IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Langlotz	Attorney Docket No. 49649-0062IP1
U.S. Patent No.:	12,240,458	
Issue Date:	March 4, 2025	
Appl. Serial No.:	18/928,137	
Filing Date:	October 27, 2024	
Title:	VEHICLE GEAR SELECTION CONTROL	

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PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT NO. 12,240,458 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42

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LISTING OF CHALLENGED CLAIMS

Claim 1	
1[p]	A motor vehicle comprising:
1[a]	a frame having wheels;
1[b]	a motor connected to the frame;
1[c]	a steering control connected to the wheels to establish a steering angle;
1[d]	a drive system operably connected to the steering control, to the motor, and to the wheels;
1[e]	the drive system operable to selectably drive the wheels in a forward direction in a drive mode and in a rearward direction in a reverse mode; and
1[f]	the drive system operable to select a direction for driving the wheels in response to steering angle movements, without operator indication of a direction.
Claim 2	
2	The motor vehicle of claim 1 including a brake control operable by a driver to generate a brake input, and wherein the drive system is operably connected to the brake control to receive the brake input, and wherein an approval indication includes actuation of the brake control.
Claim 3	
3	The motor vehicle of claim 2 wherein the drive system includes an accelerator pedal operable to slow the vehicle in response to release of the accelerator pedal, and wherein operation of the brake control for the approval indication includes the driver's foot shifting from the accelerator pedal to tap the brake control.
Claim 4	
4	The motor vehicle of claim 1 wherein the drive system is operable to offer a driver a change in the drive direction only in response to detecting a steering input greater than a selected steering angle threshold.

Claim 5	
5	The motor vehicle of claim 1 wherein the drive system is operable to offer a driver a change in the drive direction only if a vehicle velocity is below a selected velocity threshold.
Claim 6	
6	The motor vehicle of claim 1 wherein the drive system is operable to change the drive direction only in response to a steering input indicating steering in a first direction, then indicating steering in the opposite direction.
Claim 7	
7	The motor vehicle of claim 1 wherein the drive system is operable to offer a driver a change in the drive direction based at least in part on distance traveled.
Claim 8	
8	The motor vehicle of claim 1 wherein the drive system is operable in response to an approval indication from a driver to change the drive direction without driver indication of a direction other than approval of an offered change in direction.
Claim 9	
9	The motor vehicle of claim 1 wherein the drive system is operable in response to an approval indication from a driver to change the drive direction without operation of a selector by the driver.
Claim 10	
10	The motor vehicle of claim 1 including a brake control operable by a driver to generate a brake input, and wherein the drive system is operably connected to the brake control to receive the brake input, and wherein the drive system is operable in response to driving a first direction with the steering angle in a first steering direction, then changing steering to an opposite second steering direction, to change drive direction in response to operation of the brake control by the driver.
Claim 11	

11[p]	A motor vehicle comprising:
11[a]	a frame having wheels;
11[b]	a motor connected to the frame;
11[c]	a steering control connected to the wheels to establish a steering angle;
11[d]	a controller operably connected to the steering control, to the motor, and to the wheels;
11[e]	the controller operable to selectably drive the wheels in a forward direction in a drive mode and in a rearward direction in a reverse mode; and
11[f]	the controller operable to select a direction for driving the wheels in response to steering angle movements, without operator indication of a direction.
Claim 12	
12	The motor vehicle of claim 11 including a brake control operable by driver to generate a brake input, and wherein the controller is operably connected to the brake control to receive the brake input, and wherein an approval indication includes actuation of the brake control.
Claim 13	
13	The motor vehicle of claim 12 wherein the controller includes an accelerator pedal operable to slow the vehicle in response to release of the accelerator pedal, and wherein operation of the brake control for the approval indication includes the driver's foot shifting from the accelerator pedal to tap the brake control.
Claim 14	
14	The motor vehicle of claim 11 wherein the controller is operable to offer a driver a change in the drive direction only in response to detecting a steering input greater than a selected steering angle threshold.
Claim 15	
15	The motor vehicle of claim 11 wherein the controller is operable to offer a driver a change in the drive direction only if a vehicle velocity

	is below a selected velocity threshold.
Claim 16	
16	The motor vehicle of claim 11 wherein the controller is operable to change the drive direction only in response to a steering input indicating steering in a first direction, then indicating steering in the opposite direction.
Claim 17	
17	The motor vehicle of claim 11 wherein the controller is operable to offer a driver a change in the drive direction based at least in part on distance traveled.
Claim 18	
18	The motor vehicle of claim 11 wherein the controller is operable in response to an approval indication from a driver to change the drive direction without driver indication of a direction other than approval of an offered change in direction.
Claim 19	
19	The motor vehicle of claim 11 wherein the controller is operable in response to an approval indication from a driver to change the drive direction without operation of a selector by the driver.
Claim 20	
20	The motor vehicle of claim 11 including a brake control operable by a driver to generate a brake input, and wherein the controller is operably connected to the brake control to receive the brake input, and wherein the controller is operable in response to driving a first direction with the steering angle in a first steering direction, then changing steering to an opposite second steering direction, to change drive direction in response to operation of the brake control by the driver.

Tesla, Inc. ("Petitioner" or "Tesla") petitions for *Inter Partes* Review ("IPR") of claims 1-20 ("the Challenged Claims") of U.S. Patent No. 12,240,458 ("the '458 Patent"). Compelling evidence presented in this Petition demonstrates at least a reasonable likelihood that Tesla will prevail with respect to at least one of the Challenged Claims.

I. REQUIREMENTS FOR IPR

A. Grounds for Standing

Petitioner certifies that the '458 Patent is available for IPR. This Petition is being filed within one year of service of a complaint against Tesla. *See* TESLA-1100. Tesla is not barred or estopped from requesting review of the Challenged Claims on the below-identified grounds.

B. Challenge and Relief Requested

Tesla requests IPR of the Challenged Claims on the grounds indicated below. Grounds 1A-3E are supported and corroborated by evidence cited throughout this Petition, including by the expert declaration of Dr. Jason Janet. TESLA-1003, ¶59.

Ground	Claim(s)	35 U.S.C. § 103
1A	1, 6, 11, 16	Joos
1B	2, 4-5, 7-10, 12, 14-15, 17-20	Joos in view of Kischkat

Ground	Claim(s)	35 U.S.C. § 103
1C	3, 13	Joos in view of Kischkat and Hoop
1D	5, 7, 15, 17	Joos in view of Kischkat and Allexi
2A	1, 6, 11, 16	Joos in view of Bettger
2B	2, 4-5, 7-10, 12, 14-15, 17-20	Joos in view of Bettger and Kischkat
2C	3, 13	Joos in view of Bettger, Kischkat, and Hoop
2D	5, 7, 15, 17	Joos in view of Bettger, Kischkat, and Allexi
3A	1, 6, 11, 16	Joos in view of Bayer
3B	2, 4-5, 7-10, 2, 14-15, 17-20	Joos in view of Bayer and Kischkat
3C	3, 13	Joos in view of Bayer, Kischkat, and Hoop
3D	4, 14	Joos in view of Bayer, Kischkat, and Bettger
3E	5, 7, 15, 17	Joos in view of Bayer, Kischkat, and Allexi

The earliest possible priority date of the '458 Patent is June 5, 2023 ("Critical Date"). Each of the references in Grounds 1A-3E pre-dates the Critical Date.

Reference	Filed	Published	AIA Prior Art Basis
Joos	1/19/2017	8/1/2019	§102(a)(1)-(2)
Kischkat	---	8/29/2012	§102(a)(1)

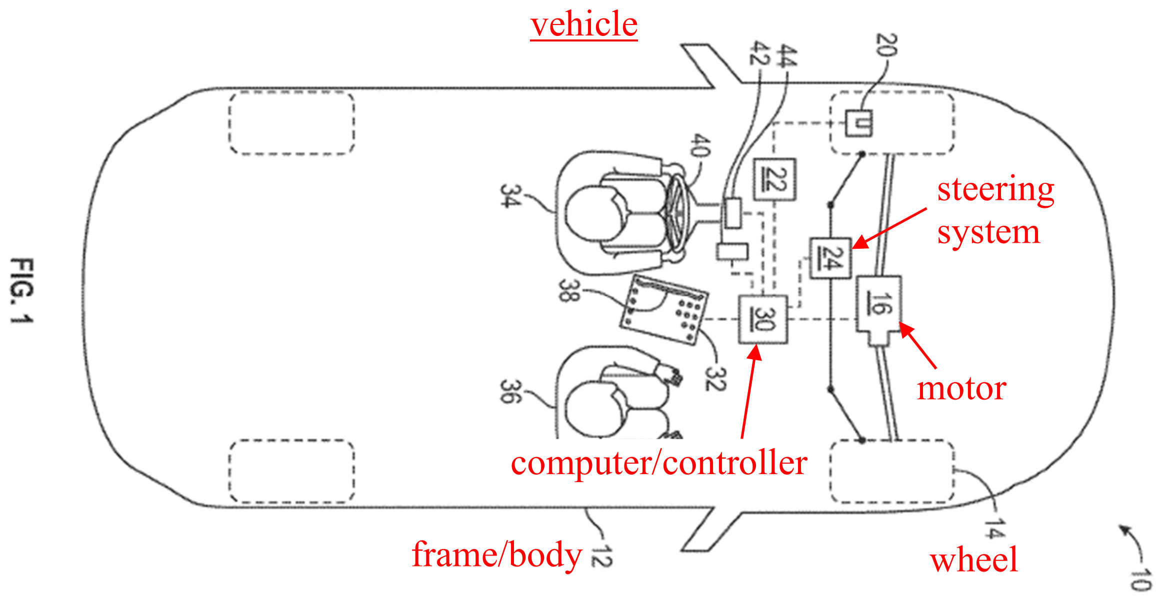
Reference	Filed	Published	AIA Prior Art Basis
Bayer	11/30/2004	12/6/2007	§102(a)(1)-(2)
Hoop	10/28/2019	4/29/2021	§102(a)(1)-(2)
Bettger	11/28/2018	5/30/2019	§102(a)(1)-(2)
Allexi	10/25/2013	9/18/2018	§102(a)(1)-(2)

All references are analogous art as they are all directed to the same field of endeavor (*e.g.*, motor vehicle operational control systems), and they are also reasonably pertinent to at least one problem that the inventors of the '458 Patent sought to address (*e.g.*, distracting or non-intuitive gear shifters and vehicle controls). *See* TESLA-1001, 1:5-6 ("present invention relates to motor vehicles and operational control systems"), 1:37-49 ("these gear direction systems may have disadvantages, or have an opportunity for automation to provide convenience"), 1:53-59 ("may be a distraction, … and may be [] non-intuitive"); TESLA-1004, [0001] ("driver assistance system for a motor vehicle"); TESLA-1005, [0001] ("park-steer assist system"); TESLA-1006, [0008] ("a driver can be assisted when reversing"); TESLA-1007, [0001]-[0006] ("driver steering assistance"); TESLA-1009, 1:51-65 ("assisted parking procedure of a vehicle"); TESLA-1023, [0002] ("vehicles may include one-pedal drive systems"); TESLA-1003, ¶¶45, 47, 49, 53, 55, 58.

II. THE ’458 PATENT

A. Brief Description

The ’458 Patent describes “motor vehicles and operational control systems.” TESLA-1001, 1:17-18; TESLA-1003, ¶¶35-38. The ’458 Patent describes a system operating in “a vehicle 10 having a frame or body 12 having wheels 14 that are driven by a motor 16,” and a “steering system 24 steers the front wheels,” as shown in FIG. 1 below. TESLA-1001, 2:27-31. “A computer or controller 30 is connected to each of the above systems, including sensors to monitor operation of each system, and cameras or other sensors (not shown) that gather information about the vehicle’s environment to enable autonomous or assisted driving.” TESLA-1001, 2:32-36.



TESLA-1001, FIG. 1[1] (rotated)

The '458 Patent describes a "typical operation of the system… in the context of 'unparking,' when a driver backs out of a parking spot in reverse, steers to adjust direction while reversing, then shifts to drive, steers the other direction, then straightens out to proceed." TESLA-1001, 2:61-3:6. The '458 Patent illustrates in FIG. 2 "the sequence of unparking." TESLA-1001, 3:13-14. "The upper trace 110 indicates steering wheel angle on a time-based horizontal chart. The lower trace 120 indicates velocity. The lower images A-F depict the vehicle 130 in a parking space 132, and are located at their relative positions on the time axis." TESLA-1001, 3:14-48.

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[1] Annotations and color added to figures unless otherwise noted.

