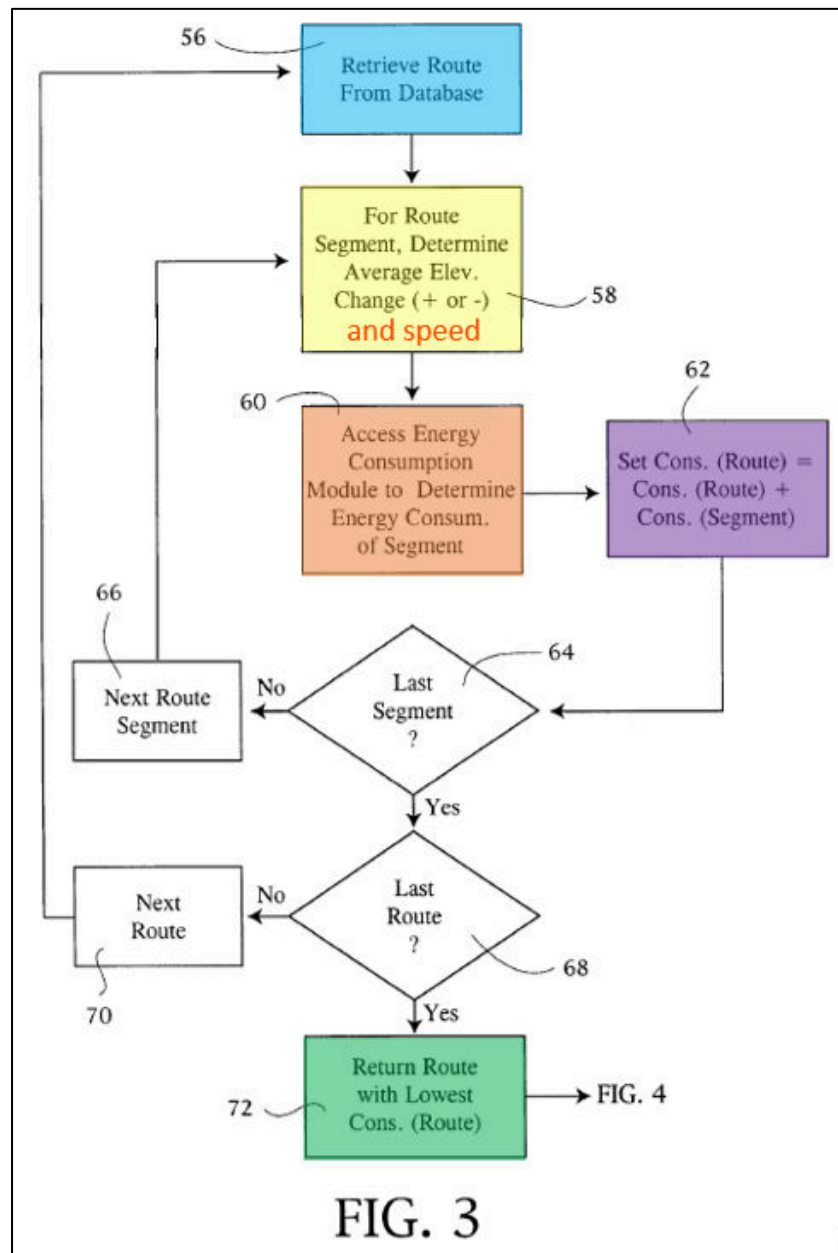
3. Schramm-Clapper combination

Schramm describes identifying an optimized route that has a best summation of energy values for a vehicle to traverse route segments at a single speed, while Clapper articulates that vehicle speed may vary along a route. Combining their teachings, a POSITA would have arrived at a route optimization process that accounts for different per-segment energy values based on speed variations. TESLA-1003, ¶198.

Schramm-Clapper's route optimization accounts for different per-segment speeds

Schramm's route identification process applies a single speed (e.g., "desired average speed" or current vehicle speed) to all route segments being evaluated. TESLA-1009, 5:1-16; *see* 5:41-48; TESLA-1003, ¶199. A POSITA would have recognized that a vehicle would not necessarily travel all segments at the same speed (*see* TESLA-1009, 57:23-25; TESLA-1006, 1:50-67, 3:13-27), and that speed variations impact vehicle energy consumption. TESLA-1003, ¶¶199-201. The POSITA thus would have adjusted Schramm's optimization process, per Clapper, to account for different per-segment speeds, as illustrated *infra*. *See* TESLA-1009, 5:45-50, 5:65-6:7; TESLA-1003, ¶¶200-203. Specifically, speeds for various locations, such as "[t]he driver's previous speed[s]" "at given locations" or "speed limits on existing roads and highways," are stored in a database, per Clapper. *See* TESLA-1006, 1:50-67, 2:37-44, 2:52-57, 3:13-23;

TESLA-1003, ¶202. For each route segment being evaluated during the optimization process, stored speed data are used along with the segment's elevation change to identify the appropriate energy value, *e.g.*, from Schramm's FIG. 6 table. TESLA-1003, ¶202.



Schramm-Clapper composite figure based on Schramm, FIG. 3

A route between origin and destination is retrieved for evaluation, per Schramm. TESLA-1009, 5:23-24 (blue *supra*). For each route segment, the segment's "average elevation change" (per Schramm) and a speed for the segment (e.g., previously-driven speed or speed limit) (per Clapper) are retrieved. TESLA-

1009, 5:41-45; *see* TESLA-1006, 1:50-67, 2:37-57, 3:13-23; TESLA-1003, ¶204.

The energy consumption value corresponding to the elevation-speed combination for each segment is retrieved, *e.g.*, from Schramm's FIG. 6 table. TESLA-1009, 5:46-6:2; TESLA-1003, ¶¶205-206.

Per Schramm, the per-segment energy consumption values are summed to determine the total energy consumption for each route (purple *supra*) and "the route with the lowest overall energy consumption" is output/returned (green). TESLA-1009, 6:12-31; TESLA-1003, ¶207. Thus, the optimization accounts for different per-segment speeds. TESLA-1003, ¶207.

A POSITA would have been motivated to account for different per-segment speeds when identifying an energy-optimum route. TESLA-1003, ¶¶208-214.

First, a POSITA would have been motivated to modify the fixed speed constraint of Schramm's optimization process to allow for the realistic possibility that per-segment speed may vary, thereby enhancing the optimization's accuracy. TESLA-1003, ¶¶209-210.

Second, the more accurate energy-optimum route identified via Schramm-Clapper's route optimization process would provide more reliable and useful information to the driver, *e.g.*, about whether the vehicle "has sufficient energy to travel" the route. TESLA-1009, 5:44-67; TESLA-1003, ¶211.

Third, this combination is merely the application of known techniques (maintaining per-segment speed data) to a known system (Schramm's route optimization process) that is ready for improvement (*e.g.*, by accounting for per-segment speed variations) to yield predictable results (route optimization accounting for varying per-segment speeds). *See KSR*, 550 U.S. at 415-421; MPEP 2143; TESLA-1003, ¶¶212-213.

A POSITA would have had a reasonable expectation of success in pursuing this combination because Schramm recognizes that speed impacts energy consumption, and thus the combination uses already-existing data (energy values for various segment speeds). *See TESLA-1009*, 5:21-6:32, FIG. 3; TESLA-1003, ¶214. Indeed, the combination process involves a straightforward and predictable modification of Schramm's process: per-segment speeds—readily available information (per Clapper)—are used with elevation data to retrieve energy consumption values included in Schramm's table. *See TESLA-1009*, 5:41-48; TESLA-1006, 1:50-51, 2:52-60, 3:13-20; TESLA-1003, ¶214. Moreover, this implementation involves common techniques and devices, *e.g.*, databases storing per-segment speeds (per Clapper) and energy values for various segment speeds (per Schramm). TESLA-1003, ¶214.

The combination vehicle is controlled by automatic cruise control

Optionally, as the driver drives along the identified energy-optimum route, an “automatic cruise control,” per Clapper, “automatically control[s]” vehicle speed “based on the vehicle’s current position” *e.g.*, based on a previously-driven speed or the speed limit at that position. TESLA-1006, 1:42-56, 3:17-19; *see* 2:15-16; TESLA-1003, ¶¶215-216.

A POSITA would have been motivated to control the Schramm-Clapper vehicle using automatic cruise control (ACC). TESLA-1003, ¶¶217-224.

First, implementing ACC improves driver experience, comfort, and safety by automatically controlling/adjusting vehicle speed for current road/environmental conditions. *See* TESLA-1006, 2:8-11, 1:14-17; TESLA-1003, ¶¶218, 221.

