IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Langlotz	Attorney Docket No. 49649-0061IP1
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Filing Date:	October 27, 2024	
Title:	VEHICLE GEAR SELECTION CONTROL	

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PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT NO. 12,240,457 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 method of operating a motor vehicle having a steering control and a drive system operable to selectably drive wheels in a drive mode and in a reverse mode, the method comprising:
1[a]	the drive system monitoring the steering control while driving in a first direction;
1[b]	the drive system offering a driver a change from one of the drive mode and reverse mode to the other of the drive mode and reverse mode based on the steering control; and
1[c]	the drive system changing from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode in response to an approval by the driver of the offered change.
Claim 2	
2	The method of claim 1 wherein the drive system offering the driver the change from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode is based on a pattern of steering control movements.
Claim 3	
3	The method of claim 1 wherein the drive system offering the driver the change from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode is based on a sequence of steering control movements.
Claim 4	
4	The method of claim 1 wherein the motor vehicle includes a brake control connected to the drive system and operable by the driver to generate a brake input transmissible to the drive system, the method including the drive system changing between modes in response to actuation of the brake control.
Claim 5	
5	The method of claim 1 wherein the drive system includes an accelerator pedal operable to slow the vehicle in response to release of

	the accelerator pedal, and wherein the method includes the drive system changing between modes in response to the driver's foot shifting from the accelerator pedal to tap a brake control.
Claim 6	
6	The method of claim 1 including the drive system offering the driver a change from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode only in response to detecting a steering input greater than a selected steering angle threshold.
Claim 7	
7	The method of claim 1 including the drive system offering the driver the change from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode only if a vehicle velocity is below a selected velocity threshold.
Claim 8	
8	The method of claim 1 including the drive system offering the driver the change from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode based at least in part on distance traveled.
Claim 9	
9	The method of claim 1 including the drive system changing the drive direction without driver indication of a direction other than approval of the offered change in direction.
Claim 10	
10	The method of claim 1 including the drive system changing from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode without operation of a selector by the driver.
Claim 11	
11	The method of claim 1 wherein the motor vehicle includes a brake control connected to the drive system and operable by the driver to generate a brake input transmissible to the drive system, the method including changing drive direction in response to driving the first direction with steering angle in a first steering direction, then to changing steering to an opposite second steering direction, and to

	operation of the brake control by the driver
Claim 12	
12[p]	A method of operating a motor vehicle having a steering control and a controller operable to selectably drive wheels in a drive mode and in a reverse mode, the method comprising:
12[a]	the controller monitoring the steering control while driving in a first direction;
12[b]	the controller offering a driver a change from one of the drive mode and reverse mode to the other of the drive mode and reverse mode based on the steering control; and
12[c]	the controller changing from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode in response to an approval by the driver of the offered change.
Claim 13	
13	The method of claim 12 wherein the controller offering the driver the change from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode is based on a pattern of steering control movements.
Claim 14	
14	The method of claim 12 wherein the controller offering the driver the change from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode is based on a sequence of steering control movements.
Claim 15	
15	The method of claim 12 wherein the motor vehicle includes a brake control connected to the controller and operable by the driver to generate a brake input transmissible to the controller, the method including the controller changing between modes in response to actuation of the brake control.
Claim 16	
16	The method 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 the method includes the controller changing between modes in response to the driver's foot shifting from the accelerator pedal to tap a brake control.
Claim 17	
17	The method of claim 12 including the controller offering the driver a change from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode only in response to detecting a steering input greater than a selected steering angle threshold.
Claim 18	
18	The method of claim 12 including the controller offering the driver the change from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode only if a vehicle velocity is below a selected velocity threshold.
Claim 19	
19	The method of claim 12 including the controller offering the driver the change from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode based at least in part on distance traveled.
Claim 20	
20	The method of claim 12 including the controller changing the drive direction without driver indication of a direction other than approval of the offered change in direction.
Claim 21	
21	The method of claim 12 including the controller changing from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode without operation of a selector by the driver.
Claim 22	
22	The method of claim 12 wherein the motor vehicle includes a brake control connected to the controller and operable by a driver to generate a brake input transmissible to the controller, the method including changing drive direction in response to driving the first direction with steering angle in a first steering direction, then to

	changing steering to an opposite second steering direction, and to operation of the brake control by the driver.