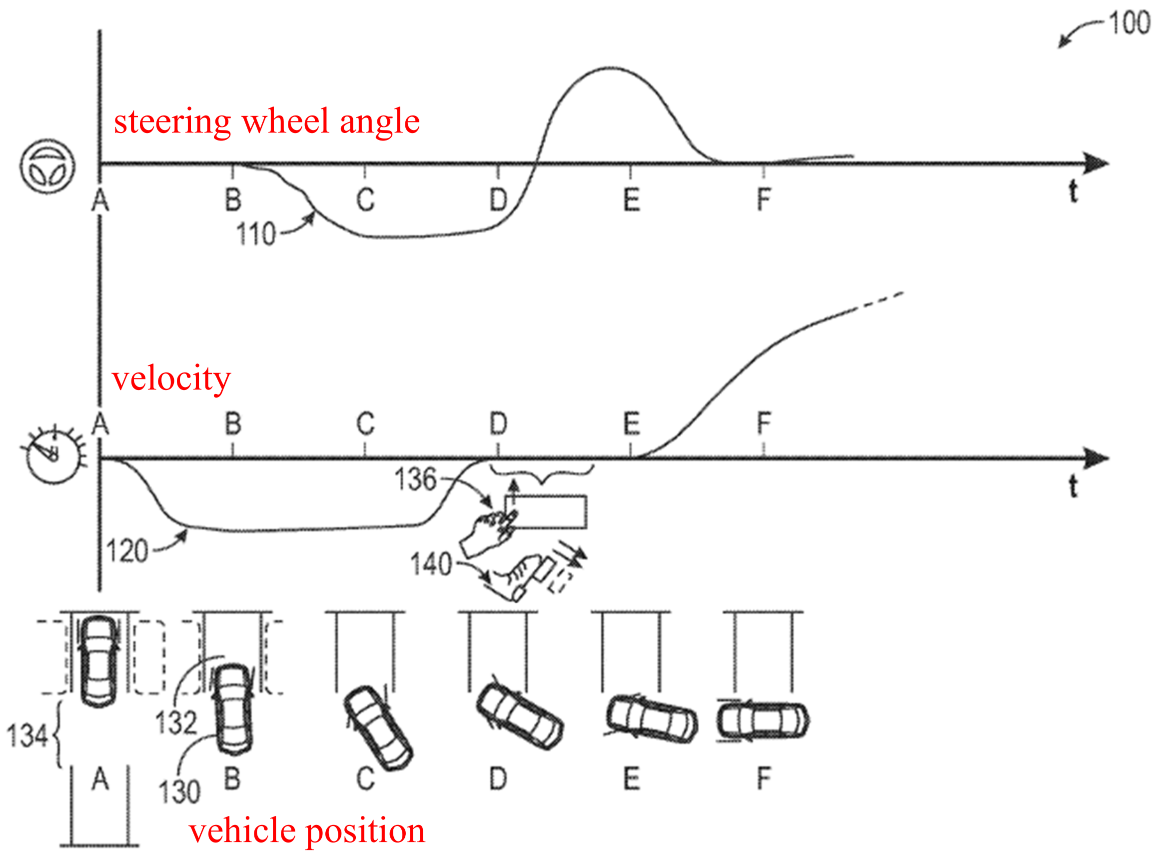

FIG. 2

TESLA-1001, FIG. 2

According to the specification, "[t]he controller may be programmed with specific functions or algorithms as to when an auto-shift is clearly safe to offer or enact, and when if offered, acceptance by the driver is likely desired and not an unwanted distraction." TESLA-1001, 3:54-57. The system may "determine actual patterns when auto-shifting might be safely offered," for example, "based on wheel angle patterns, velocity patterns, with certain thresholds of their various amounts, derivatives, and integrals." TESLA-1001, 3:57-4:1.

B. Prosecution History

The application that issued as the '458 Patent was allowed with no prior art rejections. As reasons for allowance, the examiner stated that no prior art discloses "a motor vehicle including the drive system [or controller] operable to select a direction for driving the wheels in response to steering angle movements, without operator indication of a direction." TESLA-1002, 151. The examiner noted that some prior art was made of record but not relied upon in a rejection. *Id.*, 151-152. As demonstrated below in Grounds 1A-3E, however, the prior art and evidence cited in this Petition would have rendered obvious the claim elements that the examiner believed to be missing from the prior art. TESLA-1003, ¶39.

C. Level of Ordinary Skill in the Art

For purposes of this IPR, a person of ordinary skill in the art ("POSITA") would have had a Bachelor's degree in electrical engineering, computer engineering, computer science, physics, or a related field, and at least two years of experience in the research, design or development of autonomous systems for motor vehicles, or the equivalent, as of the Critical Date. TESLA-1003, ¶¶40-42. Increased educational experience can make up for less work experience, and vice versa. *Id*.

D. Claim Construction

All claim terms should be construed according to the *Phillips* standard.

Phillips v. AWH Corp., 415 F.3d 1303 (Fed. Cir. 2005); 37 C.F.R. § 42.100. No formal claim constructions are presently necessary because "claim terms need only be construed to the extent necessary to resolve the controversy." *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011). Petitioner reserves the right to respond to any constructions offered by Patent Owner or adopted by the Board. Petitioner is not conceding that each challenged claim satisfies all statutory requirements, nor is Petitioner waiving any arguments concerning claim scope or grounds that can only be raised in district court.

III. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. GROUND 1A—Obvious based on Joos (Claims 1, 6, 11, 16)

1. Overview of Joos[2]

Joos describes "a method for unparking a motor vehicle from a cross-parking space, with which the motor vehicle is [maneuvered] along an unparking trajectory at least semi-autonomously from the cross-parking space onto a road bounding on the cross-parking space, wherein during said semi-autonomous

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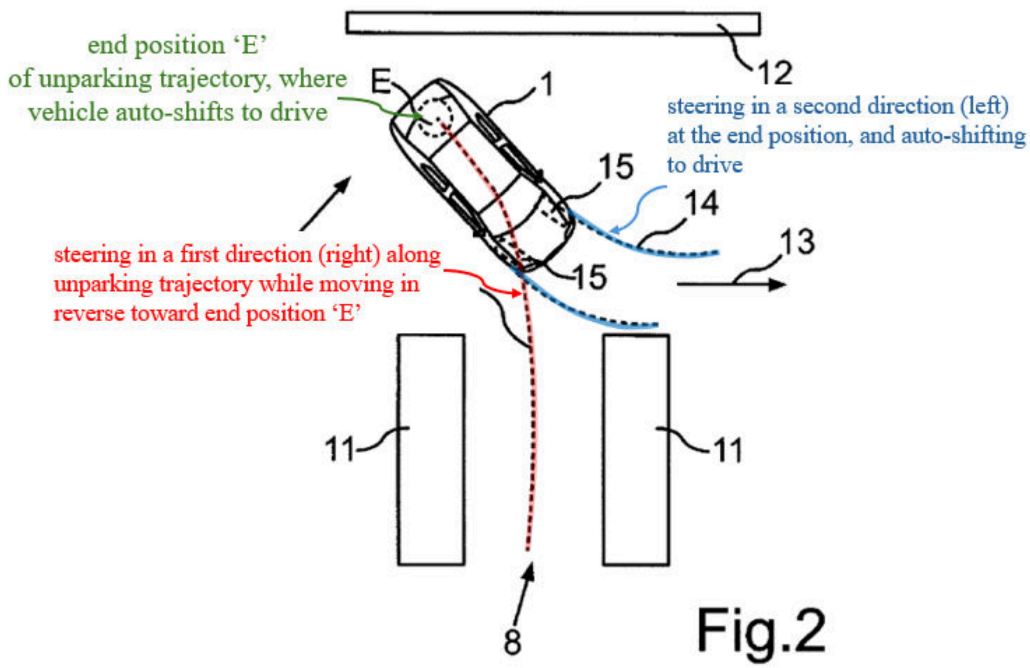
[2] General descriptions provided for the references (and combinations thereof) are incorporated into each subsection and mapping of the claims that includes citations to these references.

[maneuvering] the motor vehicle carries out at least one reversing movement along the unparking trajectory, an end position is determined and the semi-autonomous [maneuvering] of the motor vehicle along the unparking trajectory is ended at the end position." TESLA-1004, [0001], [0008].



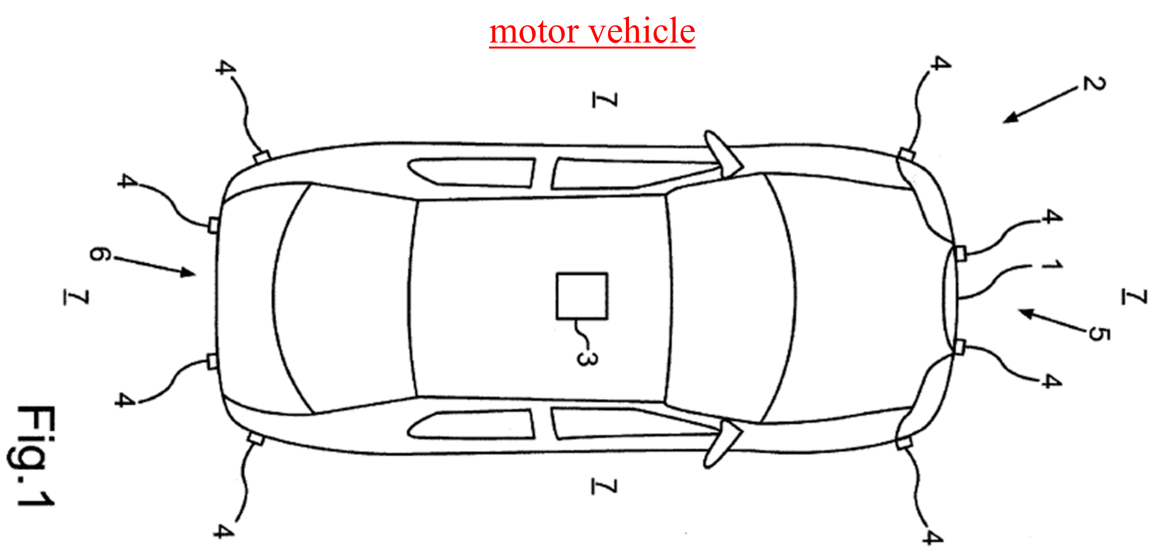
TESLA-1004, FIG. 2 (annotated)

In Joos, "after reaching the end position a forward gear is engaged or an instruction to engage the forward gear is issued to the driver of the motor vehicle." TESLA-1004, [0017], [0038]. Accordingly, Joos provides that "semi-autonomous [maneuvering] of the motor vehicle is ended, or the control of the motor vehicle is handed over to the driver, if the end position is reached, the specified steering angle has been set by the driver assistance system and the forward gear has been engaged." TESLA-1004, [0018]; TESLA-1003, ¶¶43-44.

2. Claim Element Analysis

(a) Elements 1[p] and 11[p]

To the extent the preamble is a limitation, Joos renders it obvious. TESLA-1003, ¶¶60-61. Joos discloses "a ***motor vehicle***" including the motor vehicle 1 depicted in FIG. 1 below. TESLA-1004, Abstract, [0001], [0005]-[0014], [0031], FIG. 1.

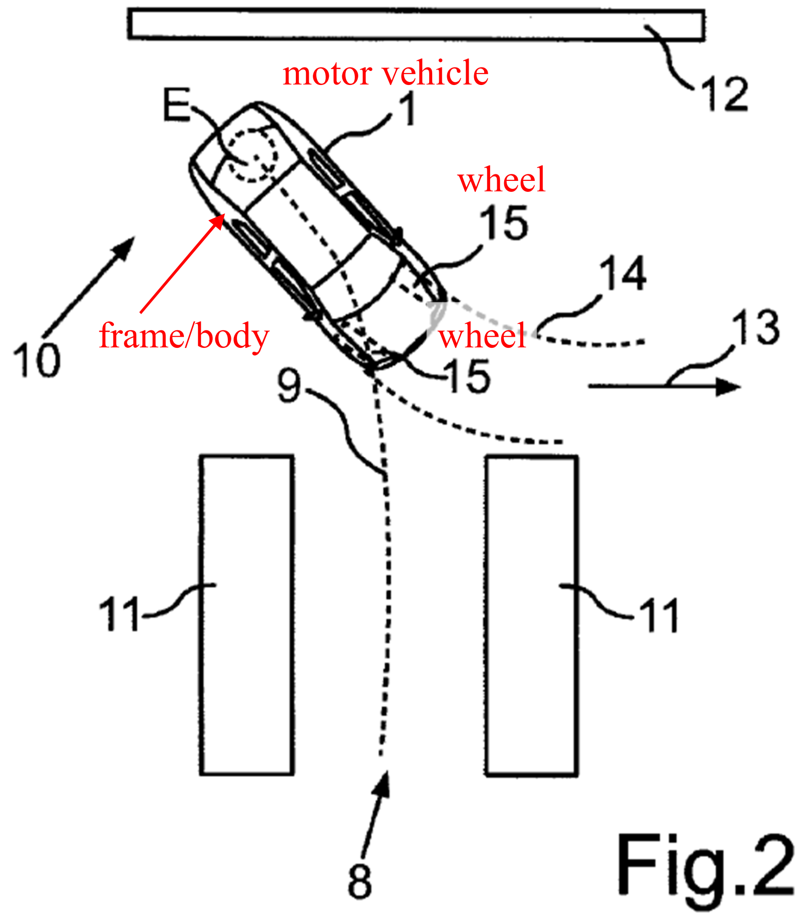


TESLA-1004, FIG. 1 (rotated)

(b) Elements 1[a] and 11[a]

Joos renders obvious 1[a] and 11[a]. TESLA-1003, ¶¶62-63. Joos discloses that the motor vehicle has a "body" (***frame***) and "wheels." TESLA-1004, [0014], [0016]. Joos also discloses "orient[ing] the steerable **wheels** of the motor vehicle in such a way that the steering has the predefined steering angle." TESLA-1004,

[0016]. FIG. 1 (above) and FIG. 2 (below) shows the motor vehicle 1 having a "body" and "wheels 15" (***a frame having wheels***). TESLA-1004, [0038].



TESLA-1004, FIG. 2

(c) Elements 1[b] and 11[b]

Joos renders obvious 1[b] and 11[b]. TESLA-1003, ¶64. Joos discloses that the motor vehicle has "a drive ***motor***." TESLA-1004, [0002], [0008], [0021]. The motor is ***connected to the frame***; indeed, Joos's vehicle travels as an integrated unit including the motor and frame together. TESLA-1004, FIGs. 2-3; TESLA-1003, ¶65. A POSITA also would have found it obvious to connect the motor to the frame of Joos's motor vehicle to ensure the motor is adequately supported in the vehicle according to well-established vehicle assembly techniques. *Id.* (citing TESLA-1012, [0127]; TESLA-1014, [0076]).