Second, implementing ACC facilitates optimized fuel consumption, *e.g.*, per Schramm’s objective of “minimizing” the vehicle’s “energy consumption.” TESLA-1009, 1:10-11; *see* TESLA-1003, ¶219, citing TESLA-1018, [0004]; TESLA-1012, 6:27-35; TESLA-1005, [0031].

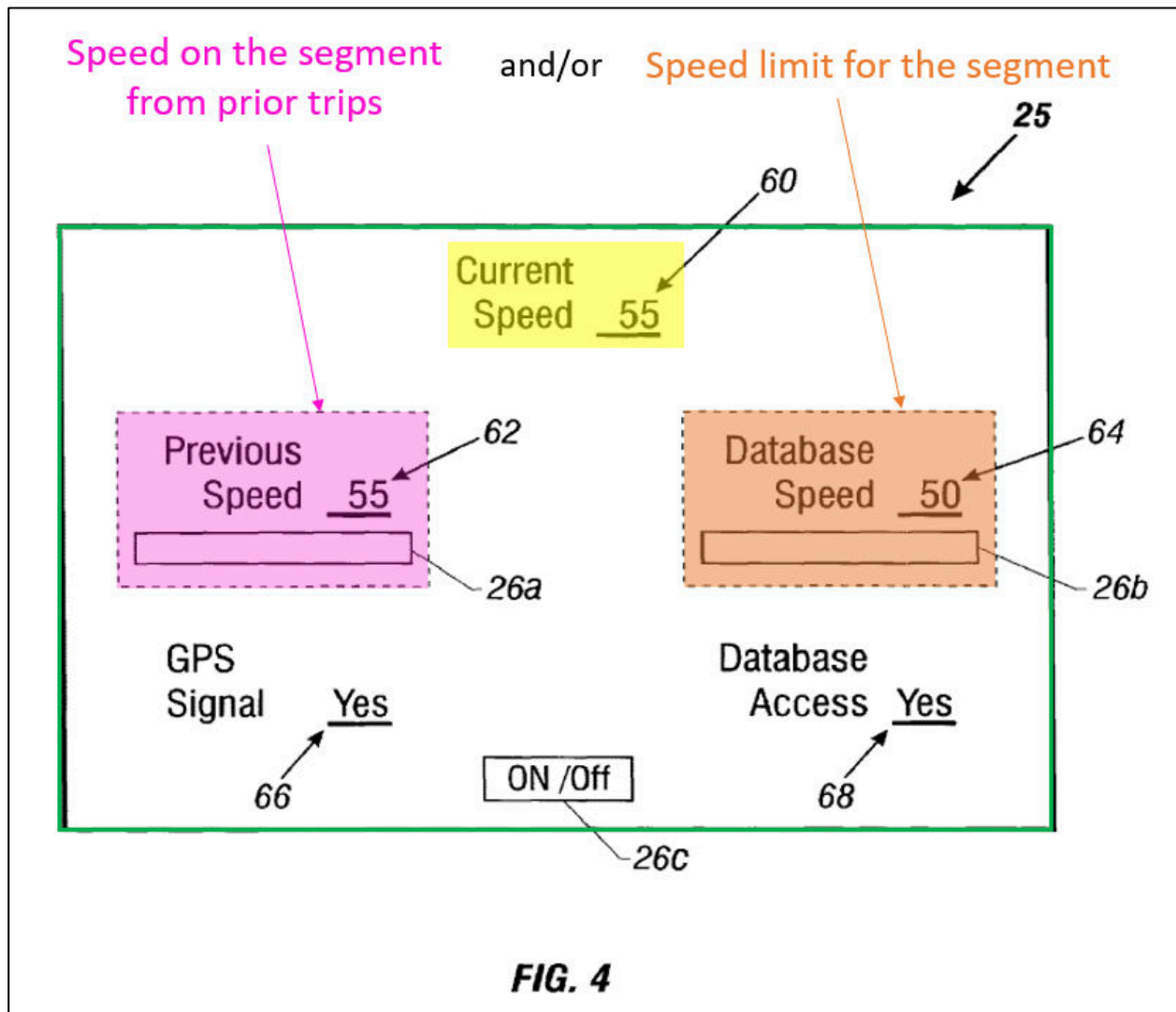
Third, implementing ACC in the Schramm-Clapper combination provides energy efficiencies enabled by controlling the vehicle to follow the per-segment speeds for the identified energy-optimum route. *See* TESLA-1009, 5:41-6:31; TESLA-1006, 1:50-51, 2:52-60, 3:13-20; TESLA-1003, ¶220.

Fourth, implementing this combination is merely the application of known techniques (ACC) to a known system (a vehicle implementing Schramm's route optimization) to yield predictable results (a vehicle controlled by ACC along an energy-optimized route), and to improve that system in the same way (improving driver experience). TESLA-1003, ¶¶222-223, citing TESLA-1006, 1:14-17; *KSR*, 550 U.S. at 415-421; MPEP 2143.

A POSITA would have expected success because (1) ACC systems were conventional and predictable, (2) Schramm's optimization would not change the ACC's conventional operation, or vice versa, and (3) the combination involves conventional hardware/software components of an ACC system. TESLA-1003, ¶224, citing TESLA-1011, 1:16-22; TESLA-1013, 1:9-11.

In the combination, the set speeds for the route segments are displayed

Optionally, the combination vehicle implements a display, per Clapper. *See* TESLA-1006, 3:28-45; TESLA-1003, ¶225.



Schramm-Clapper composite figure based on Clapper, FIG. 4

The combination display, *supra*, “display[s]” the “current actual speed” (60; yellow), “speed from prior trips” (55; pink), and/or the “speed suggested,” e.g., “speed limit” (64; orange). TESLA-1006, 3:28-42; 2:8-56, 1:55-56, FIGs. 1, 4; TESLA-1003, ¶¶226-227. These displayed speeds (62 and/or 64) may vary as the vehicle traverses the segments of the route, e.g., to reflect the stored historical

speeds and/or speed limits along the route. *See* TESLA-1006, 2:37-38, 3:13-23; TESLA-1003, ¶¶226-227.

A POSITA would have been motivated to display stored speeds for current segments as a vehicle traverses a route. TESLA-1003, ¶¶228-233.

First, displaying these speeds notifies the driver of suggested or typical location-specific driving conditions and provides a mechanism to control a vehicle otherwise operated by ACC, *e.g.*, by allowing the driver to “select either the previous speed 62 or the database speed 64,” which can enhance safety. TESLA-1006, 3:42-45; TESLA-1003, ¶¶229-230.

Second, implementing this combination is merely the application of known techniques (displaying speed information) to a known system (a vehicle that determines a route having varying per-segment speeds) to yield predictable results (a vehicle that displays per-segment speeds), and to improve that known, similar system in the same way (providing the driver with information about vehicle operation; *see* TESLA-1006, 3:42-45). *See KSR*, 550 U.S. at 415-421; MPEP 2143; TESLA-1003, ¶¶231-232.

A POSITA would have expected success because (1) displaying speeds in a vehicle was conventional and predictable, (2) Schramm’s teachings would not change/alter this conventional approach to speed display, and (3) this implementation involves common techniques/devices, *e.g.*, an in-vehicle display.

TESLA-1003, ¶233, citing TESLA-1008, FIG. 3C; TESLA-1012, 2:44-45;
TESLA-1006, FIG. 4.

4. Analysis

[1pre]

If the preamble is deemed limiting, Schramm-Clapper renders it obvious. TESLA-1003, ¶¶234-238. Schramm-Clapper's route optimization algorithm "minimiz[es] the energy consumption of vehicles" by "determining energy-optimizing routing of vehicles." TESLA-1009, 1:9-12, 1:32-65, 2:19-21, TESLA-1003, ¶235. Identifying "an energy-optimum route" corresponds to *managing a power consumption of a vehicle* because the vehicle's energy expenditure relates to power consumption, and identifying a route to minimize energy expenditure amounts to managing power consumption. TESLA-1009, Abstract; TESLA-1003, ¶235.