Tesla, Inc. ("Petitioner" or "Tesla") petitions for *Inter Partes* Review ("IPR") of claims 1-22 ("the Challenged Claims") of U.S. Patent No. 12,240,457 ("the '457 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 '457 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-3C 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	1-4, 6-15, 17-22	Joos in view of Kischkat
1B	5, 16	Joos in view of Kischkat and Hoop
1C	7-8, 18-19	Joos in view of Kischkat and Allexi
2A	1-4, 6-15, 17-22	Joos in view of Kischkat and Bettger

Ground	Claim(s)	35 U.S.C. § 103
2B	5, 16	Joos in view of Kischkat, Bettger, and Hoop
2C	7-8, 18-19	Joos in view of Kischkat, Bettger, and Allexi
3A	1-4, 6-15, 17-22	Joos in view of Kischkat and Bayer
3B	5, 16	Joos in view of Kischkat, Bayer, and Hoop
3C	7-8, 18-19	Joos in view of Kischkat, Bayer, and Allexi

The earliest possible priority date of the '457 Patent is June 5, 2023 ("Critical Date"). Each of the references in Grounds 1A-3C pre-dates the Critical Date.

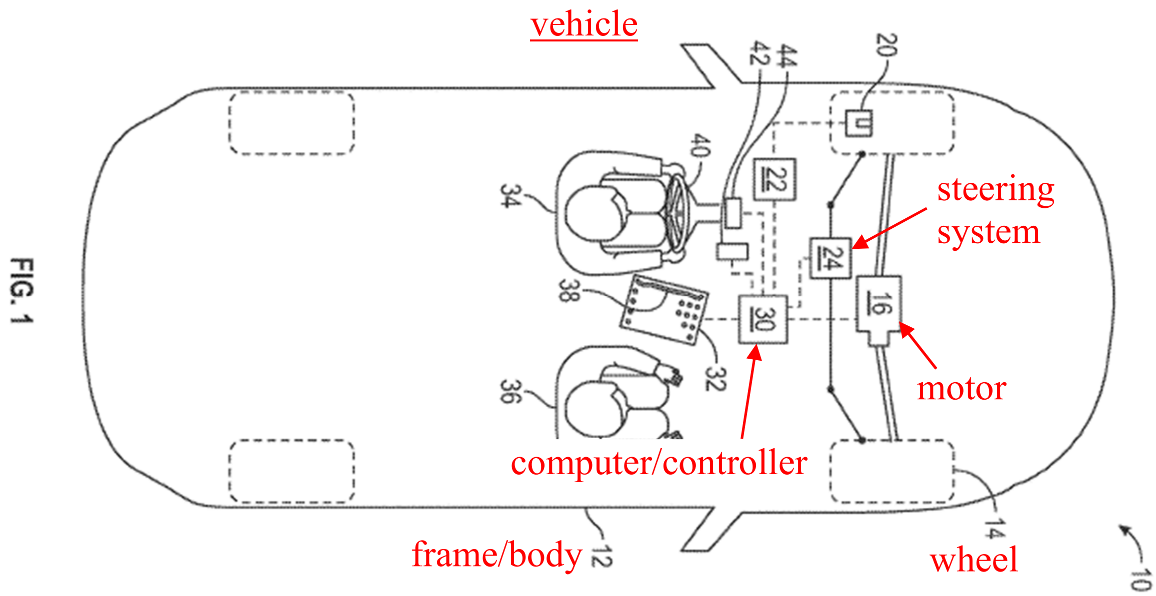
Reference	Filed	Published	AIA Prior Art Basis
Joos	1/19/2017	8/1/2019	§102(a)(1)-(2)
Kischkat	---	8/29/2012	§102(a)(1)
Bettger	11/28/2018	5/30/2019	§102(a)(1)-(2)
Bayer	11/30/2004	12/6/2007	§102(a)(1)-(2)
Allexi	10/25/2013	9/18/2018	§102(a)(1)-(2)
Hoop	10/28/2019	4/29/2021	§102(a)(1)-(2)

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 '457 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"); *see generally* TESLA-1003, ¶¶43-58.