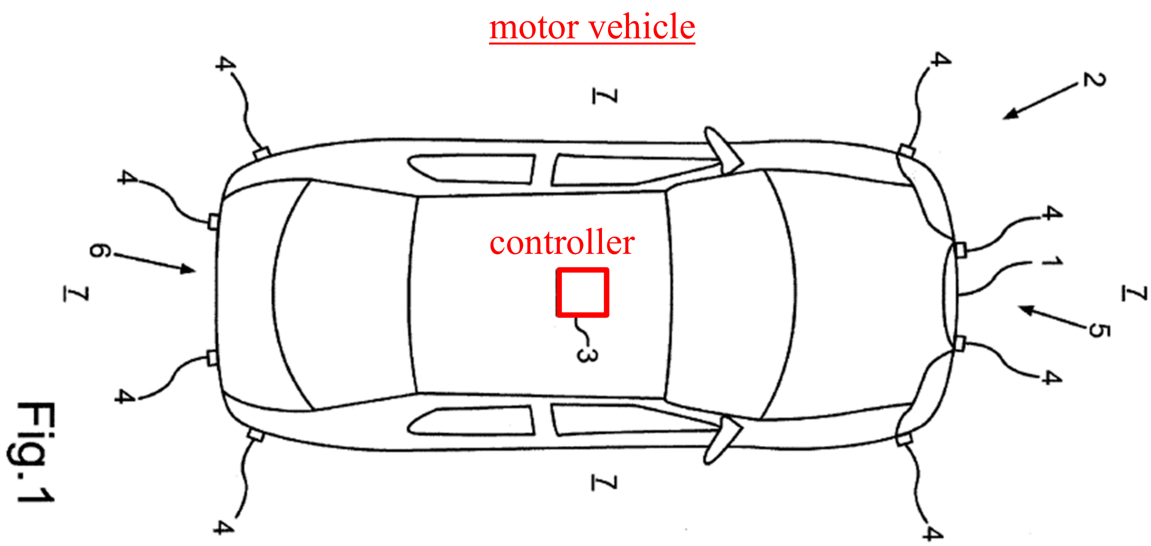
(d) Elements 1[c] and 11[c]

Joos renders obvious 1[c] and 11[c]. TESLA-1003, ¶66. Joos discloses that the motor vehicle has a "**steering wheel**" and a "**steering system**" that each individually or together provide a "***steering control***." TESLA-1004, [0014]-[0015], [0033]; TESLA-1003, ¶67.

Joos explains that "the driver assistance system can intervene in the **steering** of the motor vehicle once again and can orient the **steerable wheels** of the motor vehicle in such a way that the steering has the predefined **steering angle**." TESLA-1004, [0016], [0033]. Additionally, "the driver of the vehicle can move on the lane of the road if he turns the steering wheel fully." TESLA-1004, [0015]. Because the steering wheel and/or steering system (***steering control***) in Joos are operable by the driver and driver assistance system to generate a steering input that causes the vehicle to turn its wheels to change its driving direction, the steering wheel and steering each individually or together provide ***a steering control connected to the wheels to establish a steering angle***. TESLA-1003, ¶68.

(e) Elements 1[d] and 11[d]

Joos renders obvious 1[d] and 11[d]. TESLA-1003, ¶69. Joos discloses a "driver assistance system" (***drive system***) for a motor vehicle that includes "**a *controller* or an electronic control unit**, with which during the unparking [maneuver] **control signals are output to the steering system of the motor vehicle and possibly to** the brake system and/or **the drive motor**." TESLA-1004, [0021], [0031]; TESLA-1003, ¶70. "The driver assistance system 2 is [] embodied to continuously detect a movement of the motor vehicle 1 by means of odometry." TESLA-1004, [0033], [0037]-[0038]. By continuously monitoring movement of the vehicle by odometry, the ***controller*** of the driver assistance system (***drive system***) monitors the ***steering control***. TESLA-1004, [0016], [0021], [0031], [0033], [0037]-[0038], FIG. 2. Estimating the location of a moving vehicle by odometry involves monitoring the steering angle and other factors (*e.g.*, velocity or distance traveled) over time. TESLA-1003, ¶71 (citing TESLA-1008, 9; TESLA-1027, [0010], [0015]). "The **controller 3 can thus also receive data from a speed sensor and/or a steering angle sensor**, for example. Moreover, the **controller 3 is designed to output corresponding control signals to the steering system** of the motor vehicle 1." TESLA-1004, [0033], [0037]-[0038].



TESLA-1004, FIG. 1 (rotated)

The controller of Joos's driver assistance system (***drive system***) is ***operably connected to the*** steering system including the steering wheel (***steering control***) to detect steering inputs; indeed, Joos's drive system/controller receives data from a steering angle sensor of the steering system and issues control signals to the steering system that are operable to cause the wheels to adjust their angle in accordance with the steering input from the steering system including the steering wheel. TESLA-1004, [0016], [0021], [0031], [0033], [0037]-[0038]; TESLA-1003, ¶72. The steering angle sensor is part of a steering system (***steering control***); indeed, the steering angle sensor provides a feedback signal relating to the steering angle that allows the vehicle to be properly steered. TESLA-1004, [0033], [0037]-[0038]; TESLA-1003, ¶72 (citing TESLA-1008, 4-8, 1, 2; TESLA-1028, [0033]-[0036]).

A POSITA also would have recognized that Joos's drive system/controller monitors the steering control while autonomously or semi-autonomously driving in the reverse direction; indeed, the drive system/controller autonomously or semi autonomously guides the vehicle along the unparking trajectory to the calculated end position E. TESLA-1004, [0008]. It was known and obvious to use closed-loop steering feedback in this context to minimize a difference between the steering angles needed to follow the unparking trajectory and the measured steering angles obtained through monitoring of the steering control. TESLA-1003, ¶73 (citing TESLA-1029, [0072]-[0073]); *cf.*, TESLA-1001, 2:32-36, 2:48-56 (substantially similar features disclosed in the '458 Patent's preferred embodiments).

Joos's controller of the driver assistance system also is operably connected to the drive motor of the motor vehicle that controls their operation. TESLA-1003, ¶74. The controller of the driver assistance system issues control signals to the motor that are operable to cause the wheels to accelerate in angular velocity. TESLA-1004, [0008], [0016], [0021], [0031], [0033], [0037]-[0038].

Joos's drive system/controller is also ***operably connected to the wheels*** via each of the steering system, brake system, and drive motor since the drive system/controller issues control signals to the motor and brake system that cause the angular motion of the wheels to increase or decrease, and because the drive system/controller issues control signals to the steering system that are operable to cause the wheels to adjust their steering angle. TESLA-1004, [0016], [0021], [0031], [0033], [0037]-[0038]; TESLA-1003, ¶75. Operably connecting Joos's drive system/controller to the steering control, motor, and wheels also would have been obvious to a POSITA to enable the driver assistance system to brake, accelerate, and steer the motor vehicle as needed to carry out autonomous or semi-autonomous tasks such as the disclosed unparking maneuver and in accordance with well-established vehicle assembly techniques. TESLA-1003, ¶¶75-76; *cf.*, TESLA-1001, 2:14-21, FIG. 1.

(f) Elements 1[e] and 11[e]

Joos renders obvious 1[e] and 11[e]. TESLA-1003, ¶77. Joos discloses that a "driver assistance system can for example comprise **a controller or an electronic control unit**, with which during the unparking [maneuver] **control signals are output to** the steering system of the motor vehicle and possibly to the brake system and/or **the drive motor**. Thus, an autonomous unparking [maneuver] can be carried out using the driver assistance system." TESLA-1004, [0021], FIG. 2. Joos also discloses that "the driver assistance system itself can change from the **reverse gear** into the **forward gear**. A gear change can thus be carried out by the driver assistance system." TESLA-1004, [0017]. In Joos, if necessary, "a **forward movement** and a further **reversing movement** are carried out for [maneuvering] the motor vehicle along the unparking trajectory." TESLA-1004, [0020], FIGs. 3-5. For example, "a **forward movement** and then a further **reversing movement** can be carried out. The performance of the forward movement and the subsequent reverse movement can also be carried out multiple times. It can thus be provided that the motor vehicle is moved back and forth until the end point can be reached." TESLA-1004, [0020], [0039]-[0040]. Accordingly, Joos provides a ***drive system/controller*** operable to shift between the reverse and forward gears ***to selectively drive the wheels in a forward direction in a drive mode and a rearward direction in a reverse mode***. TESLA-1003, ¶78.

(g) Elements 1[f] and 11[f]

Joos renders obvious 1[f] and 11[f]. TESLA-1003, ¶79. Joos's ***controller*** of the driver assistance system (***drive system***) is operable to ***select*** a (forward) ***direction*** for driving the wheels by auto-shifting from reverse to drive at the end position E of the autonomous or semi-autonomous unparking maneuver without "operator indication of direction," but rather ***in response to steering angle movements*** made during the maneuver. TESLA-1003, ¶80. As described further below, Joos's ***steering angle movements*** includes at least **(1)** steering in a first direction (*e.g.*, right as depicted in Fig. 2) while reversing to reach the end position E of the unparking maneuver and **(2)** steering in the opposite direction (*e.g.*, left) at the end position E to set "a predetermined or adjusted steering angle," e.g., "a maximum steering angle," for the anticipated forward movement of the vehicle when manual control of the vehicle is returned to the driver at the end of the unparking maneuver.[3] TESLA-1004, [0010], [0014], [0015], [0037]-[0038], FIG. 2; TESLA-1003, ¶80.

In more detail, Joos discloses that the driver assistance system sets the steering angle in a first direction while traveling "along the unparking trajectory" "in the reversing direction" "until it has reached an end position" where "the autonomous parking [maneuver] is ended" and "the motor vehicle is stopped." TESLA-1004, [0008], [0016]-[0017]. The steering adjustments made while reversing from the parking space to the end position E of the maneuver provides at least a first one or more ***steering angle movements***. TESLA-1003, ¶81. For example, as shown in FIG. 2 (reproduced further below), the driver assistance system may apply steering angle movement(s) to turn the wheels to the right while reversing to the end position E. *Id.*; TESLA-1004, FIG. 2.

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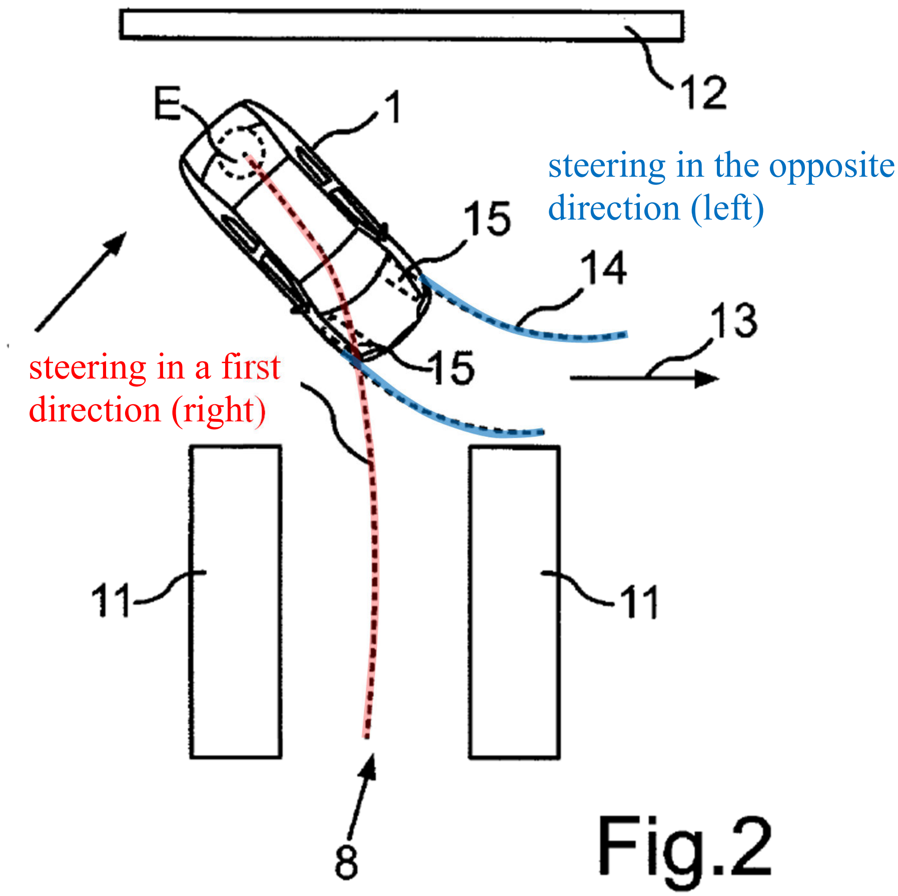
[3] The steering angle movements described in this example is the same steering angle movements recited in claim 6. *Infra*, §III.A.(h). This pattern is also recited in claim 4 of related U.S. Patent No. 11,932,230 (TESLA-1026).

Once the vehicle arrives and stops at the end position E of the unparking maneuver, Joos discloses that the driver assistance system steers the wheels in the opposite direction from the direction steered while the vehicle was reversing to set "a predefined steering angle, in particular a maximum steering angle" "so that the driver can carry out [a] collision-free forward movement without changing the adjusted steering angle." TESLA-1004, [0010], [0015], [0016], [0037]-[0038]. The steering adjustments made to set the predefined steering angle for the anticipated forward motion of the vehicle at the end position E provides an additional ***steering angle movement*** that follows the steering angle movement(s) made when the vehicle was reversing to the end position E. TESLA-1003, ¶82. For example, as shown in FIG. 2 (reproduced below), the driver assistance system may turn the wheels to the left at the end position E. *Id.*; TESLA-1004, FIG. 2.



TESLA-1004, FIG. 2 (annotated)

Joos also explains that the driver assistance system/controller is ***operable to select a direction for driving the wheels*** after the reversing movement. TESLA-1003, ¶83. Joos discloses that after "the end position is reached, the driver assistance system itself can change from the reverse gear into the forward gear." TESLA-1004, [0017], [0038], [0018]. The driver assistance system's automatic changing from the reverse gear into the forward gear includes ***selecting*** a (forward) ***direction*** for driving the wheels of the motor vehicle. TESLA-1003, ¶83.

Because the vehicle is steered in a first direction while reversing to reach the end position E of the unparking maneuver and is then steered in the opposite direction to achieve the predefined steering angle that will allow the driver to safely pull the vehicle forward when manual control of the vehicle is returned to the driver, and because the ***steering angle movements*** indicated by control signals from the driver assistance system must be detected for the requisite steering to be performed for the vehicle to arrive at the end position E and be placed in a state where the drive system auto-shifts from reverse to drive, Joos's drive system/controller is ***operable to select a direction for driving the wheels in response to steering angle movements***. TESLA-1003, ¶84. As shown in FIG. 2, the vehicle is reversed while applying a steering angle movement in the first direction (turned to the right) until it reaches the end position E. Also shown in FIG. 2, the maximum steering angle set while the vehicle is stopped at the end position is a steering angle in the opposite direction (turned to the left) "so that the motor vehicle 1 can be oriented along the driving direction 13 in a single forward movement starting from the end position E." TESLA-1004, [0036], [0008], [0015], [0028], [0037], [0009]-[0010], FIG. 2.