Moreover, in Schramm-Clapper, set speeds for the segments of the identified energy-optimum route are displayed. *See* TESLA-1006, 3:28-45, FIG. 4; *see* [1e]; TESLA-1003, ¶236. This display alternatively/additionally corresponds to *managing a power consumption of the vehicle* because the display provides information enabling vehicle operation at those per-segment speeds, thereby

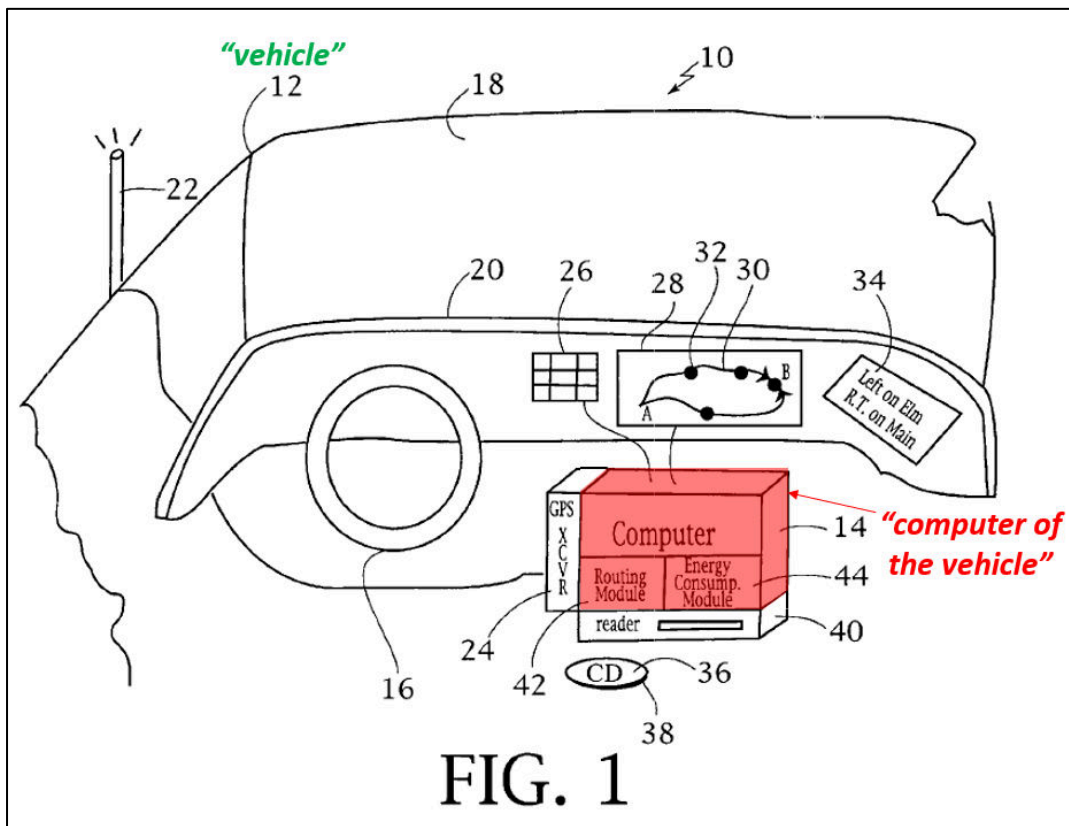
achieving the energy efficiencies indicated by the identified optimum route.

TESLA-1003, ¶236.

Optionally, the combination vehicle is controlled to travel at the set speeds for the identified energy-optimum route's segments. TESLA-1003, ¶237. This alternatively/additionally corresponds to *managing a power consumption of the vehicle* because vehicle operation at those per-segment speeds achieve energy efficiencies indicated by the identified optimum route. TESLA-1003, ¶¶237-238.

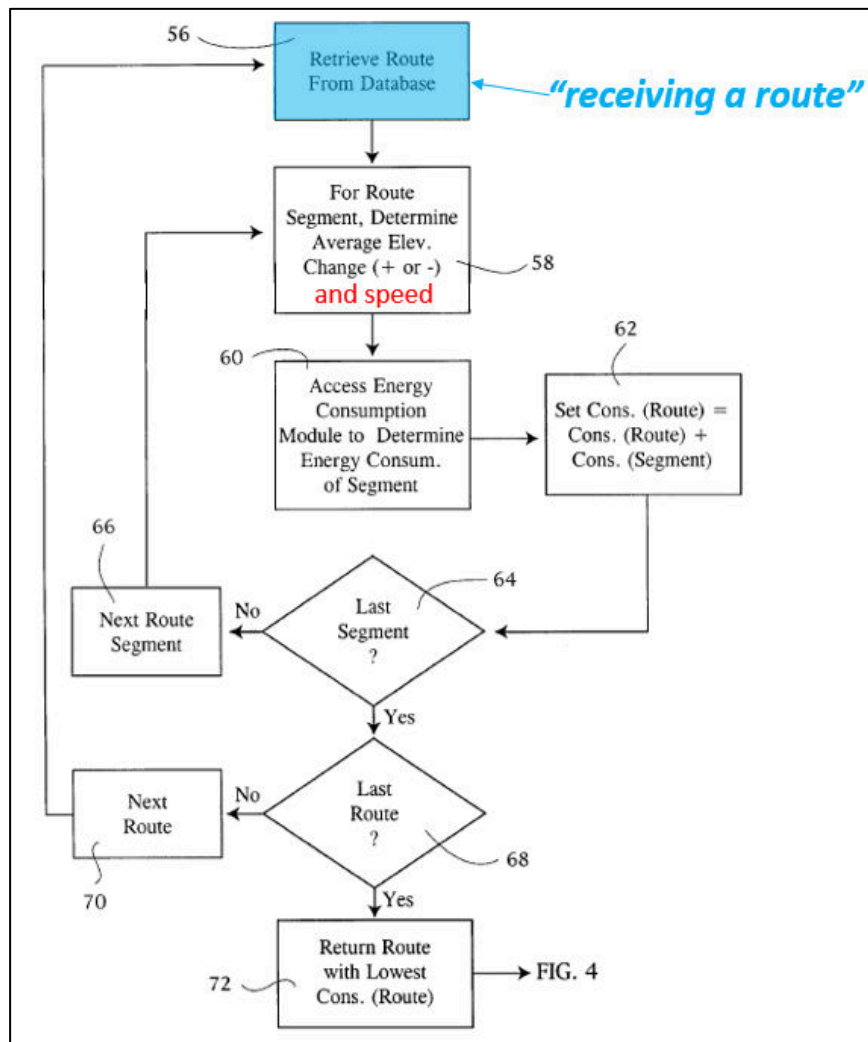
[1a]

Schramm's "computer 14" [red, *infra*] is "onboard the vehicle 12," *e.g.*, a *computer of the vehicle*. TESLA-1009, 3:42-43; *see* Abstract, claims 1, 9, 17; TESLA-1003, ¶¶239-240.



Schramm, FIG. 1 (annotated)

The onboard computer, which includes “routing module 42 and energy consumption module 44 (*the computer of the vehicle*)”, identifies “an energy-optimum route” based on Schramm-Clapper’s iterative calculation process. TESLA-1009, Abstract, 4:22-25, 5:1-6:32, FIG. 3; §III.C.3; TESLA-1003, ¶241. As part of this process, the routing module *receives a route*, e.g., “retrieves from the database” “possible route” between the origination point ‘A’ and the destination point ‘B’” (block 56 *infra*). TESLA-1009, 5:21-32, 2:14-17, 2:55-59, 3:5-7, 4:22-27, claims 1, 9, 17; TESLA-1003, ¶¶241-243.



Schramm-Clapper composite figure based on Schramm, FIG. 3

[1b]

In Schramm-Clapper, “each route includes one or more segments, and the computer determines an energy consumption for each segment.” TESLA-1009, 2:33-35, 5:32-33, claims 1, 9, 17, FIG. 3. Each segment’s “end point” corresponds to a **segment destination** (e.g., destination/endpoint of a segment). TESLA-1009, 7:33; TESLA-1003, ¶¶244-245. Schramm’s logic regards “each route...as a series

of contiguous segments,” thereby *segmenting the route into a plurality of segment destinations* because it divides the route into segments, each ending at a corresponding segment destination. TESLA-1009, 5:32-33; TESLA-1003, ¶¶246-247. A segment extends between a pair of segment destinations: the end of the segment and that of the immediately previous segment. TESLA-1003, ¶¶247-248.

[1c]

Entries in Schramm’s energy consumption table correspond to energy values

In Schramm-Clapper, entries in the FIG. 6 energy consumption table (*infra*) correspond to *energy values consumed by said vehicle to travel said route*.

TESLA-1003, ¶¶249-250. This table includes “energy consumption value[s]” for travel along segments having various average elevation changes (as represented by the table rows) and at various speeds (as represented by the table columns).

TESLA-1009, 5:56-6:6, claim 7; TESLA-1003, ¶250.

		Δ Elev. Factors, For Speech =			
Segment Δ Elev. (Aug.)		<i>"plurality of variations in a target speed"</i>			
		1	2	3	
-x		.8	.8	1	.
.		.	.	.	.
.		.	.	.	.
.		.	.	.	.
(base energy consumption) 0		1	1.01	.	.
1		1.01	1.02	.	.
2		1.02	1.03	.	.
.		.	.	.	.
.		.	.	.	.
.		.	.	.	.
+x		n	m	k	.