II. THE '457 PATENT

A. Brief Description

The '457 Patent describes "motor vehicles and operational control systems." TESLA-1001, 1:17-18.



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

The ’457 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 ’457 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.

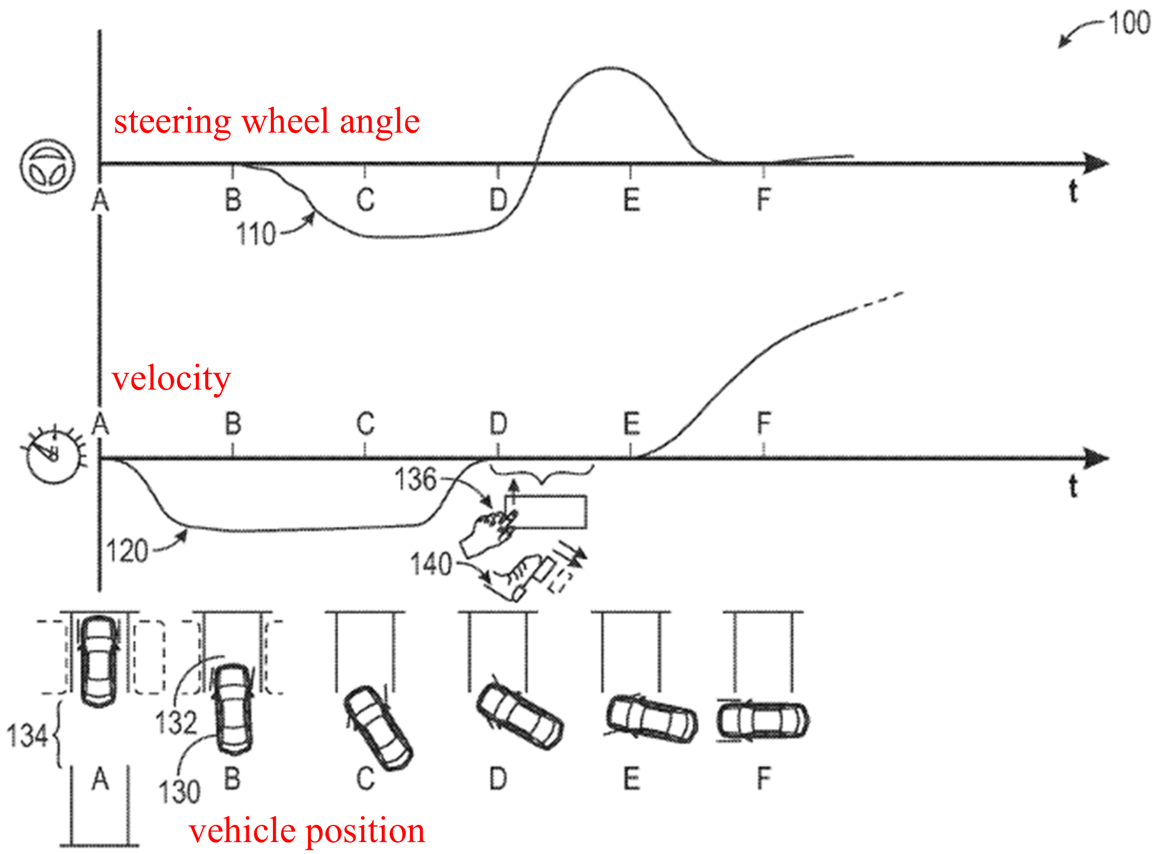


FIG. 2

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 '457 Patent was allowed with no prior art rejections. As reasons for allowance, the examiner stated that no prior art discloses "a method of operating a motor vehicle having a steering control and a drive system [or controller] operable to selectably drive wheels in a drive mode and in a reverse mode, the method including: the drive system [or controller] offering a driver a change from one of the drive mode and reverse mode to the other of the drive mode and reverse mode based on the steering control" as recited in claims 1 and 12. TESLA-1002, 149-151. As demonstrated below in Grounds 1A-3C, 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