Thus, by shifting gears from reverse to drive as a result of detecting a steering angle movement that steers the wheels first in a rightward direction to reverse the vehicle to the desired end position E, and detecting a steering angle movement that steers the wheels in a leftward direction to set the specified (e.g., maximum) steering angle that ensures the driver will not collide with adjacent vehicles 11 during forward movement, Joos's driver assistance system (***drive system***) ***selects*** a (forward) ***direction*** for driving the wheels ***in response to steering angle movements*** that includes steering in the rightward direction and steering in the opposite (leftward) direction. TESLA-1003, ¶85.

To be sure, Joos's drive system/controller selects to auto-shift to drive (***selecting a direction for driving the wheels***) at the end position E of the unparking maneuver only after and in response to the steering angle movements that includes setting the predefined steering angle at the end position E by steering in the opposite direction from the steering angle while reversing. TESLA-1003, ¶86. Joos explicitly states that the driver "take[s] over directly and rapidly" from the driver assistance system to manually operate the vehicle once the vehicle shifts to drive. TESLA-1004, [0017], [0038]. The pull-forward steering angle would therefore need to be set *before* the drive system/controller auto-shifts to drive for the driver to "take over directly and rapidly" as disclosed. TESLA-1003, ¶86. Additionally, Joos explains that the *last* action to occur when "the automatic or autonomous unparking manoeuevre is [] ended" is to "engage the forward gear." TESLA-1004, [0017]-[0018], [0009], [0011]-[0012], [0014]-[0015], [0037]-[0039]. This means that the pull-forward steering angle must be set *before* the forward gear is engaged because the pull-forward steering angle is set by the driver assistance system before the automatic or autonomous unparking maneuver is ended. *Id.*; TESLA-1003, ¶86.

A POSITA also would have found it obvious to condition Joos's auto-shift to drive (***select a direction for driving the wheels***) at the end position E of the unparking trajectory on completion of the steering angle movements, including detecting that the pull-forward steering angle has been set while the vehicle is parked at the end position. TESLA-1003, ¶87. Indeed, this would have been obvious and beneficial to ensure full control of the vehicle could be handed back to the driver more quickly upon shifting to drive and to ensure the driver would not pull forward from the end position before the steering angle is set. TESLA-1004, [0017]; *Id.* Joos teaches that the steering angle is set to avoid collisions and to allow the vehicle to properly orient itself in the lane of travel when the driver pulls forward while maintaining the set steering angle. TESLA-1004, [0010], [0014]-[0016], [0036]-[0038]. Maintenance of the set steering angle also allows the vehicle to avoid collisions with other parked vehicles. *Id.* Allowing the driver to pull forward before the steering angle is set introduces risk of collisions with other vehicles and prevents the vehicle from being properly oriented such that it could move forward into the lane of travel, all of which may compromise safety. *Id.*; TESLA-1004, [0010], [0014]-[0016], [0036]-[0038]. Accordingly, a POSITA would have been motivated to configure Joos's drive system/controller to auto-shift to drive based on the pull-forward steering angle first being set to enhance safety and provide a more intuitive driving experience that would allow the driver to immediately assume full control of the vehicle once the vehicle shifts to drive. TESLA-1003, ¶87. Allowing the driver to more quickly assume control of the vehicle after the auto-shift to drive also furthers Joos's objective of "enabl[ing] the driver of the motor vehicle to take over directly and rapidly." TESLA-1004, [0017]. Further, it provides added convenience because the set steering angle allows the driver to simply pull forward into the direction of the lane of travel while avoiding collisions with nearby vehicles or objects (*e.g.*, vehicle in adjacent parking spaces). *Id.*, [0014]; TESLA-1003, ¶87. Even basic driver's education instructional materials teach drivers to set the pull-forward steering angle before shifting to drive upon exiting a parking space. *See, e.g.*, TESLA-1003, ¶87; TESLA-1024, 1; TESLA-1025, 3.

Moreover, configuring the drive system/controller to auto-shift to drive only after setting the steering angle would have been obvious to try. TESLA-1003, ¶88. Joos discloses both setting of the steering angle and shifting to drive as two actions that must occur at the end of the unparking procedure before control is handed back to the user. *Id.*; TESLA-1004, [0018]. A finite number of options exist for sequencing these actions. TESLA-1003, ¶88. Namely, the steering angle could only be set before, during, or after the auto-shift to drive of the vehicle. *Id.*

Considering these limited options and the known benefits of setting the steering angle before auto-shifting to drive as described above, it would have been obvious to implement Joos such that the auto-shift to drive would occur only if the steering angle had been successfully set beforehand. *Id.* A POSITA would have reasonably expected success because implementing the system in this manner would merely involve applying capabilities that the driver assistance system in Joos was already configured to perform (*e.g.*, setting the steering angle and auto-shifting to drive). *Id.* Joos's vehicle is also capable of adjusting the steering angle while in a reverse gear as evident from the curved trajectory taken by the vehicle when reversing from the parking space. TESLA-1003, ¶89; TESLA-1004, FIG. 2, [0039]-[0040] & FIGs. 3-5 (disclosing additional ***steering angle movements*** when the end position E cannot be reached in a single reversing motion).

Further, in Joos, the driver assistance system's auto-shift to drive (***select a direction for driving the wheels***) is accomplished ***without operator indication of a direction***. TESLA-1003, ¶90. This is evident, or at least obvious, because the driver never manipulates the vehicle's gear selector or any other control that specifies a particular direction at end position E when the driver assistance system determines to shift the vehicle from reverse to drive. TESLA-1004, [0017]; *cf.*, TESLA-1001, 1:42-47, 3:49-53, 5:15-24 ('458 Patent disclosing similar inputs that do not involve operator indication of direction); TESLA-1003, ¶90.

(h) Claims 6 and 16

Supra, 1[f]; TESLA-1003, ¶91.

B. GROUND 1B—Obvious based on Joos in view of Kischkat (Claims 2, 4-5, 7-10, 12, 14-15, 17-20)

1. Overview of Kischkat

Kischkat describes "a motor vehicle comprising an electronically shiftable automatic transmission and a park-steer assist system for supporting a parking process." TESLA-1005, [0001], [0009]; TESLA-1003, ¶46. Kischkat discloses that "during a parking process supported by the assistance system, the signal for shifting the automatic transmission from a forward driving mode to a reverse driving mode or vice versa after automatic braking to a standstill can be given via the accelerator or brake pedal[,] via a voice input into a voice control system[,] or by actuating a control element on the steering wheel, dashboard, or key side." TESLA-1005, [0009], [0001]-[0025], FIGs. 1-2. Kischkat also describes the driver giving "a confirmation response to change direction – if necessary, after asking via the voice control system or the vehicle's loudspeaker whether a change of direction is desired. For example, if the voice control system or assistance system asks 'Change direction?', the driver simply has to answer 'yes'." TESLA-1005, [0016].

2. Combination of Joos and Kischkat

A POSITA would have found it obvious to implement the gear shift that occurs at the end of Joos's unparking trajectory in accordance with Kischkat's option for offering an automated gear shift that would be made only upon confirmation from the driver. TESLA-1003, ¶92.

In more detail, Joos describes two options for engaging the forward gear after reversing during an unparking maneuver. TESLA-1004, [0017], [0038]. In the first option, "the driver assistance system itself can change from the reverse gear into the forward gear." *Id.*, [0017]. In the second option, "an instruction to engage the forward gear is issued to the driver of the motor vehicle" and "[t]he driver of the vehicle… engage[s] the forward gear." *Id.*, [0017], [0038]. The first option relieves the driver of the burden of manually shifting to the forward gear, but the driver may alternatively prefer to confirm agreement with the gear change before the driver assistance system effects the change automatically. *Id.* The second option provides the driver with more control, but still the driver will need to manually manipulate the vehicle's gear shifter to indicate the forward direction and engage the forward gear. TESLA-1003, ¶93.

Because each of Joos's options for shifting gears during the unparking procedure carry distinct tradeoffs, a POSITA would have turned to references like Kischkat that describe techniques for shifting gears that require a different level of driver involvement. TESLA-1003, ¶94.

As discussed above, Kischkat describes the option of automatically shifting gears using a driver assistance system—but only after the driver assistance system offers to shift gears and the driver is able to accept or reject the offer via a control input other than the vehicle's manual gear selector. TESLA-1005, [0003], [0016], [0010]-[0012], [0019]; *supra*, §III.B.1. Multiple reasons would have prompted a POSITA to pursue a Joos-Kischkat combination that expands Joos's options for shifting gears according to the techniques described in Kischkat. TESLA-1003, ¶95.

First, a POSITA would have pursued the combination to provide drivers with another option for shifting from reverse to drive during the unparking procedure to achieve distinct benefits from those attained by Joos's original solution. TESLA-1003, ¶96. Considering these distinct benefits, a POSITA would have expected Kischkat's option to be preferred by a significant population of drivers. *Id*. For example, Kischkat's offer/acceptance technique allows the driver to retain control in accepting/rejecting a proposed gear shift before the driver assistance system makes the change. *Id.* At the same time, Kischkat's solution relieves the driver of the burden of manually manipulating the gear selector. *Id.*; TESLA-1005, [0012].

Kischkat's approach would also beneficially afford an opportunity for the driver to independently assess whether a collision-free forward movement can successfully be carried out from the end position E or whether a further reverse movement may be necessary. TESLA-1003, ¶97; TESLA-1004, [0015]-[0016],

[0037]-[0038]. The driver confirmation to change gears would have provided a valuable precaution, further reducing the risk of costly collisions and enhancing safety by mitigating the possibility that the vehicle changes a critical operating parameter such as the transmission gear/vehicle direction before control of the vehicle is returned to the driver without the driver's awareness. TESLA-1003, ¶97.

Second, a POSITA would have applied Kischkat's suggestion for offering an automated gear shift that could be confirmed by the driver before the gear shift is made in Joos's system to ensure valets, new drivers, or others who are unfamiliar with the driver assistance system are better capable of operating the vehicle and are not surprised by an unexpected change in direction of the vehicle. TESLA-1003, ¶98.

Third, a POSITA would have applied Kischkat's suggestion for offering an automated gear shift in Joos's system to achieve known benefits like those expressly described in Kischkat. TESLA-1003, ¶99. For example, Kischkat explains that "the use of the accelerator or brake pedal is advantageous in that the driver does not have to turn his attention away from what he is doing at all, since it is easy for him to press one or the other pedal to signal.… It is also very easy for him to operate a control element, as he does not have to be careful to use a certain predetermined position" to select a specific gear. TESLA-1005, [0013], [0009], [0012]-[0013], [0016], [0019].

Fourth, a POSITA would have pursued the Joos-Kischkat combination because it merely involves the application of known techniques (*e.g.*, Kischkat's automated gear shift conditioned on a confirmatory response) to improve a conventional system (*e.g.*, Joos's semi-autonomous parking system) to achieve predictable results. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007); *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1380-81 (Fed. Cir. 2023). Here, a POSITA would have recognized the tradeoffs associated with the gear shifting options provided in Joos and would have appreciated that some drivers would prefer a third option like that described in Kischkat. TESLA-1003, ¶100. Kischkat's techniques would have benefitted these drivers for each of the reasons described above. TESLA-1003, ¶100, ¶¶101-104 (describing additional motivations).

A POSITA would have reasonably expected success implementing the Joos-Kischkat combination, especially since both references describe straightforward techniques for shifting gears during a parking/unparking process. TESLA-1003, ¶105. Adding driver confirmation of an automated gear change as taught in Kischkat to Joos's driver assistance system that already implements a gear change would be a straightforward modification and would have been well-within the capabilities of a POSITA. *Id.* Notably, Kischkat explicitly states that its techniques can be "easily" implemented "because motor vehicles usually have a central signal or data bus, often the CAN bus, via which all signals or data are exchanged" and "[a]s a result, it is easily possible to 'reconfigure' an element… as a gearshift signal." TESLA-1005, [0010]. Moreover, considering the substantial similarities between Joos's system and Kischkat's, a POSITA would have expected the benefits provided by Kischkat's teachings to apply with equal force when combined with Joos. TESLA-1003, ¶105.

3. Claim Element Analysis

(a) Claims 2 and 12

Joos-Kischkat renders obvious Claims 2 and 12. TESLA-1003, ¶106. Joos discloses ***a brake control operable by the driver to generate a brake input***. TESLA-1003, ¶107. Joos discloses that the "driver of the motor vehicle… operate[s]… the **brakes**." TESLA-1004, [0002], [0008]-[0009].

Joos also discloses that ***the drive system/controller is operably connected to the brake control to receive the brake input***. TESLA-1003, ¶108. Joos discloses that "the driver assistance system also carries out the intervention into a brake system." TESLA-1004, [0002], [0008]-[0009]. "The **driver assistance system** can for example comprise a **controller** or an electronic control unit, with which during the unparking [maneuver] **control signals are output** to… **the brake system**." TESLA-1004, [0021]. Joos's ***controller*** of the driver assistance system (***drive system***) is therefore connected to the ***brake control*** because the drive system/controller, responsive to brake input transmitted from the brake control, issues control signals to the brake system that are operable to cause the wheels to decelerate their angular velocity. TESLA-1004, [0002], [0008]-[0009], [0021]; TESLA-1003, ¶108. Operably connecting Joos's drive system/controller to the brake control also would have been obvious to enable each of the driver and the driver assistance system to slow or stop the vehicle during autonomous or semi-autonomous operations including during Joos's autonomous or semi-autonomous unparking procedures. *Id.*

Kischkat teaches that ***an approval indication*** for an automated gear shift ***includes actuation of the brake control***. TESLA-1003, ¶109. Kischkat discloses that various "elements provided on the vehicle, which otherwise serves a different purpose, [can be] modified or configured in such a way that the shift signal for changing the driving gear can be given via this element." TESLA-1005, [0010]. Kischkat identifies the "**brake pedal**" (***brake control***) as one such configurable element that can be used by the driver to approve an offer to auto-shift from one gear to another (e.g., shift from a reverse gear in a reverse mode to a forward gear in a drive mode). *Id.*, [0010]-[0013], [0016]-[0018]. As explained in the combination overview (*supra* §III.B.2), it would have been obvious to implement Joos's vehicle according to Kischkat's teachings such that the brake control (e.g., brake pedal), when actuated by the driver, would be received by the driver assistance system/controller to provide ***the approval indication*** for the offer to auto-shift from one gear to another. TESLA-1005, [0009], [0011], [0016]; §§III.B.1-2; TESLA-1003, ¶109.