"energy values"

Schramm, FIG. 6 (annotated)

Each table entry (examples in pink above) thus represents the energy consumption value for travel along a segment with a particular elevation change at a particular speed, *e.g.*, ***a plurality of energy values consumed by the vehicle.***

TESLA-1003, ¶251.

Each energy consumption value corresponds to an ***energy value consumed by the vehicle to travel*** between a pair of segment destinations, *e.g.*, along a segment. *See* TESLA-1009, 2:33-35, 5:32-33, claim 1; *see* [1b]; TESLA-1003, ¶252. Each segment has a corresponding “average elevation change.” TESLA-

1009, 5:56-59. When the vehicle traverses a segment having a given elevational change (*e.g., travels between a pair of segment destinations*) at a given speed, the energy consumption value for that elevation-speed combination corresponds to *an energy value consumed by the vehicle to travel* between that pair of segment destinations. TESLA-1003, ¶252.

In Schramm-Clapper, each segment's set speed, *e.g.,* per Clapper's database, corresponds to *a target speed* between the *pair of segment destinations* defining that segment. *See* TESLA-1006, 2:52-57, 3:13-23; *see* 1:50-67, 2:37-44; TESLA-1003, ¶253. The set speed may vary between segments of the route, *e.g.,* prompted by different speed limits or past user speeds for the segments, and thus correspond to *variations in the target speed*. TESLA-1003, ¶254.

The energy values are *based on a plurality of variations in a target speed* because they are for transit along segments at various speeds. *See* TESLA-1009, 5:62-64 (the table headings represent desired vehicle speed along the route segment), 5:65-6:2 (“selecting...the energy consumption value in...the column corresponding to the speed that was input”), 5:47-49, 6:3-6; TESLA-1003, ¶255.

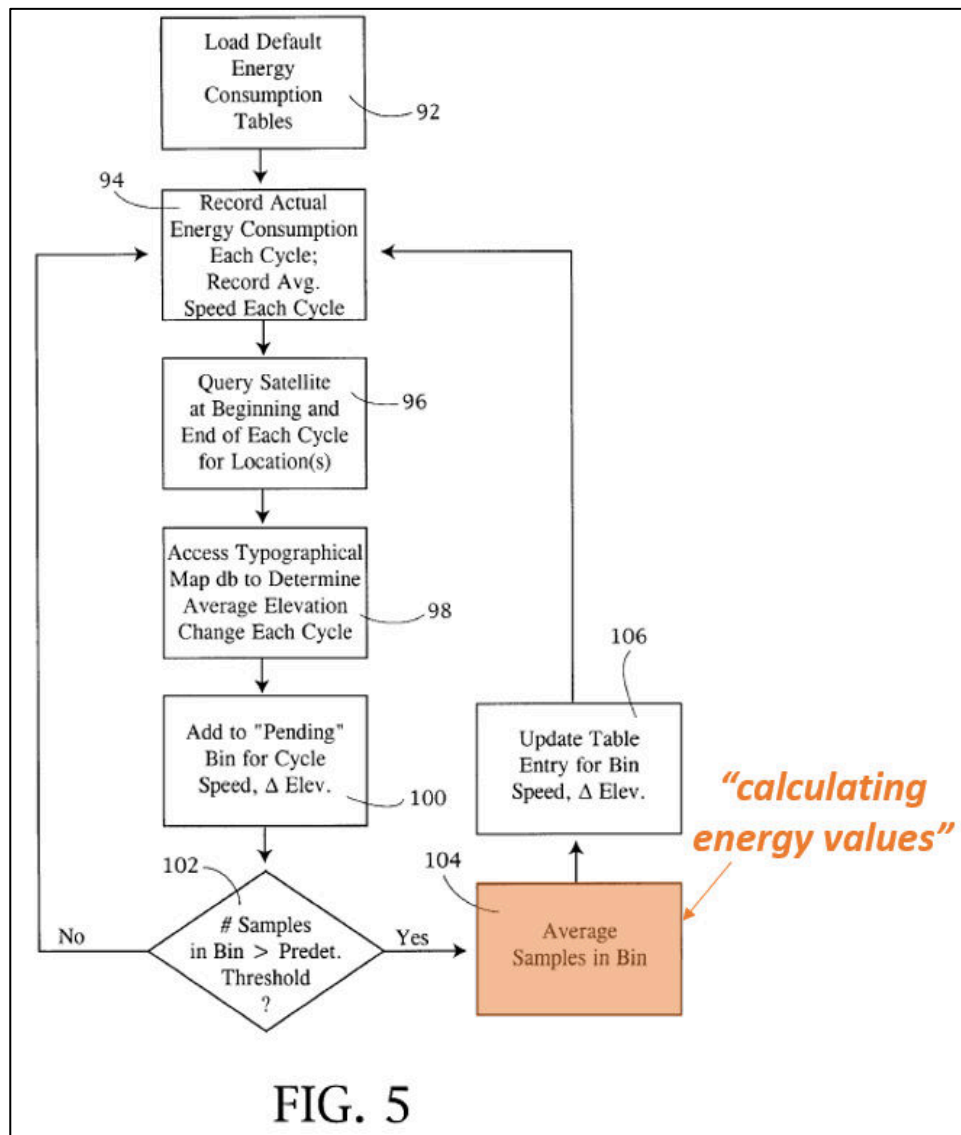
The table's energy values thus correspond to *energy values consumed by said vehicle to travel said route based on a plurality of variations in a target speed of said vehicle between pairs of said segment destinations* because they are applicable to travel along route segments (*between pairs of segment destinations*)

with different set speeds (*variations in a target speed*). TESLA-1003, ¶¶256-257 (providing an illustrative example).

Calculating energy values in the combination

In Schramm-Clapper, the table entries (*energy values*) are “updated as the energy consumption module 44 ‘learns’ about the actual energy consumption of the particular vehicle” *e.g.*, *calculating the energy values*. TESLA-1009, 6:8-10, 2:38-41 (each segment’s energy consumption is “provided by an energy consumption source such as a table” that is “updated based on” the vehicle’s operation”), Abstract, claims 7-8, 7:13-38, FIG. 5; TESLA-1003, ¶258.

Specifically, this table is initially populated with “default energy consumption unit values.” TESLA-1009, 7:17-19. During vehicle operation, the actual energy consumption, “along with the” average vehicle speed, “is recorded each cycle,” along with “the elevation characteristics of the” traveled segment. *Id.*, 7:23-39; *see* blocks 94-98 of FIG. 5, *infra*. These data are “added to a pending bin that represents actual energy consumption for the particular speed and elevational change.” *Id.*, 7:40-43; *see* block 100; TESLA-1003, ¶259.