(b) Claims 4 and 14

Joos-Kischkat renders obvious Claims 4 and 14. TESLA-1003, ¶110. For the reasons discussed above in §III.B.2 and Claim 2, the vehicle offers an auto-shift to drive as taught in Kischkat, and the combined teachings of Joos and Kischkat thus suggest ***the drive system/controller is operable to offer a driver a change in the drive direction in response to steering input***. TESLA-1003, ¶111. Based on Joos's teachings, the offered change in drive direction can be made ***only in response to detecting the steering input greater than a selected steering angle threshold***. *Id.* Joos discloses that "the end position is determined under the assumption that a predefined steering angle, in particular a maximum steering angle, is set during manual control of the motor vehicle." TESLA-1004, [0015]-[0016], [0010], [0014], [0018], [0037]-[0038]. As described above in further detail with respect to Element 1[f], the "predefined steering angle, in particular a maximum steering angle," must be set before the drive system/controller shifts to drive at the end position E of the unparking trajectory. *Supra*, Element 1[f], Claim 2; TESLA-1003, ¶111. Accordingly, the Joos-Kischkat drive system/controller only offers to change the drive direction from reverse to drive at the end position E in response to setting the predefined (*e.g.*, maximum) steering angle for the anticipated pull-forward movement of the vehicle. *Id.*

Joos's drive system/controller applies a threshold to determine whether the steering input suffices to auto-shift to drive. TESLA-1003, ¶112. Determining that the steering angle is set to the "predefined steering angle, in particular a maximum steering angle," involves detecting that a ***steering input is greater than a selected steering angle threshold*** (*e.g.*, a neutral (zero) steering angle threshold, a non-maximum steering angle threshold, or any other steering angle threshold just below the "predefined" angle). *Id.*; TESLA-1004, [0015]-[0016], [0010], [0014], [0018], [0037]-[0038]. The use of a steering angle threshold to ensure the maximum steering angle is set as taught in Joos also would have been an obvious design choice since thresholds were commonly implemented in software and control systems before the Critical Date. TESLA-1003, ¶112 (citing TESLA-1006, [0044]).

(c) Claims 5 and 15

Joos-Kischkat renders obvious Claims 5 and 15. TESLA-1003, ¶113. Joos teaches that the vehicle must be stopped (*i.e.*, a velocity of zero that is below a positive velocity (***selected velocity threshold***)) at the end position E of the unparking trajectory as a condition for the ***controller*** of the driver assistance system (***drive system***) to shift gears from reverse to drive (***change from reverse***

mode to drive mode only if a vehicle velocity is below a selected velocity threshold). TESLA-1004, [0016], [0018]; TESLA-1003, ¶114. The use of a velocity threshold to ensure the vehicle is stopped as taught in Joos also would have been an obvious design choice since thresholds were commonly implemented in software and control systems before the Critical Date. *Id*. Further, based on Kischkat, the Joos-Kischkat drive system/controller would offer to change from reverse to drive only if stopped at the end position E, and thus only if the vehicle velocity is below the selected threshold. *Id.*; §III.B.2.

(d) Claims 7 and 17

Joos-Kischkat renders obvious Claims 7 and 17. TESLA-1003, ¶115. Joos discloses that "[d]uring the unparking of the motor vehicle 1, the **distance** between the vehicle 1 and the respective objects 11 [bounding on the cross-parking space 8] can be continuously detected" and "the current position of the motor vehicle 1 can be determined by means of **odometry**." TESLA-1004, [0035], [0013]-[0014]. The distance between the motor vehicle and nearby objects detected while reversing "enables more precise determination of the end position." *Id.*, [0013]. The end position E can also be calculated to allow for a "safety distance" between the vehicle and surrounding objects. *Id.*, [0014]; TESLA-1003, ¶116.

The ***controller*** of the driver assistance system (***drive system***) thus continuously monitors the position of the vehicle and the vehicle's distance to objects during travel to reach an end position E (which position E is calculated to leave sufficient room for the vehicle to pull forward after the vehicle has reversed a certain distance to reach the end position E), and further the driver assistance system does not change the drive direction to the forward gear until the vehicle reaches the end position E. TESLA-1004, [0008], [0013]-[0014], [0035]. Joos thus teaches that the drive system/controller chang[es] the drive direction based at least in part on distance traveled. TESLA-1003, ¶117. In the combination, the vehicle offers an auto-shift to drive as taught in Kischkat, and the combined teachings of Joos and Kischkat thus suggest that the controller/drive system is ***operable to offer a driver a change in the drive direction based at least in part on distance traveled***. *Id.*; *supra*, §§III.B.1-2.

(e) Claims 8 and 18

Joos-Kischkat renders obvious Claims 8 and 18. TESLA-1003, ¶118. For reasons discussed above for 1[f] and below for Claim 9, the Joos-Kischkat combination renders obvious ***the drive system/controller is operable in response to an approval indication from a driver to change the drive direction without driver indication of a direction other than approval of an offered change in direction***. TESLA-1003, ¶119; *supra*, §III.A.2(g); *infra*, §III.B.3(f). In the Joos-Kischkat combination, the drive system's/controller's ***change of the drive direction*** from the reverse mode to the drive mode is accomplished ***without driver***

indication of a direction for offering an auto-shift to drive as taught in Kischkat. *Id.* Kischkat discloses that "during a parking process supported by the assistance system, the signal for shifting the automatic transmission from a forward driving mode to a reverse driving mode or vice versa… can be given via the accelerator or brake pedal via a voice input into a voice control system or by actuating a control element on the steering wheel, dashboard, or key side." TESLA-1005, [0009]; *generally id.*, [0001]-[0025], FIGs. 1-2. Kischkat explains that the driver can provide "a confirmation response to change direction – if necessary, after asking via the voice control system or the vehicle's loudspeaker whether a change of direction is desired. For example, if the voice control system or assistance system asks 'Change direction?', the driver simply has to answer 'yes'." TESLA-1005, [0016], [0019].

The types of confirmation responses described in Kischkat—such as tapping the accelerator or brake pedal or providing a simple voice input (e.g., "yes")—allow the driver to approve an offer to auto-shift and therefore change directions—but these confirmation responses themselves do not indicate a direction. TESLA-1003, ¶120. Kischkat's confirmation responses are substantially the same as the approval indications disclosed in the specification of the '458 Patent that are also said to lack an indication of a direction. *Cf.* TESLA-1001, 1:35-47, 5:8-33; TESLA-1004, [0017]; *supra*, claim 2; TESLA-1003, ¶120.

(f) Claims 9 and 19

The Joos-Kischkat combination renders obvious Claims 9 and 19 for the reasons addressed above with respect to 1[f] and Claims 2 and 8. *Supra*, §III.A.2(g), §III.B.3(e); TESLA-1003, ¶121. Joos teaches that the "gear change can thus be carried out by the driver assistance system" rather than the driver. TESLA-1004, [0017]; *supra*, 1[f] and Claims 2 and 8. TESLA-1003, ¶122; *cf.* TESLA-1001, 1:35-47, 5:8-33. A POSITA also would have found it obvious that Joos's driver would not operate a selector to change the drive direction when Joos's driver assistance system/controller carries out the shift to the forward gear at the end position E because Joos delineates scenarios where the driver is issued an instruction to manually shift to drive and where the driver assistance system/controller instead auto-shifts to drive without the driver's operation of a selector. *See* TESLA-1004, [0017]; *supra*, Claim 8; TESLA-1003, ¶122. Additionally, the types of confirmation responses described in Kischkat that trigger auto-shifting to drive in the Joos-Kischkat combination—such as tapping the accelerator or brake pedal or providing a simple voice input (e.g., "yes")—allow the driver to approve an offer to auto-shift and therefore change direction without operation of a selector or indication of a direction by the driver.*Id*.

(g) Claims 10 and 20

The Joos-Kischkat combination renders obvious Claims 10 and 20 for the reasons addressed above with respect to Element 1[f] and Claim 2. *Supra*, Element 1[f], Claim 2; TESLA-1003, ¶123. Joos-Kischkat would have rendered obvious the additional features recited in Claims 10 and 20 because the ***controller*** of the driver assistance system (***drive system***) ***changes the driving direction*** from reverse to drive (forward) in response to detection of the steering angle movements described above for 1[f] (§III.A.2(g))—which prompts the driver assistance system to offer an auto-shift to drive at the end position E—and further in response to the driver's ***operation of the brake control*** to accept the offer to auto-shift to drive as taught in Kischkat. *Supra*, Claims 2 (§III.B.3(a)). TESLA-1003, ¶124.

C. GROUND 1C—Obvious based on Joos in view of Kischkat and Hoop (Claims 3, 13)

1. Overview of Hoop

Hoop generally describes "one-pedal drive systems that are configured to brake the vehicle through regenerative braking in response to releasing the accelerator pedal and without application of the brake pedal." TESLA-1023, [0002]; TESLA-1003, ¶48. Hoop explains that in "one-pedal drive mode, the speed of the vehicle may be increased in response to increasing a depressed position of the accelerator pedal 34 while releasing the accelerator pedal 34 results in breaking the vehicle 10 via regenerative braking through the [motor/generator] M/G 14. More specifically, the vehicle 10 may be slowed or braked via releasing the accelerator pedal 34 alone without an application or depression of the brake pedal 36." TESLA-1023, [0022]. Even with one-pedal driving, however, the brake pedal 36 can still be depressed to apply the friction brakes 38 and further slow the vehicle. TESLA-1023, [0017], FIGs. 1-2.

2. Combination of Joos, Kischkat, and Hoop

A POSITA would have found it obvious to further modify the Joos-Kischkat vehicle from Ground 1A to implement a "one-pedal" driving capability in which the vehicle is actively slowed in response to release of the accelerator pedal as taught in Hoop. *Supra*, §III.C.1; TESLA-1023, [0002], [0022]; TESLA-1003, ¶125. Based on Joos's teachings, the Joos-Kischkat-Hoop vehicle would be operated semi-autonomously during an unparking procedure with the driver assistance system controlling steering and the driver controlling acceleration/braking to follow a prescribed unparking trajectory to a calculated end position E. TESLA-1004, [0002], [0008], FIG. 2. Further, based on Hoop's suggestion for one-pedal driving, the driver would release the accelerator pedal to slow the vehicle to a stop at the end position E. TESLA-1003, ¶125; *supra*, §III.C.1. After the maximum or other pre-defined steering angle is set as taught in Joos, the driver assistance system/controller would offer an auto-shift to drive as taught in Kischkat. TESLA-1003, ¶125; TESLA-1004, [0015]-[0018], [0037]-[0038]; TESLA-1005, [0009], [0016], [0019]. The driver can then shift her foot from the accelerator pedal and tap/depress the brake pedal to confirm acceptance of the offer to auto-shift to drive as taught in Kischkat. *Supra*, Claims 2, 10; TESLA-1005, [0010]-[0013], [0016]-[0019]; TESLA-1003, ¶125.

Multiple reasons would have motivated a POSITA to apply Hoop's one-pedal driving capability to the vehicle of the Joos-Kischkat combination. TESLA-1003, ¶126.

First, a POSITA would have applied Hoop's suggested use of one-pedal driving to the Joos-Kischkat vehicle to achieve a convenient method of activating regenerative braking, particularly in hybrid- or fully-electric implementations of Joos's vehicle. TESLA-1003, ¶127. Joos's unparking techniques are broadly applicable to any "autonomous" or "semi-autonomous" motor vehicle, which a POSITA would have understood to include electric vehicles as suggested by Hoop. TESLA-1004, [0001]-[0003], [0006]-[0008]. Regenerative braking is especially beneficial in hybrid- and fully-electric vehicles because it allows the vehicle's battery to be re-charged while the vehicle decelerates, thereby increasing the electric range of the vehicle and increasing the effective charge capacity of the battery. *Id.*; TESLA-1023, [0002], [0018]-[0020].

Second, a POSITA would have applied Hoop's suggested use of one-pedal driving to the Joos-Kischkat vehicle to reduce the need for and frequency of use of the vehicle's friction brakes (*e.g.*, since regenerative braking can be used instead in many cases). TESLA-1003, ¶128. The reduced use of the friction brakes would beneficially increase the life of the vehicle's friction brake parts (e.g., rotors, pads) and reduce costs of maintaining or replacing the friction brake parts. *Id.*

Third, a POSITA would have applied Hoop's suggested use of one-pedal driving to the Joos-Kischkat vehicle because regenerative braking often provides a smoother, and therefore more pleasant, deceleration than friction braking. TESLA-1003, ¶129.

Fourth, a POSITA would have applied Hoop's suggested use of one-pedal driving to the Joos-Kischkat vehicle to enhance the driving experience for the driver of the vehicle. TESLA-1003, ¶130. One-pedal driving is preferred by many drivers of electric vehicles because these drivers find one-pedal driving to be simpler, more intuitive, and less burdensome than constantly shifting the foot between the accelerator and brake pedals whenever acceleration or deceleration is needed. *Id.*

Fifth, applying Hoop's techniques in combination with Joos and Kischkat would have been obvious as a matter of law because the combination merely involves combining prior art elements according to known methods to yield predictable results. *KSR*, 550 U.S. at 415-421; *Intel*, 61 F.4th at 1380-81; TELSA-1003, ¶131.

A POSITA likewise would have reasonably expected success implementing the combination. TESLA-1003, ¶132. Indeed, Joos, Kischkat, and Hoop all similarly describe motor vehicle systems and established technologies. Electric vehicles utilizing one-pedal driving with regenerative braking were common before the Critical Date. *Id*. Moreover, Joos's and Kischkat's techniques are fully compatible with electric and hybrid-electric vehicles of the type that would use Hoop's one-pedal driving techniques. *Id.* Adding a capability for braking in response to releasing the accelerator pedal to a similar system as proposed in the combination would have been well within the capabilities of a POSITA. *Id.*

3. Claim Element Analysis

(a) Claims 3 and 13

Joos-Kischkat-Hoop renders obvious Claims 3 and 13. TESLA-1003, ¶133. Joos discloses that the "driver of the motor vehicle… operate[s] the **gas pedal** and the brakes" (***an accelerator pedal*** and ***brake***) and that "the driver assistance system also carries out the intervention into a brake system and a drive motor of the motor vehicle." TESLA-1004, [0002], [0008]-[0009]. "The **driver assistance system** can for example comprise a **controller** or an electronic control unit, with which during the unparking [maneuver] **control signals are output** to the steering system of the motor vehicle and possibly to **the brake system and/or the drive motor**." TESLA-1004, [0021]. Joos's driver assistance system (***drive system***)/***controller*** would be understood to include ***an accelerator pedal*** because the driver assistance system/controller, responsive to actuation of the accelerator pedal, issues control signals to the drive motor that are operable to cause the wheels to accelerate rotationally. TESLA-1004, [0002], [0008]-[0009], [0021]; TESLA-1023, [0017]-[0018]; TESLA-1003, ¶134.

As discussed in §III.C.2, *supra*, a POSITA would have implemented the vehicle in the Joos-Kischkat-Hoop combination to include one-pedal driving as taught in Hoop such that the driver would release the accelerator pedal after following the unparking trajectory to slow the vehicle to a stop at the end position E. TESLA-1003, ¶135; *supra*, §III.C.1. After the maximum or other pre-defined steering angle is set as taught in Joos, the driver assistance system/controller would offer an auto-shift to drive as taught in Kischkat. TESLA-1003, ¶135; TESLA-1004, [0015]-[0018], [0037]-[0038]; TESLA-1005, [0009], [0016], [0019]. The driver would then shift her foot from the accelerator pedal and tap/depress the brake pedal to confirm approval of the offer (***operation of the brake control for the approval indication***) to auto-shift to drive as taught in Kischkat. *Supra*, Claims 2, 10; TESLA-1005, [0010]-[0013], [0016]-[0019]; TESLA-1003, ¶135. Allowing the driver to release the accelerator pedal to brake the vehicle is also consistent with Joos's teaching that the vehicle should be stopped before shifting gears. TESLA-1004, [0016]-[0018]; TESLA-1003, ¶135. Accordingly, the Joos-Kischkat-Hoop combination further renders obvious the drive system/controller

selecting a direction for driving the wheels (forward direction in drive mode) ***in response to operation of the brake control for the approval indication including the driver's foot shifting from the accelerator pedal to tap a brake control***. *Id.*

D. GROUND 1D—Obvious based on Joos in view of Kischkat and Allexi (Claims 5, 7, 15, 17)

1. Overview of Allexi

Allexi describes an "assisted parking procedure" that includes "leaving a parking space in the… reverse direction." TESLA-1009, 4:9-15; TESLA-1003, ¶¶50-52. Allexi explains that "[p]arking maneuvers with good parking results follow a typical pattern. In addition to the pure control or steering of the vehicle, the speed of the vehicle must be within a certain range; that is, application of the rate/speed versus the distance or time results in a typical curve." TESLA-1009, 2:14-18. Accordingly, Allexi describes a vehicle with "a velocity or speed limiter limiting the speed of the vehicle during parking to a speed less than or equal to an upper speed limit." TESLA-1009, 3:18-29.

Allexi's FIG. 2 (below) illustrates the assisted parking procedure. TESLA-1009, 4:61-6:67.

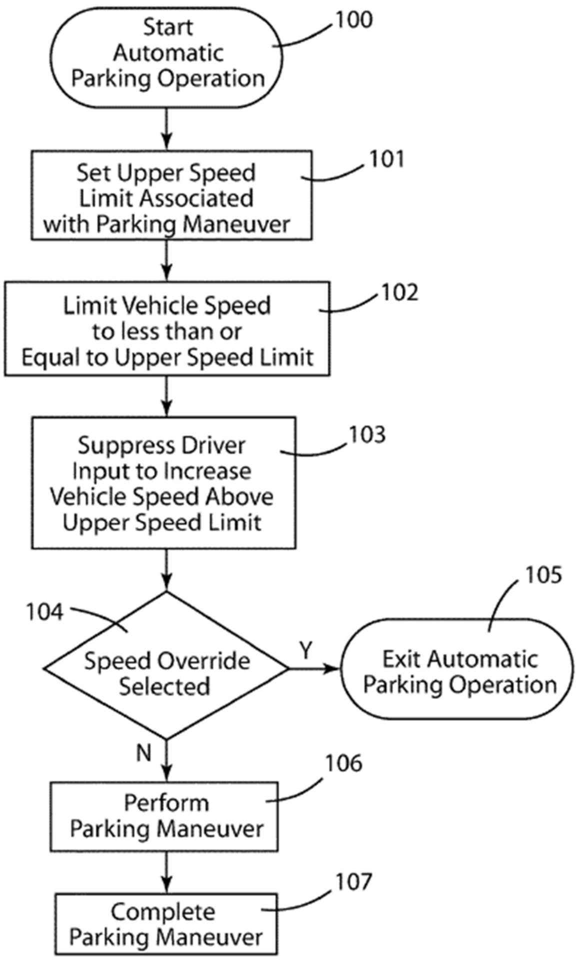
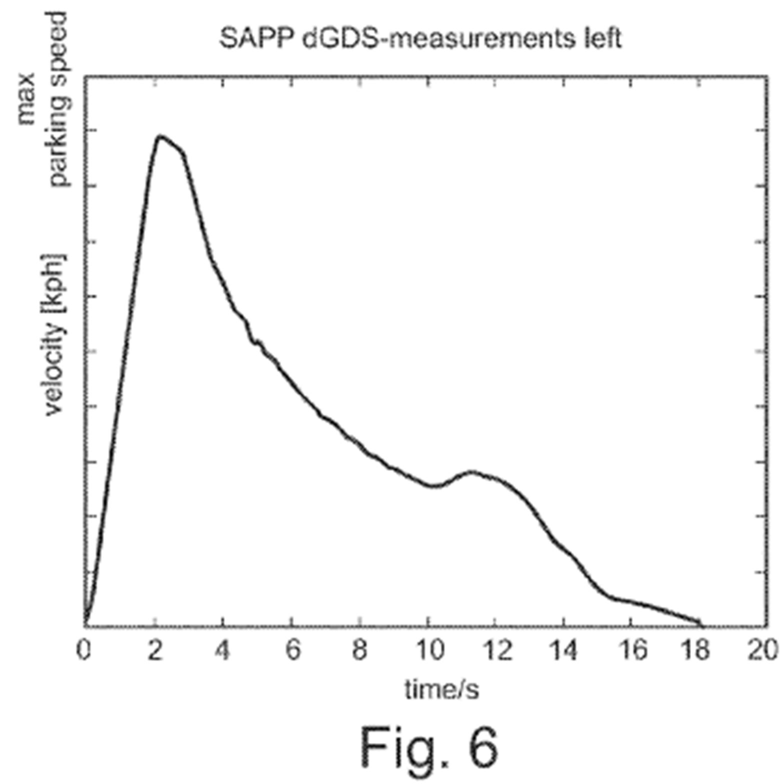


Fig. 2

TESLA-1009, FIG. 2

Allexi's FIG. 6 (below) "shows the velocity plotted against the time of the parking process." TESLA-1009, 5:59-61. "Several examples or possibilities for implementing a predefined speed profile or a dynamic speed limitation include an adjustable speed limitation device or variable speed; predefined braking interventions as a function of ultrasonic sensors to simulate a behavior shown in FIGS. 5 and 6; or use of a combination of speed limit and braking interventions especially for low speeds less than 5 km/h." TESLA-1009, 6:22-28.



TESLA-1009, FIG. 6

2. Combination of Joos, Kischkat, and Allexi

A POSITA would have found it obvious to further modify the Joos-Kischkat vehicle from Ground 1B based on Allexi to implement "a velocity or speed limiter" that would limit the speed of the vehicle during an autonomous or semi-autonomous unparking procedure to a speed less than an upper speed limit threshold. *Supra,* §III.D.1; TESLA-1009, 3:18-29, 1:51-2:49, FIG. 2; TESLA-1003, ¶136. In the resulting Joos-Kischkat-Allexi combination, the assisted unparking procedure is "cancelled" if the vehicle speed exceeds a defined speed limit. TESLA-1009, 1:34-36, 2:50-3:8, 4:61-67, 5:35-39; TESLA-1003, ¶136.

Thus, the assisted unparking procedure is maintained, and the Joos-Kischkat-Allexi vehicle would only successfully reach the target (end) position E of the unparking trajectory where an auto-shift to drive or an offer to auto-shift to drive is made, if the vehicle's velocity does not exceed the speed limit. *Supra,* §III.E.1; TESLA-1009, 3:18-29, 5:19-29, 6:16-28, FIG. 6, 4:9-15, 2:14-18, 3:18-29, 6:22-28; TESLA-1003, ¶136.

A POSITA would have been motivated to pursue the combination for multiple reasons. TESLA-1003, ¶137. Allexi explains that the application of a fixed or dynamic speed limit while "entering" or "leaving" a parking space beneficially provides "a higher degree of automation with a higher success rate, as well as enabling assisted parking on sloping or sloped surface." TESLA-1009, 2:8-10; TESLA-1003, ¶137. Allexi's technique "prevents the vehicle from travel faster than a defined or calculated speed for the calculated moving/parking path. Thus, a disruption of the parking maneuver or process based on excessive speed can be prevented. In addition, limiting the speed reduces the need for warnings to the driver to slow down and avoid disruption of the parking function." TESLA-1009, 2:35-41, 2:19-21, 4:11-15. A POSITA also would have appreciated the importance of limiting vehicle speed both during parking and unparking procedures because low speeds are characteristic of parking and unparking. TESLA-1003, ¶137 (citing TESLA-1006, [0003], [0026], [0035]).

Applying Allexi's techniques in combination with Joos and Kischkat also would have been obvious as a matter of law; indeed, the combination merely involves combining prior art elements according to known methods to yield predictable results. *KSR*, 550 U.S. at 415-421. A POSITA would have reasonably expected success implementing the combination. TESLA-1003, ¶138. Indeed, Joos, Kischkat, and Allexi each describe autonomous or semi-autonomous parking/unparking systems and adding a velocity limiter to a similar system would have been well within the skill of a POSITA. *Id.*

3. Claim Element Analysis

(a) Claims 5 and 15

Joos-Kischkat-Allexi renders obvious Claims 5 and 15. TESLA-1003, ¶139. As discussed above in §III.D.2, a POSITA would have implemented the Joos-Kischkat-Allexi vehicle to include a velocity or speed limiter that limits the speed of the vehicle during unparking to a speed less than or equal to an upper speed limit, as suggested by Allexi. *Supra,* §III.D.1-2; TESLA-1009, 3:18-29, 1:51-2:49, 4:54-5:18, FIG. 2; TESLA-1003, ¶140. In the combination, Allexi teaches that the unparking procedure is "cancelled" if the vehicle speeds during travel exceed a defined speed limit. TESLA-1009, 1:34-36, 2:50-3:8, 4:61-67, 5:35-39; TESLA-1003, ¶140. Thus, the unparking procedure is maintained, and the vehicle only successfully reaches the target (end) position of the unparking trajectory where the offer for auto-shift to drive occurs, if the vehicle's velocity does not exceed the speed limit (***offer a driver a change in the drive direction only if a vehicle velocity is below a selected velocity threshold***). TESLA-1009, 4:9-15, 2:14-21, 3:18-29, 6:21-28, FIGs. 2-3, 5-6; TESLA-1003, ¶140. Requiring that the vehicle speed be limited is also consistent with Joos's teaching that the vehicle be stopped before auto-shifting to engage the forward gear. TESLA-1004, [0016]-[0018]; TESLA-1003, ¶140.

(b) Claims 7 and 17

Joos-Kischkat-Allexi renders obvious Claims 7 and 17. TESLA-1003, ¶141. To the extent Joos-Kischkat does not explicitly disclose the additional features recited in Claims 7 and 17, they still would have been rendered obvious by the Joos-Kischkat-Allexi combination based on the additional teachings from Allexi. TESLA-1003, ¶142. In the combination, Allexi teaches that the vehicle can be determined to reach its endpoint during a parking/unparking process, and the vehicle can be caused to slow to a stop at the endpoint, based on the distance traveled by the vehicle. TESLA-1009, 3:9-17, 6:33-53, 2:14-18, 2:31-42, FIG. 5.

As another example, Allexi discloses use of a "distance-to-travel calculated from planned trajectory" to determine the "hold point of the vehicle" where the vehicle is stopped at the end of the unparking process, which a POSITA would have understood to be equivalent to a calculated distance traveled since the distance-to-travel is simply the distance of the planned trajectory minus the distance traveled. TESLA-1009, 6:33-44; TESLA-1003, ¶143. The distance traveled would thus be obvious substitutes in Allexi's calculations of distance-to-travel, either of which could be used for the same purpose. *Id.* Limiting the distance traveled so as not to overshoot the calculated end position was also a well-known safety precaution for autonomous or semi-autonomous parking/unparking procedures, which would have further motivated a POSITA to condition the auto-shift based on distance traveled. *Id.* (citing TESLA-1010, [0002], [0041], [0069], [0054]-[0056], [0076]). The Joos-Kischkat-Allexi vehicle drive system/controller would thus limit the velocity of the vehicle to zero to cause the vehicle to stop at the end position E of the unparking procedure based on the distance traveled by the vehicle. And because the driver assistance system/controller does not change the drive direction to the forward gear until the vehicle reaches the end position E and all other conditions are satisfied (*e.g.,* setting the specified steering angle), the Joos-Kischkat-Allexi drive system/controller is ***operable to offer a driver a change in the drive direction based at least in part on distance traveled***. *Id*.