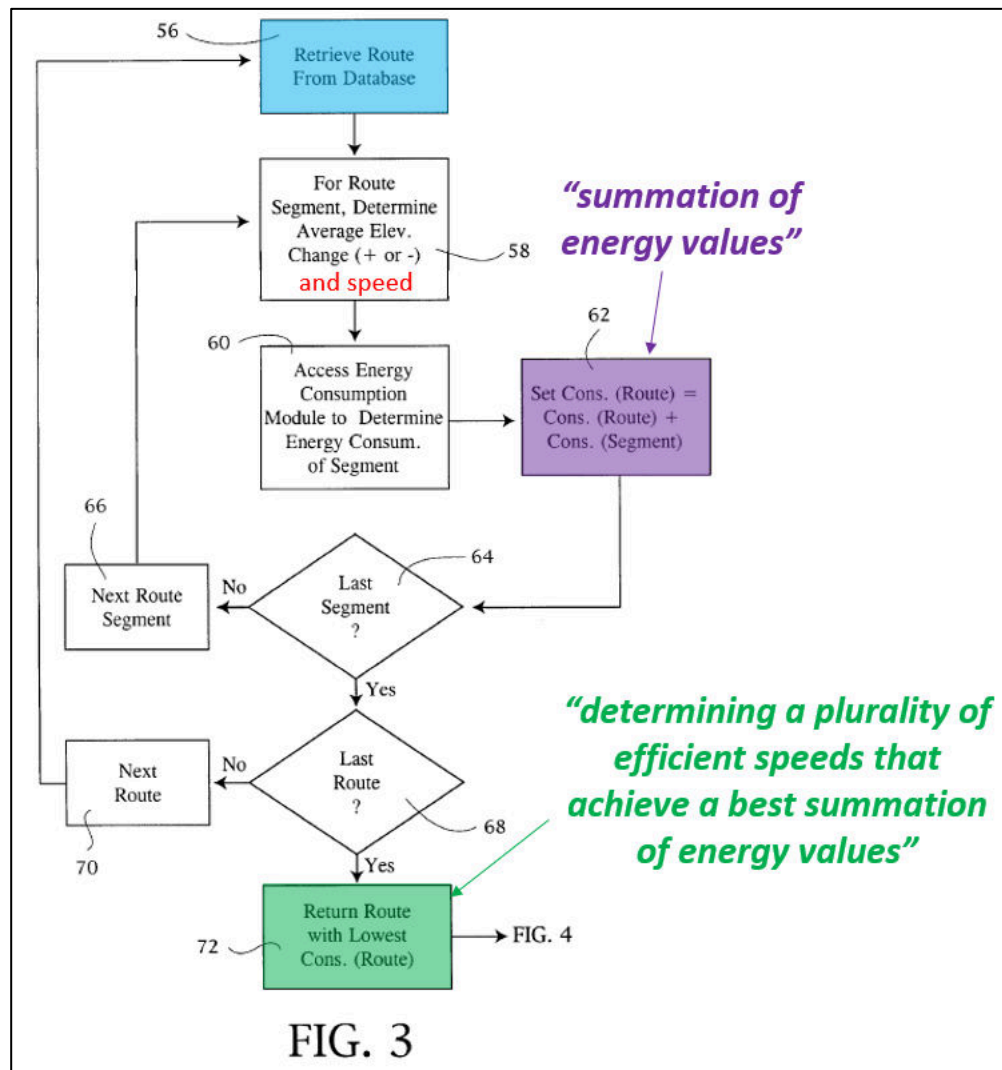
Schramm, FIG. 6 (annotated)

“[T]he actual energy consumption values for the samples in the bin are averaged” (block 104) and the value in the table for that elevation-speed combination is replaced with the new average value (block 106). TESLA-1009, 7:44-50. Averaging the energy consumption value samples in the pending bins for various speed-elevation combinations (block 104, orange) corresponds to

calculating (e.g., mathematically determining) *the energy values*. TESLA-1003, ¶260.

[1d]

Schramm-Clapper's iterative addition process is performed to identify the route with "the lowest overall energy consumption," e.g., lowest summation of per-segment energy consumption values. TESLA-1009, Abstract, 6:30-31; TESLA-1003, ¶¶261-262. Determining an energy-optimum route, illustrated *infra*, corresponds to *determining a plurality of efficient speeds that achieve a best summation of said energy values*. TESLA-1003, ¶262.



Schramm-Clapper composite figure based on Schramm, FIG. 3

Efficient speeds that achieve a best summation of energy values

In Schramm-Clapper, the set speeds for the energy-optimum route’s segments correspond to *a plurality of efficient speeds*. TESLA-1003, ¶¶263-270.

For each segment of a possible route, “the average elevation change” is retrieved, per Schramm. TESLA-1009, 5:41-45; *see* block 58 *supra*, claim 1;

TESLA-1003, ¶264. Additionally, Schramm-Clapper's system retrieves, e.g., from a database, each segment's speed, e.g., "the speed that the driver used previously" on that segment or the "speed limit" of that segment, per Clapper. TESLA-1006, 1:53-55, 3:18-20; *see* 2:12-14, 2:37-38, 3:13-20, 1:61-64; block 58 *supra*; TESLA-1009, 5:14-20; TESLA-1003, ¶265.

Using the per-segment elevation and speed, "the logic accesses the energy consumption module...to determine the energy consumption value...for the vehicle 12 to traverse the route segment under test at the speed." TESLA-1009, 5:45-49; TESLA-1003, ¶266. For instance, Schramm's FIG. 6 table is accessed to retrieve "the energy consumption value" corresponding to "the average elevation change" and "speed" retrieved for that segment. TESLA-1009, 5:66-6:2; *see* block 60 of the composite figure *supra*, 2:33-35 ("computer determines an energy consumption for each segment" of the route), claim 1, 5:53-6:2; TESLA-1003, ¶266.

The computer "adds the energy consumption values" (*energy values*; *see* [1c]) "of the segments of [the] route to determine" the route's energy consumption. TESLA-1009, 2:35-37. Specifically, for each segment, "the logic of the routing module 42 sets a variable 'consumption_{route}' (initialized at zero) to be equal to 'consumption_{route}' plus the energy consumption ('consumption_{segment}') determined at block 60." TESLA-1009, 6:11-15; *see* block 62 (purple in the composite figure *supra*), claims 1, 9, 17; TESLA-1003, ¶267. The retrieval and summation of

energy consumption values is repeated for each segment of the possible route. *See id.*, 6:17-23, blocks 64-66. The resulting “energy consumption of the route,” *e.g.*, the value of “consumption_{route},” as calculated by summing the energy consumption values (***energy values***) for all segments of a given route, corresponds to ***a summation of the energy values*** for that route’s segments. TESLA-1009, 2:35-37, 6:11-15; TESLA-1003, ¶267.

This process of determining energy consumption for a possible route is repeated “for each route” under consideration. TESLA-1009, 6:18-29, blocks 68-70. Once the total energy consumption (***summation of the energy values***) has been calculated for each route, “the logic returns the route with the lowest overall energy consumption.” TESLA-1009, 6:29-30; *see* block 72 (green in the composite figure *supra*); TESLA-1003, ¶268. The identification of “the route with the lowest overall energy consumption” corresponds to ***determining*** a route ***that achieves a best summation of the energy values***, *e.g.*, a route that has the lowest value of the “consumption_{route}” summation, indicating that it is the “energy-optimum route” from among the evaluated routes. TESLA-1009, Abstract, 6:29-31; *see* 2:19-21, 4:25-28, Abstract, 2:60-63, 3:10-12, claims 1, 9, 17; TESLA-1003, ¶269.

The identified energy-optimum route is composed of “a series of contiguous route segments.” TESLA-1009, 5:33-35; *see* [1b]; TESLA-1003, ¶270. Per

Clapper, each route segment has a corresponding speed, *e.g.*, “the speed that the driver used previously” on that segment or the “speed limit” of that segment; indeed, these are the speeds that were used to retrieve the energy values for the segments of the route, as discussed *supra*. TESLA-1006, 1:53-55, 3:13-23; *see* 1:50-67, 2:37-44, 2:52-57. The segment speeds of the identified energy-optimum route correspond to *a plurality of efficient speeds* because they are the segment speeds of the identified energy-optimum (*e.g.*, efficient) route produce the “lowest overall energy consumption” (*e.g.*, *best summation* of energy values) for a route between origin and destination, as discussed *supra*. TESLA-1009, 6:29-31; TESLA-1003, ¶270.

Determining the energy-optimum route in the combination corresponds to determining a plurality of efficient speeds

In Schramm-Clapper, these efficient speeds are *determined* as part of the energy-optimum route identification process. TESLA-1003, ¶271. Specifically, as described in the preceding section, determining the energy-optimum route that achieves the best summation of energy values encompasses determining (*e.g.*, identifying) the segments that constitute that energy-optimum route. TESLA-1009, 5:33-35; TESLA-1003, ¶271. Per Clapper, each segment has a corresponding speed, *e.g.*, “the speed that the driver used previously” on that segment or the “speed limit” of that segment. TESLA-1006, 1:50-67, 3:13-23,

2:37-57; TESLA-1003, ¶271. Thus, when a possible route (and its associated segments) is retrieved for evaluation, the speeds for that route's segments are also retrieved, *e.g.*, to enable lookup of the respective energy values, *e.g.*, via Schramm's FIG. 6 table. *See* TESLA-1009, 5:41-48; TESLA-1003, ¶271. And determining the energy-optimum route is based on the route having the best summation of energy values (*e.g.*, the energy values in a table such as that of Schramm's FIG. 6, as discussed in the preceding section) that corresponds to the speeds determined for that route's segments (***determining a plurality of efficient speeds***). This is because identifying the energy-optimum route determines (*e.g.*, specifies) the segments and thus their corresponding speeds (*e.g.*, "the speed that the driver used previously" on each segment or the "speed limit" of each segment). TESLA-1006, 1:50-67, 3:13-23; *see* 2:37-44, 2:52-57; TESLA-1003, ¶271.