E. GROUND 2A—Obvious based on Joos in view of Bettger (Claim 1, 6, 11, 16)

1. Overview of Bettger

Bettger describes "assisted performance of a reverse-turning maneuver of a vehicle." TESLA-1006, [0002], [0036]; TESLA-1003, ¶54. In Bettger, if "the driver of the vehicle agrees with executing the reverse-turning maneuver, he confirms the same by… carrying out a certain steering movement, for example, a steering movement of an angle which lies above a certain threshold value and which corresponds to the steering movement that is necessary for carrying out the reverse-turning maneuver." TESLA-1006, [0044], [0021]. "Receipt by the processing unit 14 of the driver's confirmation causes the processing unit to perform computerized determination and outputting of instructions for carrying out the reverse-turning maneuver." TESLA-1006, [0045], [0017]. When the vehicle's orientation permits travelling in a forward direction, a vehicle dynamics controller 18 selects "the appropriate transmission gear range" and shifts gears from the REVERSE range "to the DRIVE range" so that the "vehicle can now continue travelling rapidly forwards." TESLA-1006, [0047], [0045].

2. Combination of Joos and Bettger

It would have been obvious to modify Joos in view of Bettger's suggestion for the driver to confirm initiation of an assisted reverse-turning maneuver based on the driver's steering input to the vehicle. TESLA-1003, ¶144. In the combination, the Joos-Bettger vehicle would initiate Joos's autonomous or semi-autonomous unparking maneuver—*i.e.*, a type of reverse-turning maneuver like those taught in Bettger—only following confirmation by the driver. TESLA-1006,

[0021], [0043]-[0047], FIGs. 1-2; TESLA-1003, ¶145. More specifically, the driver would provide confirmation by "carrying out a certain steering movement, for example, a steering movement of an angle which lies above a certain threshold value and which corresponds to the steering movement that is necessary for carrying out the reverse-turning maneuver." TESLA-1006, [0044]. For example, in the combination, while the vehicle is parked, or even after the driver begins reversing from the parking space, "[i]f it is determined that the maneuver is permitted, an audible, haptic or visible signal may be output to the driver of the vehicle." TESLA-1006, [0043]. The driver would then signal confirmation to initiate the maneuver (or at least initiate the assisted maneuver) by "carrying out a certain steering angle movement" that "corresponds to the steering movement" for carrying out the unparking maneuver (*e.g.*, steering angle movement for following Joos's "predetermined" "unparking trajectory"). *Id.*, [0044]. In response to this initiating steering movement, the driver assistance system would intervene in one or more aspects of the vehicle's operation (*e.g.*, steering, acceleration, braking) to carry out Joos's autonomous or semi-autonomous unparking maneuver. TESLA-1004, [0008], [0017]; TESLA-1006, [0044]-[0047].

Once the vehicle arrives and stops at the end position of Joos's unparking trajectory, and the pull-forward steering angle is set as taught in Joos, the controller of the driver assistance system in the Joos-Bettger vehicle changes from the reverse mode to drive mode by auto-shifting from a reverse gear to a drive gear as taught in each of Joos and Bettger. TESLA-1004, [0017], [0038]; TESLA-1006, [0045], [0047]. Because the driver's steering input that sets a steering angle greater than a threshold as taught in Bettger triggers initiation of the assisted unparking maneuver that culminates in auto-shifting from reverse to drive at the end position E as taught in Joos, the controller/driver assistance system in the Joos-Bettger vehicle initiates the assisted unparking maneuver and shifts from reverse to drive at the end position E in response to the initiating steering input. TESLA-1003, ¶146. Multiple reasons would have prompted a POSITA to implement Joos in accordance with Bettger's teachings in this manner. *Id*.

First, Bettger's approach would promote safety and improve the user experience by allowing the driver to confirm that an assisted reverse-turning unparking maneuver should be initiated by adjusting the steering angle by at least a threshold value. TESLA-1003, ¶147. As Bettger explains, by requiring driver confirmation, "unintentional performance of a reverse-turning maneuver can advantageously be prevented." TESLA-1006, [0021]. Thus, Bettger's driver confirmation allows the driver to retain control in accepting/rejecting a proposed unparking maneuver before the driver assistance system/controller initiates the maneuver (or intervenes to assist in the maneuver), rather than leaving the determination entirely up to the vehicle. TESLA-1006, [0043]-[0044]; TESLA-

1003, ¶147. Indeed, a POSITA would have expected Bettger's solution to enhance drivers' overall satisfaction with the driver assistance system since the system would be restricted from initiating the assisted unparking maneuver without the driver's awareness and confirmation. *Id.*

Second, a POSITA would have applied Bettger's suggestion to require driver confirmation for initiating an assisted unparking maneuver to ensure valets, new drivers, or others who are unfamiliar with the driver assistance system are better capable of operating the vehicle and are not surprised by unexpected autonomous driving by the vehicle. TESLA-1003, ¶148.

Third, a POSITA would have combined Joos and Bettger as described above because Bettger's suggestion for allowing the driver to confirm initiation of an unparking maneuver via a steering input that "corresponds to the steering input that is necessary for carrying out the reverse-turning maneuver" provides a convenient and natural confirmation mechanism that avoids burdening the driver with offering confirmation via other controls that are not normally used when reversing the vehicle. TESLA-1003, ¶149.

Fourth, a POSITA would have pursued the combination because it merely involves the application of known techniques (*e.g.*, Bettger's confirmatory steering input to initiate an unparking maneuver) to improve a conventional system (*e.g.*, Joos's autonomous or semi-autonomous unparking assistant) to achieve predictable results. *KSR*, 550 U.S. at 421; *Intel Corp.*, 61 F.4th at 1380-81; TESLA-1003, ¶150.

A POSITA would have reasonably expected success implementing the combination at least because Joos and Bettger each describes driver assistance systems designed for use in similar contexts (*e.g*., reverse-turning unparking maneuvers). TESLA-1003, ¶150. Because Joos's motor vehicle already includes a driver assistance system and associated steering controls, it would be well suited to implement Bettger's techniques. *Id.* The combination entails no more than predictable electromechanical and software adaptations that were well within the skill of a POSITA to implement by the Critical Date. *Id.*

3. Claim Element Analysis

Ground 2A incorporates the analysis of Ground 1A. Where Ground 1A relies on the teachings of Joos, Ground 2A relies on the combined teachings of Joos and Bettger. Integration of Bettger in Joos does not disturb the mapping of Joos's teachings to each of the claim elements in claims 1, 6, 11, and 16 addressed in Ground 1A but not addressed below because the Joos-Bettger combination maintains the aspects of Joos's teachings mapped to these claim elements in Ground 1A. For brevity, only claim elements whose mappings are materially affected by the integration of Bettger in the combination are addressed below. TESLA-1003, ¶151.

(a) Elements 1[f] and 11[f]

Joos-Bettger renders obvious 1[f] and 11[f]. TESLA-1003, ¶152. As discussed above in §III.E.2, the controller of the driver assistance system of the Joos-Bettger vehicle initiates Joos's assisted unparking maneuver—*i.e.*, a type of reverse-turning maneuver like those taught in Bettger and Joos—only following confirmation by the driver as taught in Bettger. TESLA-1006, [0021], [0043]-[0047], FIGs. 1-2. More specifically, the driver would provide confirmation by "carrying out a certain steering movement, for example, a steering movement of an angle which lies above a certain threshold value and which corresponds to the steering movement that is necessary for carrying out the reverse-turning maneuver." TESLA-1006, [0044]; *supra*, VIII.A. In the combination, the "the steering movement that is necessary for carrying out" Joos's assisted unparking (reverse-turning) maneuver includes a steering movement that is necessary to reverse the vehicle to the target (end) position E of the unparking trajectory 9. TESLA-1004, [0008]-[0009], FIG. 2. As Joos shows in FIG. 2, this steering movement involves turning the wheels to the right while reversing. *Id.* Once the vehicle reaches and stops at the target (end) position E, a steering angle movement is made to turn the wheels in the opposite direction in anticipation that the driver will pull forward from the end position while maintaining this steering angle. TESLA-1004, [0010], [0015]-[0018], [0037]-[0038]. Because the steering movement in a first direction (*e.g.*, right) to confirm initiation of the unparking maneuver (as taught in Bettger) and then the steering movement in the opposite direction (*e.g.*, left) at the target (end) position E (as taught in Joos) must be carried out for the drive system/controller to select to engage the forward gear for a forward driving direction, Joos-Bettger's drive system/controller is ***operable to select a direction for driving the wheels in response to steering angle movements***. TESLA-1003, ¶153; *supra*, Ground 1A at 1[f], [4]. This is accomplished ***without operator indication of a direction*** for the reasons previously discussed. *Supra*, Ground 1A at 1[f].

(b) Claims 6 and 16

Supra, Ground 2A at 1[f]. TESLA-1003, ¶154.

F. GROUND 2B—Obvious based on Joos in view of Bettger and Kischkat (Claims 2, 4-5, 7-10, 12, 14-15, 17-20)

1. Combination of Joos, Bettger, and Kischkat

It would have been obvious to combine Joos (as modified by Bettger (*supra*, §III.E.2)) with Kischkat for the reasons described above in Ground 1B. *Supra*, §III.B.2; TESLA-1003, ¶155. The resulting Joos-Bettger-Kischkat combination maintains the functionality of the Joos-Bettger combination from Ground 2A but further adds Kischkat's techniques as described above in Ground 1B. *Id.* The Joos-Bettger-Kischkat combination provides the additional features recited in claims 2, 4-5, 7-10, 12, 14-15, and 17-20 for each of the reasons described above for the same claims in Ground 1B. *Supra*, §III.B.3 (Claims 2, 4-5, 7-10, 12, 14-15, 17-20); TESLA-1003, ¶155. The Joos-Bettger-Kischkat combination also provides claims 4 and 14 for the reasons discussed below. *Id.*

2. Claim Element Analysis

(a) Claims 4 and 14

Joos-Bettger-Kischkat renders obvious Claims 4 and 14. TESLA-1003, ¶156. Bettger teaches that the driver provides confirmation by "carrying out a certain steering movement, for example, a steering movement of an **angle which lies above a certain threshold value**." TESLA-1006, [0043]-[0044]. Because this steering movement must be made in the Joos-Bettger-Kischkat-combination for the assisted unparking procedure to be initiated and for the offer to auto-shift to be made (the offer is part of the assisted unparking procedure), ***the drive system/controller is operable to offer a driver a change in the drive direction only in response to detecting a steering input greater than a selected steering angle threshold***. TESLA-1003, ¶157; *supra,* §§III.E.1, III.E.2, III.B.2. Joos also teaches that the steering angle set at the end position E is a "maximum" angle that is greater than a selected threshold below the maximum. TESLA-1004, [0015], [0037]-[0039]; TESLA-1003, ¶157.

G. GROUND 2C—Obvious based on Joos in view of Bettger, Kischkat, and Hoop (Claims 3, 13)

It would have been obvious to combine Joos (as modified by Bettger and

Kischkat (*supra*, §§III.E.2, III.B.2)) with Hoop for the reasons described above in Ground 1C. *Supra*, §III.C.2; TESLA-1003, ¶158. The resulting Joos-Bettger-Kischkat-Hoop combination maintains the functionality of the Joos-Bettger-Kischkat combination from Ground 2B but further adds Hoop's techniques as described above in Ground 1C. *Id.* The Joos-Bettger-Kischkat-Hoop combination provides the additional features recited in claim 3 for each of the reasons described above for the same claims in Ground 1C. *Supra*, §III.C.3 (Claims 3 and 13); TESLA-1003, ¶158.

H. GROUND 2D—Obvious based on Joos in view of Bettger, Kischkat, and Allexi (Claims 5, 7, 15, 17)

It would have been obvious to combine Joos (as modified by Bettger and Kischkat (*supra*, §§III.E.2, III.B.2)) with Allexi for the reasons described above in Ground 1D. *Supra*, §III.D.2; TESLA-1003, ¶159. The resulting Joos-Bettger-Kischkat-Allexi combination maintains the functionality of the Joos-Bettger-Kischkat combination from Ground 2B but further adds Allexi's techniques as described above in Ground 1D. *Id.* The Joos-Bettger-Kischkat-Allexi combination provides the additional features recited in claims 5, 7, 15, and 17 for each of the reasons described above for the same claims in Ground 1D. *Supra*, §III.D.3 (Claims 5, 7, 15, 17); TESLA-1003, ¶159.

I. GROUND 3A—Obvious based on Joos in view of Bayer (Claims 1, 6, 11, 16)

1. Overview of Bayer

Bayer describes "a parking aid for a motor vehicle" that continuously adjusts the torque applied to the steering wheel to assist a driver in steering the vehicle along a planned trajectory during a parking maneuver. TESLA-1007, [0001]; TESLA-1003, ¶¶56-57. Bayer's motor vehicle includes "a vehicle steering [system] with a manual steering wheel and a steering torque regulating module by which a steering torque can be impressed upon the steering wheel" to provide "driver steering assistance." TESLA-1007, [0001]-[0003], [0006], [0012], [0024]. In Bayer, a steering angle control module calculates a trajectory for a parking maneuver and provides steering assistance to the driver that will cause "the vehicle [to] move[] on [the] trajectory." TESLA-1007, [0049], [0054]. Bayer's "parking aid gives the driver… handling instructions for steering through an additional steering torque. This haptic feedback supports the driver in parking in a manner that is convenient for him." TESLA-1007, [0013], [0024]. "If the driver follows the handling instructions for steering, *i.e.*, correctly implements the corresponding steering instructions applied through the additional steering torque, the driver will certainly be in agreement with the steering operation." TESLA-1007, [0014], [0016]-[0018], [0020]-[0021]. The vehicle can also "be braked as a function of the driver recognition" and "as soon as the driver's torque has exceeded a threshold value." TESLA-1007, [0065]. "In this case the vehicle is stopped until the correct steering torque prevails again," which "makes it difficult to or even prevents the driver from unintentionally departing from the preselected trajectory." *Id.*; *see also id.*, [0043], [0056]-[0057].