Controlling vehicle speed using automatic cruise control corresponds to determining the efficient speeds

Alternatively/additionally, the above-described efficient speeds are ***determined*** as the vehicle drives the segments of the identified energy-optimum route, *e.g.*, using "automatic cruise control," per Clapper. TESLA-1006, 1:54-64; TESLA-1003, ¶272. Per Clapper, as the vehicle traverses the segments of the identified energy-optimum route, the current vehicle position is determined and the "automatic cruise control" "set[s] the vehicle's speed" to the current segment's set

speed, *e.g.*, which can be a previously-driven speed or the speed limit at that location/segment. TESLA-1006, 1:43-56, 3:18-20; TESLA-1003, ¶272.

In Schramm-Clapper, the set speeds for the route's segments correspond to the speeds for the segments of the identified energy-optimum route, *e.g.*, ***plurality of efficient speeds***. That is, the automatic cruise control controls vehicle operation such that it traverses energy-optimum route at the set speeds for the segments of this route (***efficient speeds***). TESLA-1003, ¶272. A POSITA would have understood the automatic cruise control to ***determine*** the efficient speeds for the identified route's segments (*e.g.*, by accessing "entries in a user database" or a "speed limit database") and control the vehicle to travel at those efficient speeds. TESLA-1003, ¶272; TESLA-1006, 2:52-55, 3:18-20.

Displaying speeds as the vehicle traverses the energy-optimum route corresponds to determining the efficient speeds

Alternatively/additionally, the efficient speeds (*e.g.*, the speeds for the segments of the energy-optimum route) are ***determined*** as the vehicle drives the segments of this route such that these speeds can be displayed to the driver. *See* TESLA-1006, 3:37-45; FIG. 4, *infra*; TESLA-1003, ¶273. As discussed further in [1e], *infra*, as the vehicle travels the identified energy-optimum route, an in-vehicle display displays "information about speeds used at given locations in the past" and/or a "speed limit" that corresponds to each current segment along which the

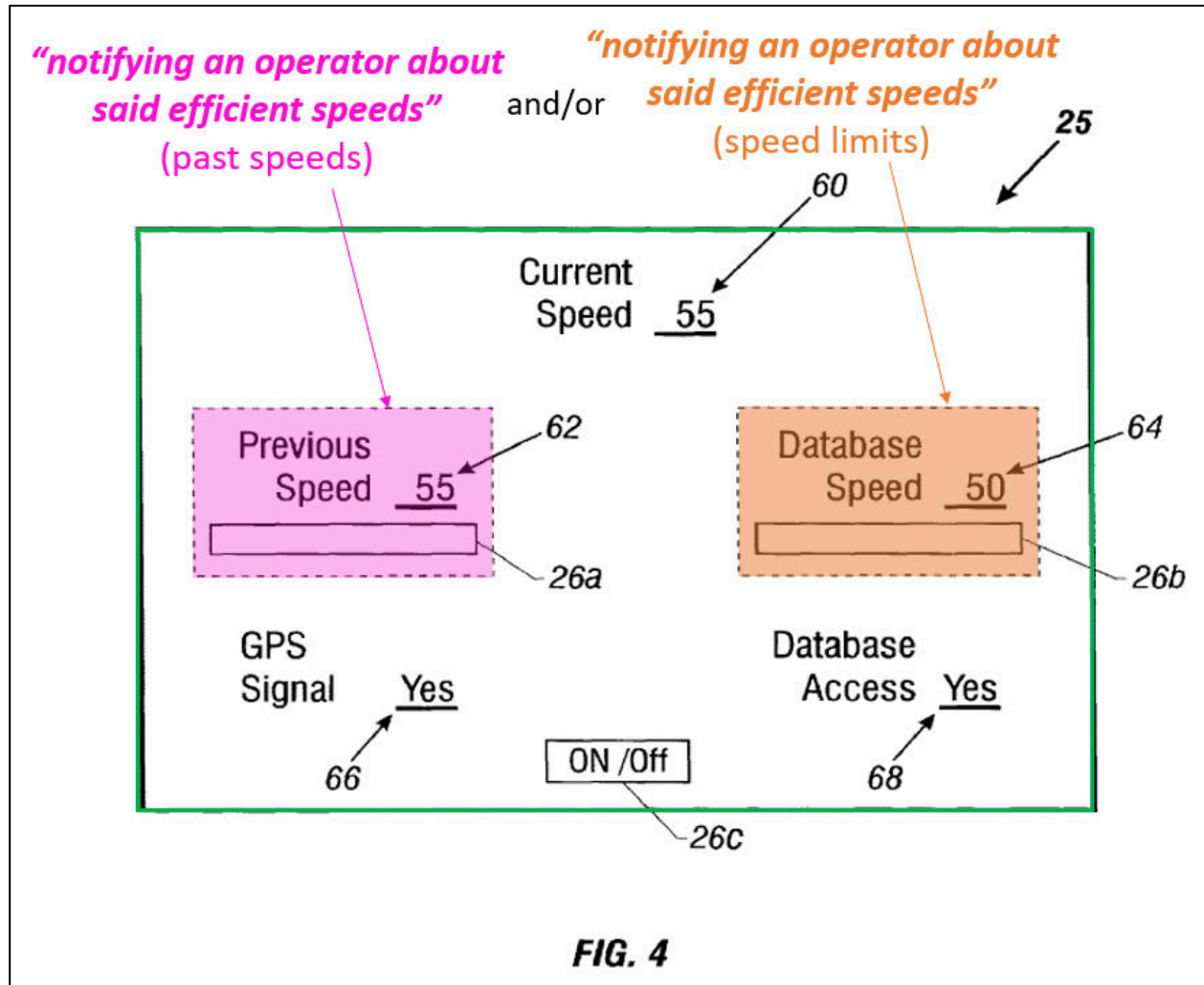
vehicle is travelling. TESLA-1006, 1:50-55, 3:14-19; *see* 3:38-41; TESLA-1003, ¶273. These speeds, for the segments of the energy-optimum route, correspond to the ***plurality of efficient speeds***, as discussed *supra*. A POSITA would have understood these efficient speeds to be ***determined*** so that they can be displayed. TESLA-1003, ¶274. For instance, the efficient speeds can be ***determined*** by obtaining “[t]he speed from memory” or “[a] speed suggested from a database” for the segments. TESLA-1006, 3:38-40; TESLA-1003, ¶274.

[1e]

The speeds for the segments of the energy-optimum route (*see* [1d], *supra*), correspond to ***efficient speeds to travel between each of said segment destinations***, *e.g.*, because the efficient speed for a given segment (*e.g.*, set speed for that segment, such as speed from prior trips or speed limit) corresponds to the speed to travel between the segment destinations defining that segment. TESLA-1003, ¶¶275-276; TESLA-1006, 2:52-57, 3:13-23; *see* [1c], *supra*.

Per Clapper, a display displays speed information as the vehicle traverses the segments identified energy-optimum route, which corresponds to ***notifying an operator of said vehicle about said efficient speeds to travel between each of said segment destinations***, *e.g.*, between pairs of segment destinations defining the

segments. See [1c], *supra*; TESLA-1009, 2:33-35, 5:32-33, claim 1; TESLA-1006, 3:37-45; FIG. 4, *infra*; TESLA-1003, ¶277.



TESLA-1006, FIG. 4

Specifically, the display displays “[t]he speed from memory,” pink, corresponding to each current segment along which the vehicle travels and “[a] speed suggested from a database,” *e.g.*, a speed limit, for each current segment.

TESLA-1006, 3:14-41; TESLA-1003, ¶¶278-279. The previously-driven speeds and/or speed-limit-based speeds correspond to *the efficient speeds* for the segments of the identified route. *See* [1d], *supra*; TESLA-1006, 1:50-55, 3:14-41; TESLA-1003, ¶¶278-279. As the vehicle drives the identified route, these speeds for the route segments (*efficient speeds*) are displayed. *Id.*; TESLA-1003, ¶¶278-279.

As the vehicle transits the route from one segment having one stored speed (*e.g.*, speed that the driver used previously, or the speed limit) to another segment having a different stored speed, the displayed speed changes to reflect the stored speed (*efficient speed*) for the new current segment. TESLA-1006, 3:38-39; TESLA-1003, ¶280. Once the vehicle has transited the entire route, the speed for all segments have been displayed, *e.g.*, *efficient speeds* for all segments of the route are displayed. TESLA-1003, ¶280.

Displaying efficient speeds corresponds to *notifying the operator of the vehicle about the efficient speeds* because it provides information to (*notifies*) the vehicle operator. *See* TESLA-1006, 3:30-34; TESLA-1003, ¶281.

[3]

In the combination, determining the energy-optimum route (and hence *determining the efficient speeds*; *see* [1d], *supra*) is based on energy consumption

values in a table such as Schramm's FIG. 6. *See* TESLA-1009, 5:41-6:31; TESLA-1003, ¶¶282-283. These values—and thus *determining the efficient speeds*—are *based on (i) an aerodynamic drag of the vehicle, (ii) a rolling resistance of the vehicle and (iii) a change in potential energy of the vehicle due to a road gradient*, as discussed here. TESLA-1003, ¶¶283-287.

Values in the energy consumption table are calculated by averaging measured “actual energy consumption of the vehicle,” (*see* [1c], *supra*), which is determined by “access[ing] the fuel gauge, battery discharge meter, or other fuel consumption instrument.” *Id.*, 7:23-28. The “actual energy consumption” thus indicates the energy (*e.g.*, fuel) consumed by the vehicle. *Id.*, 7:23-28; TESLA-1003, ¶284.

As Dr. Papanikolopoulos explains, the energy consumption values are determined based on actual vehicle energy consumption, which is affected by characteristics, *e.g.*, aerodynamic drag and the rolling resistance of the vehicle (based on *(i) aerodynamic drag and (ii) rolling resistance of the vehicle*). TESLA-1003, ¶285, citing TESLA-1007, 2; TESLA-1005, [0053]-[0059]; TESLA-1009, 7:17-50, FIG. 5.

Additionally, energy consumption values are determined based on actual vehicle energy consumption, which is affected by road gradient, as reflected by Schramm's categorization of energy consumption values based on road gradient.

See TESLA-1009, 5:41-6:2, FIG. 6; TESLA-1003, ¶286. As Dr.

Papanikolopoulos, a POSITA would have understood that a vehicle transiting a road gradient experiences a change in potential energy. TESLA-1003, ¶286, citing TESLA-1007, 2; TESLA-1005, [0053]-[0059]. Thus, the energy consumption values are determined based on *change in potential energy of the vehicle due to a road gradient*. See TESLA-1009, 7:17-50, FIG. 5; TESLA-1003, ¶286.

Determining the energy-optimum route (*determining the efficient speeds*) is based on energy consumption values and thus *is based on (i) aerodynamic drag, (ii) rolling resistance, and (iii) change in potential energy of the vehicle due to a road gradient*. TESLA-1003, ¶287.

[6]

In Schramm-Clapper, the vehicle's "actual energy consumption" and "average speed" are "recorded each cycle" along with "elevational change of the segment." TESLA-1009, 7:23-30; see block 94 of FIG. 5. This is achieved by determining "the start point and end point of the segment," *e.g.*, determining *a current location of the vehicle*, and correlating that location "with the appropriate segment stored in the database." *Id.*, 7:30-39; see blocks 96-98 of FIG. 5. Based on elevation characteristics (and thus based on the *current location of the vehicle*) and speed, the recorded vehicle energy consumption sample "is added to a pending

bin” for that elevation-speed combination, and averaged to determine an “energy consumption value” to populate the table of Schramm’s FIG. 6. *Id.*, 7:40-50; *see* blocks 100-106 of FIG. 5; TESLA-1003, ¶¶288-291. That is, averaging the energy consumption value samples (*calculating the energy values*; *see* [1c]) is based on assigning energy consumption value samples to pending bins, which is ***based on a current location of said vehicle***. TESLA-1003, ¶291.

Moreover, per Schramm, ***the current location of the vehicle is determined by GPS information*** received, e.g., using a GPS transceiver that obtains a segment’s start and end point. TESLA-1009, 7:30-33; *see* Abstract, 3:47-48; TESLA-1003, ¶292.

[7]

In Schramm-Clapper, averaging energy consumption value samples in pending bins corresponds to ***calculating the energy values***. *See*[1c], *supra*; TESLA-1009, 7:44-50, FIG. 5; TESLA-1003, ¶¶293-294. The energy consumption value samples used in the averaging are assigned to their respective pending bins based on “the average speed of the vehicle” when each sample was recorded, e.g., calculating the energy values is based on vehicle speed. TESLA-1009, 7:23-25; *see* 7:40-43; *see* [6]; TESLA-1003, ¶¶293-294.

A POSITA would have understood that the “average speed of a vehicle” as it transits a segment is, at least in some cases, ***based on a speed limit*** of that segment. TESLA-1009, 7:23-25; TESLA-1003, ¶295. For instance, when the vehicle speed is controlled by an automatic cruise control based on Clapper, the automatic cruise control can set “the speed for a given location” (e.g., the current segment) found in the speed limit database.” TESLA-1006, 3:15-19; TESLA-1003, ¶295.

Alternatively/additionally, if the driver is controlling vehicle speed, a POSITA would have found it reasonable for the driver to select speed based on the speed limit. TESLA-1003, ¶295.

The speed limit of a segment corresponds to a speed limit between a pair of segment destinations. TESLA-1003, ¶296; *see* [1c], *supra*; TESLA-1009, 2:33-35, 5:32-33, claim 1.

Averaging the energy consumption value samples (***calculating the energy values***; *see* [1c]) is based on assigning energy consumption value samples to pending bins. *See* [6], *supra*; TESLA-1009, 7:40-42, FIG. 5; TESLA-1003, ¶297. This assignment to pending bins is based on vehicle speed when each sample was collected (*see* TESLA-1009, 7:23-30), which in turn is based on the segment’s speed limit, as discussed in the preceding paragraphs. TESLA-1003, ¶297. Thus, averaging the energy consumption value samples (***calculating of the energy***

values) is based on speed limits between pairs of segment destinations. TESLA-1003, ¶297.

[8]

As discussed in [1c], *supra*, in Schramm-Clapper, the segment's set speed, corresponds to *a target speed*. TESLA-1006, 1:53-56; *see* 2:52-57; TESLA-1003, ¶¶298-299. Notably, Clapper describes that a user may “override[]” the set speed “by accelerating beyond the proposed speed or by decelerating below it,” and this new, override speed is recorded to “thereafter be used as the speed for a given location at a given time,” *e.g.*, the *target speed* is set based on the driver accelerating/decelerating relative to the proposed speed. TESLA-1006, 2:61-66; *see* 3:19-22, 2:38-41; TESLA-1003, ¶299. A POSITA would have understood that the driver accelerating/decelerating relative to the proposed speed—which informs the setting of the target speed—is conventionally achieved by the driver's interaction with the gas pedal (which affects the position of the gas pedal). TESLA-1003, ¶299. In this manner, the target speed is set *in response to a position of the gas pedal*. TESLA-1003, ¶299. Moreover, a POSITA would have understood that the target speed is *calculated* in response to a position of the gas pedal because based on the driver's acceleration/deceleration relative to the

proposed speed, a new numerical value for the actual vehicle speed is determined.

TESLA-1003, ¶299; *see* TESLA-1015, 3; TESLA-1016, 3; TESLA-1017, 3.

[9]

In Schramm-Clapper, an “automatic cruise control,” is used “to automatically control” vehicle speed “based on the vehicle’s current position” along the energy-optimum route. TESLA-1006, 1:42-44; *see* §III.C.3, *supra*; TESLA-1003, ¶¶300-301. Specifically, as the vehicle traverses the segments of the identified energy-optimum route, “[t]he vehicle’s current position [is] determined,” *e.g.*, by GPS, and “the automatic cruise control [] set[s] the vehicle’s speed” for the segments based on “a previously-driven speed or speed limit for those segments/locations (*the efficient speeds*; *see* [1d]). TESLA-1006, 1:43-55, 2:52-60, 3:13-20; *see* [1d]; TESLA-1003, ¶301.

A POSITA would have understood, or found it obvious, for the Schramm-Clapper vehicle to have *an automatic transmission* and for the cruise control to shift its gears, as discussed *supra* for [9] of Ground 1A. *See* TESLA-1009, 3:57-63; TESLA-1003, ¶¶149-150, 302; citing TESLA-1012, 1:6-7; TESLA-1013, 2:35-45; TESLA-1018, [0004]. Furthermore, a POSITA would have found it obvious for the cruise control to *shift gears* of the automatic transmission given that this is standard functionality.

Moreover, given widespread adoption and advantages of cruise control systems that shift gears of automatic transmissions, as also discussed *supra* for [9] of Ground 1A, a POSITA would have understood that Schramm-Clapper's automatic cruise control *shifts gears of the automatic transmission* to control the vehicle to travel at the efficient speed for each current segment of its travel along the identified energy-optimum route, *e.g.*, shifts gears *based on the efficient speeds*. TESLA-1003, ¶¶149-151, 303-304, citing TESLA-1012, 1:6-7, 6:27-35, TESLA-1018, [0003]-[0004], TESLA-1013, 2:35-45.

[10pre]-[10d]

See [1pre]-[1d]; TESLA-1003, ¶305.