2. Combination of Joos and Bayer

A POSITA would have found it obvious to integrate Bayer's "driving steering assistance" techniques in Joos's semi-autonomous vehicle and unparking system. TESLA-1003, ¶160; *supra*, §§III.A.1, III.I.1. In the resulting combination, Joos's controller of the "driver assistance system" would implement Bayer's "driving steering assistance" techniques such that the driver would be guided in steering the vehicle along a prescribed unparking trajectory as taught in Joos to the targeted "end position E" of the unparking trajectory. TESLA-1004, [0008], [0010], [0016]-[0018], FIG. 2; TESLA-1003, ¶160. Consistent with Bayer's teachings, the steering assistance would be indicated at least in part by "a steering torque applied to the steering wheel" and/or "steering stops" that would aid the driver in maintaining or adjusting the angle of the steering wheel while reversing to the angle(s) needed for the vehicle to be correctly steered along the unparking trajectory to the end position E. TESLA-1007, [0028], [0001]-[0006], [0049], [0054], [0064]-[0065], Abstract; TESLA-1003, ¶160.

The Joos-Bayer vehicle would further include a "driver recognition module" and related capabilities as taught in Bayer "to determine whether the driver is properly monitoring" the unparking procedure and to check whether the driver is providing either not enough or too much force to the steering wheel. TESLA-1005, [0045], [0046], [0057]-[0058], [0065]; TESLA-1003, ¶160. Bayer's techniques would thus allow Joos's vehicle to attain the benefit of semi-autonomous steering interventions—*i.e.*, a type of intervention that Joos explicitly acknowledged was a suitable solution. TESLA-1004, [0008] ("the driver assistance system interven[ing] in the steering").

Multiple reasons would have motivated a POSITA to pursue the combination before the alleged invention of the '458 Patent. TESLA-1003, ¶161.

First, a POSITA would have applied Bayer's steering assistance in Joos to assist drivers in properly following Joos's unparking trajectory, thereby improving the driver's ability to consistently, reliably, and efficiently reach the target end position of the trajectory. TESLA-1003, ¶162. Joos explains that "[d]uring the unparking, the motor vehicle is [maneuvered] from a parked position in the cross-parking space onto the road bounding on the cross-parking space" by following a "predetermined" unparking trajectory. TESLA-1004, [0008]. "The motor vehicle is moved along the unparking trajectory until it has reached an end position," which is "defined at least as a position such that in the event of further movement from the end position…, manual driving of the motor vehicle can be carried out by a vehicle driver in a driving direction determined by the road." *Id.*, [0006], [0008]-

[0009]. Joos requires the motor vehicle to reach the targeted end position for the unparking maneuver to be completed, meaning that it is important for the vehicle to reliably reach the end position if Joos's unparking procedure is to be successfully completed on a consistent basis. TESLA-1003, ¶162. Bayer's steering assistance techniques would predictably aid the driver in operating the vehicle to follow a trajectory to the end position, especially since Bayer's techniques are specifically designed for this purpose. TESLA-1007, [0065], [0049], [0054], [0064], [0075].

Second, a POSITA would have applied Bayer's steering assistance to Joos to increase safety by ensuring the driver remains engaged during the unparking maneuver and ready to assume control of the vehicle at a moment's notice. TESLA-1003, ¶163. Bayer explains that "[f]ully automatic" steering assist systems (which could be employed even in a semi-autonomous vehicle where the driver is responsible for acceleration and/or braking) "entail the risk that the driver feels relieved of responsibility," which "could lead to an accident in the event of a system failure." TESLA-1007, [0008]. Bayer's steering assistance techniques, by contrast, "supports the driver and at the same time ensures that the driver can control the vehicle and thus retains responsibility" for the unparking procedure. *Id.*, [0009].

Third, a POSITA would have applied Bayer's steering assistance to Joos to increase safety through a driver recognition module that would monitor the driver's compliance with the steering instructions and allow the driver to quickly abort a trajectory (*e.g.*, to avoid collisions or for any other reason). TESLA-1003, ¶164. For example, Bayer explains that "[t]he vehicle may… be braked as a function of the driver recognition… as soon as the driver's torque has exceeded a threshold value." TESLA-1007, [0065]. "The… procedure is also terminated if the maximum torque of the artificial steering stop has been exceeded and the vehicle has come to a stop." *Id.*, [0068], [0064]-[0070].

<u>Fourth</u>, a POSITA would have applied Bayer's steering assistance techniques in Joos because Bayer's techniques beneficially provide "haptic feedback [that] supports the driver in parking in a manner that is convenient for him." TESLA-1007, [0013]; TESLA-1003, ¶165.

<u>Fifth</u>, a POSITA would have pursued the Joos-Bayer combination because it merely involves the application of known techniques (*e.g.*, Bayer's steering assistance techniques) to improve a known system (*e.g.*, Joos's semi-autonomous parking system) to achieve predictable results. *KSR*, 550 U.S. at 421; *Intel*, 61 F.4th at 1380-81. Here, there were known problems associated with driver assistance systems available as of the Critical Date that fully relieved the driver of responsibility for steering during an autonomous or semi-autonomous parking/unparking maneuver like that described in Joos. TESLA-1007, [0008]-

[0009]; TESLA-1004, [0008]. Bayer's techniques helped address that problem (and provided the other benefits discussed above). TESLA-1003, ¶166.

A POSITA would have reasonably expected success implementing the Joos-Bayer combination, especially as Joos and Bayer both describe driver steering assistance systems designed for use in similar contexts (*e.g.*, parking/unparking maneuvers). TESLA-1003, ¶167. Bayer also confirms that its techniques can be applied broadly to a range of different motor vehicles including "compact vehicles having electric servo steering with an electronic brake system" and in "vehicles having hydraulic servo steering." TESLA-1007, [0071]-[0072]. Because Joos's motor vehicle already includes a driver assistance system and associated steering and braking controls, it would be well suited to implement Bayer's techniques. TESLA-1003, ¶168. The combination entails no more than predictable electromechanical and software adaptations that were well within the skill of a POSITA by the Critical Date. *Id.*

3. Claim Element Analysis

Ground 3A incorporates the analysis of Ground 1A. Where Ground 1A relies on the teachings of Joos, Ground 3A relies on the combined teachings of Joos and Bayer. Integration of Bayer in Joos does not disturb the mapping of Joos's teachings to each of the claim elements in claims 1, 6, 11, and 16 addressed in Ground 1A but not addressed below because the Joos-Bayer combination maintains the aspects of Joos's teachings mapped to these claim elements in Ground 1A. For brevity, only claim elements whose mappings are materially affected by the integration of Bayer in the combination are addressed below. TESLA-1003, ¶169.

(a) Elements 1[f] and 11[f]

Joos-Bayer renders obvious 1[f] and 11[f]. TESLA-1003, ¶170. As described above (*supra*, §III.A.2(g) (Ground 1A at 1[f])), Joos's drive system/controller ***selects a direction for driving the wheels in response to steering angle movements, without operator indication of a direction***, where the steering angle movements include **(1)** steering in a first direction (*e.g.*, right) while reversing to reach the end position E of the unparking maneuver and **(2)** steering in the opposite direction (*e.g.*, left) at the end position E to set "a predetermined or adjusted steering angle," e.g., "a maximum steering angle," for the anticipated forward movement of the vehicle when manual control of the vehicle is returned to the driver at the end of the unparking maneuver. TESLA-1004, [0010], [0014]-[0015], [0037]-[0038], FIG. 2; *supra*, §III.A.2(g) TESLA-1003, ¶171. In the combination, Bayer further teaches a parking/unparking procedure in which a steering assistance system guides the driver in steering the vehicle to follow a prescribed trajectory like Joos's unparking trajectory 9. TESLA-1007, [0001]-[0003], [0006], [0012], [0016]-[0018], [0020]-[0021], [0024], [0065]; *supra*, III.I.1.

The Joos-Bayer vehicle provides these same steering angle movements as Joos, except that the driver steers the vehicle during the unparking maneuver guided by Bayer's steering assistance. *Supra*, III.I.2. The ***steering angle movements*** in the Joos-Bayer combination corresponds to the sequence of steering angle movements provided by the driver in compliance with the prescribed steering torque adjustments and steering stops indicated by Bayer's steering assistance necessary to follow Joos's unparking trajectory and set the pull-forward steering angle at the end position E. *Id.* The Joos-Bayer drive system/controller is operable to select a drive direction by auto-shifting to drive at the end position E in response to the steering angle movements for each of the reasons discussed above (*supra*, §III.A.2(g) (Ground 1A at 1[f])), and further because Bayer's technique enforces compliance with the steering assistance; otherwise, the maneuver is aborted or the vehicle is stopped. TESLA-1007, [0020]-[0021], [0043], [0056]-[0057], [0065]; TESLA-1003, ¶172.

(b) Claims 6 and 16

Supra, Ground 3A at 1[f]. TESLA-1003, ¶173.

J. GROUND 3B—Obvious based on Joos in view of Bayer and Kischkat (Claims 2, 4-5, 7-10, 12, 14-15, 17-20)

It would have been obvious to combine Joos (as modified by Bayer (*supra*,

§III.I.2)) with Kischkat for the reasons described above in Ground 1B. *Supra*, §III.B.2; TESLA-1003, ¶174. The resulting Joos-Bayer-Kischkat combination maintains the functionality of the Joos-Bayer combination from Ground 3A but further adds Kischkat's techniques as described above in Ground 1B. *Id.* The Joos-Bayer-Kischkat combination provides the additional features recited in claims 2, 4-5, 7-10, 12, 14-15, and 17-20 for each of the reasons described above for the same claims in Ground 1B and for additional reasons described below. *Supra*, §III.B.3 (Claims 2, 4-5, 7-10, 12, 14-15, 17-20); TESLA-1003, ¶174.

1. Claim Element Analysis

(a) Claims 4 and 14

Joos-Bayer-Kischkat renders obvious Claims 4 and 14. *Supra*, §III.B.3(b); TESLA-1003, ¶175. The steering angle in the combination may also be set by the driver as a ***steering input*** guided by steering torque indicators provided in accordance with Bayer's steering assistance techniques. *Supra*, §III.I.1-2; TESLA-1003, ¶176.

K. GROUND 3C—Obvious based on Joos in view of Bayer, Kischkat, and Hoop (Claims 3, 13)

It would have been obvious to combine Joos (as modified by Bayer and Kischkat (*supra*, §§III.I.2, III.B.2)) with Hoop for the reasons described above in Ground 1C. *Supra*, §III.C.2; TESLA-1003, ¶177. The resulting Joos-Bayer-Kischkat-Hoop combination maintains the functionality of the Joos-Bayer-

Kischkat combination from Ground 3B but further adds Hoop's techniques as described above in Ground 1C. *Id.* The Joos-Bayer-Kischkat-Hoop combination provides the additional features recited in claims 3 and 13 for each of the reasons described above for the same claims in Ground 1C. *Supra*, §III.C.3 (Claims 3 and 13); TESLA-1003, ¶177.

L. GROUND 3D—Obvious based on Joos in view of Bayer, Kischkat, and Bettger (Claims 4, 14)

It would have been obvious to combine Joos (as modified by Bayer and Kischkat (*supra*, §§III.I.2, III.B.2)) with Bettger for the reasons described above in Grounds 2A and 2B. *Supra*, §§III.E.2, III.F.1; TESLA-1003, ¶178. The resulting Joos-Bayer-Kischkat-Bettger combination maintains the functionality of the Joos-Bayer-Kischkat combination from Ground 3B but further adds Bettger's techniques as described above in Ground 2A. *Id.* The Joos-Bayer-Kischkat-Bettger combination provides the additional features recited in claims 4 and 14 for each of the reasons described above for the same claims in Grounds 2A and 2B. *Supra*, §III.F.2 (Claims 4 and 14); TESLA-1003, ¶178.

M. GROUND 3E—Obvious based on Joos in view of Bayer, Kischkat, and Allexi (Claims 5, 7, 15, 17)

It would have been obvious to combine Joos (as modified by Bayer and Kischkat (*supra*, §§III.I.2, III.B.2)) with Allexi for the reasons described above in Ground 1D. *Supra*, §III.D.2; TESLA-1003, ¶179. The resulting Joos-Bayer-

Kischkat-Allexi combination maintains the functionality of the Joos-Bayer-Kischkat combination from Ground 3B but further adds Allexi's techniques as described above in Ground 1D. *Id.* The Joos-Bayer-Kischkat-Allexi combination provides the additional features recited in claims 5, 7, 15, and 17 for each of the reasons described above for the same claims in Ground 1D. *Supra*, §III.D.3 (Claims 5, 7, 15, 17); TESLA-1003, ¶179.

IV. CONCLUSION AND FEES

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

V. 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 real party-in-interest.

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

The ’458 Patent is the subject of civil action *Bulletproof Property Management, LLC v. Tesla, Inc. et al.,* Case No. 1:25-cv-00665 (W.D. Tex.) filed May 5, 2025 (“Texas Litigation”). Petitioner is not aware of any disclaimers, reexamination certificates, or IPR petitions addressing the ’458 Patent.

The ’458 Patent is one of seven related patents that Bulletproof asserts in the Texas Litigation. Petitioner is filing IPR petitions on each of the seven asserted patents in the following proceedings:

Patent No.	IPR Proceeding No.
11,932,230	IPR2026-00227
12,221,104	IPR2026-00219
12,227,184	IPR2026-00204
12,233,871	IPR2026-00222
12,240,456	IPR2026-00228
12,240,457	IPR2026-00205
12,240,458	IPR2026-00229

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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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 13,944 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

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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 January 23, 2026, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided by USPS Priority Express, to the Patent Owner, by serving the correspondence address of record as follows:

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