[10e]

A POSITA would have understood the Schramm-Clapper vehicle to have *an engine*, based on Schramm's disclosure that the vehicle is fueled by gasoline. *See* TESLA-1009, 1:57-63; TESLA-1003, ¶¶306-307.

Per Clapper, an “automatic cruise control” “automatically control[s] the speed of [the] vehicle based on the vehicle's current position” along the identified route. TESLA-1006, 1:42-53; *see* 2:52-60, 3:13-20; TESLA-1003, ¶308. As described for [9] and [1c]-[1d], the cruise control controls vehicle operation such that it traverses segments of the route (*travel between each of said segment*

destinations; see [1c]; TESLA-1009, 2:33-35, 5:32-33, claim 1) at the previously-used speeds or speed limits for the segments (*the efficient speeds*; see [1d]).

TESLA-1006, 1:43-51, 2:52-60, 3:13-20; see [1d]; TESLA-1003, ¶308.

Per Clapper, the cruise control controls vehicle speed via “[a] brake interface 23 and a carburetor interface 21.” TESLA-1006, 2:15-16; TESLA-1003, ¶309. A carburetor controls the air/fuel mixture entering an engine. See TESLA-1003, ¶309, citing TESLA-1014, Abstract. Given this conventional functionality, a POSITA would have understood that controlling speed via a carburetor interface involves controlling the air/fuel mixture supplied to the engine such that the vehicle travels at the desired speed, *e.g.*, at *the efficient speed* for each route segment. TESLA-1003, ¶309. Indeed, this is a conventional way that cruise control systems operate. See TESLA-1003, ¶309, citing TESLA-1014, 2:39-50.

Moreover, controlling the carburetor interface to achieve travel at the efficient speeds corresponds to *applying power to the engine corresponding to the efficient speeds*. TESLA-1003, ¶310. Power is an amount of energy per unit time. Controlling the carburetor interface (and thus the air/fuel mixture flowing into the engine) corresponds to *applying power to the engine* because the fuel flow into the engine is application, to the engine, of an amount of energy over time. TESLA-1003, ¶310. Moreover, the applied power (*e.g.*, air/fuel flow) *corresponds to the*

efficient speeds because the flow is controlled to achieve the efficient speeds.

TESLA-1003, ¶310.

[12]-[13]

See [3], [1e]; TESLA-1003, ¶¶311-312.

[15]-[18]

See [6]-[9]; TESLA-1003, ¶¶313-316.

IV. PTAB DISCRETION SHOULD NOT PRECLUDE INSTITUTION

A. Discretionary denial under 35 U.S.C. §325(d) is not warranted

Discretionary denial under the Board's §325(d) *Advanced Bionics* analysis is not warranted. See *Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, 8-10 (PTAB Feb. 13, 2020) (precedential).

None of the references advanced herein was previously before the Office. See *generally* TESLA-1002.

If it is argued that the same or substantially the same art or arguments were previously presented to the Office, the second prong of *Advanced Bionics* is not met. See TESLA-1003, ¶¶30-316.

B. The *Fintiv* Factors favor institution and no denial under 35 U.S.C. §314(a)

Consistent with Congressional intent, *Fintiv*'s goals, and Director Vidal's interim guidance (TESLA-1050), Tesla asks the Board to consider the challenges raised herein. IPR2020-00019, Paper 11, at 6 (PTAB Mar. 20, 2020) ("*Fintiv*") (precedential). As explained below, a holistic analysis of the *Fintiv* factors favors institution.⁵

1. Factor 1: Institution will enable a stay

Factor 1 is neutral because neither Tesla nor iQar have requested a stay in co-pending litigation in the Western District of Texas (*iQar Inc. v. Tesla, Inc.*, 1-23-cv-00694, (W.D. Tex.)(*"WDTX Litigation"*). Moreover, the Board does "not attempt to predict" how an appeals or district court might adjudicate a future motion to stay. *Fintiv*, 12; IPR2019-01393, Pap. 24, at 7 (PTAB June 16, 2020) ("*Sand Revolution*") (informative); IPR2020-01019, Pap. 12, at 14 (PTAB Dec. 1, 2020) ("*Sotera*") (precedential). Should Tesla file an IPR petition against another of

⁵ Apart from Tesla's showing that *Fintiv* favors institution, the *Fintiv* framework is legally invalid and should not be followed. The framework (1) exceeds the Director's authority, (2) is arbitrary and capricious, and (3) was adopted without notice-and-comment rulemaking.

the patents involved in the WDTX Litigation, this Factor is subject to change to favor institution.

2. Factor 2: Uncertain district court schedule

Factor 2 favors institution because no trial date is set in the WDTX Litigation, and regardless, any scheduled trial date is speculative because “scheduled trial dates are unreliable and often change.” TESLA-1050, 8. As of the filing of this petition, the WDTX Litigation is still conducting venue discovery and the parties have agreed to stay all merits-based fact discovery until transfer is decided. Further, the median time-to-trial for WDTX is currently 26 months,⁶ which suggests a likely trial date no sooner than March 2026, and the pending Motion to Transfer Venue (TESLA-1052), if granted, may extend the trial date further. In contrast, if this proceeding is instituted, the Board will likely issue its Final Written Decision around July 2025.

3. Factor 3: Early stage of parallel proceedings

This petition is being filed at an early stage of the WDTX Litigation, which “has weighed against exercising the authority to deny institution[.]” IPR2020-00156, Paper 10, 9 & n.8 (June 15, 2020)(“Seven”), 11-12 (quoting *Fintiv*, 11).

⁶ Over the past year, according to Docket Navigator.

The District Court has yet to expend significant resources, and indeed, a Motion to Transfer Venue is still pending (TESLA-1052). *Seven*, 10-13; IPR2020-01019, *Sotera*, 14, 16-17; IPR2020-00820, Paper 15, 11-13 (Oct. 21, 2020)(“*Snap*”)(precedential). By contrast, Tesla has diligently filed this petition roughly four-to-five months ahead of the one-year time bar, while the WDTX Litigation remains in its early stages.

4. Factor 4: Petition raises unique issues

The WDTX Litigation is still in its infancy, with no due date for initial invalidity contentions. Thus, at present, there is no overlap of issues between the WDTX Litigation and any IPR resulting from this petition. Such a lack of overlap “has tended to weigh against exercising discretion to deny institution.” *Fintiv*, 12-14. iQar also hasn’t identified allegedly infringing claims in the district court, while this petition addresses all claims.

5. Factor 5: Tesla’s involvement in the WDTX Litigation

Tesla’s status as a defendant in the WDTX Litigation is at worst neutral under Factor 5. Indeed, *Fintiv* “says nothing about situations in which the petitioner is the same as, or is related to, the district court defendant.” IPR2020-00122, Paper 15, at 10 (Crumbley, dissenting); *Fintiv*, 13-14. At worst, where the parties are the same, Factor 5 is neutral. *Id.*

6. Factor 6: Other considerations support institution

No party has previously challenged the '161 Patent in a PTAB post-issuance proceeding. Further, the Board has not previously considered this petition's grounds or substantively similar grounds. Director Vidal has also explained that "the PTAB will not deny institution...under *Fintiv*...when a petition presents compelling evidence of unpatentability..." TESLA-1050, 3-5, 9; *see Fintiv*, 14-15.

This Petition's merits are compelling. As demonstrated herein and with reference to expert testimony and additional evidence, institution would result in a finding of unpatentability of the Challenged Claims, which are obvious based on prior art references that materially differ from those considered during prosecution, and render obvious features relied upon by the Examiner in allowing the '161 Patent. *See generally* TESLA-1003; TESLA-1002, 9-15.

Even if the WDTX Litigation may be relevant, the strength of the merits alone outweigh any inefficiencies borne of parallel litigation. TESLA-1050, 3-5, 9; *Fintiv*, 14-15. Accordingly, Factor 6 favors institution.

V. CONCLUSION AND FEES

The Challenged Claims are unpatentable. Petitioner authorizes charge of fees to Deposit Account 06-1050.

VI. MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Tesla, Inc. is the petitioner and real party-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

The '161 Patent is the subject of a civil action, *iQar Inc. v. Tesla, Inc.*, 1:23-cv-00694, W.D. Tex., filed June 20, 2023 (TESLA-1010).

Petitioner is not aware of any other disclaimers, reexamination certificates, or IPR petitions addressing the '161 Patent.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

Please address all correspondence and service to the address listed above.

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Respectfully submitted,

Dated: February 6, 2024

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,981 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated: February 6, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on February 6, 2024, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided by Federal Express, to the Patent Owner, by serving the correspondence address of record as follows:

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