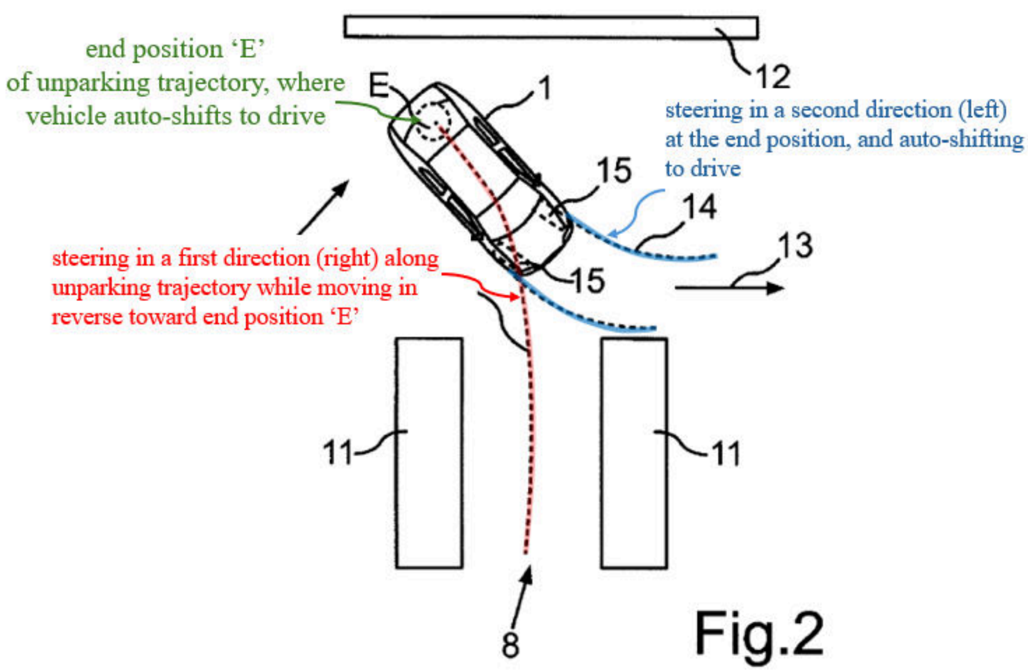
A. GROUND 1A—Obvious based on Joos in view of Kischkat (Claims 1-4, 6-15, 17-22)

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

[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.

at least semi-autonomously from the cross-parking space onto a road bounding on the cross-parking space, wherein during said semi-autonomous [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].

2. 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]. 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]; *generally id.*, [0001]-[0025], [0036], 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].

3. 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, ¶60.

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, ¶61.

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, ¶62.

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.A.2. 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, ¶63.

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, ¶64. Considering these benefits, a POSITA would have expected Kischkat's option to be preferred by a significant population of drivers. TESLA-1003, ¶64. 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. TESLA-1005, [0012]; TESLA-1003, ¶64.

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 before shifting gears. TESLA-1003, ¶65; TESLA-1004, [0015]-[0016], [0037]-[0038]; TESLA-1003, ¶65.

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, ¶66.

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, ¶67. 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]; *see also id.*, [0009], [0012]-[0013], [0016], [0019]; TESLA-1003, ¶67.

Fourth, a POSITA would have integrated Kischkat's techniques in the 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) ("a person of ordinary skill has good reason to pursue the known options within his or her technical grasp."); *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1380-81 (Fed. Cir. 2023) ("It's enough… to show that there was a known problem… in the art, that [another known teaching]… helped address that issue, and that combining the teachings… wasn't beyond the skill of an ordinary artisan. Nothing more is required to show a motivation to combine under *KSR*."). 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, ¶68. Kischkat's techniques would have benefitted these drivers for each of the reasons described above. TESLA-1003, ¶68; *see also id.* ¶¶69-72 (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, ¶73. 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. TESLA-1005, [0010] ("easily"). TESLA-1003, ¶73.

4. Claim Element Analysis

(a) Elements 1[p] and 12[p]

To the extent the preamble is a limitation, Joos discloses ***a method of operating a motor vehicle***. *Id*. For example, Joos discloses "a **method** for unparking **a motor vehicle** from a cross-parking space."[3] TESLA-1004, Abstract, [0001], [0005], FIG. 1. FIG. 1, reproduced below, depicts a top view of Joos's ***motor vehicle***. TESLA-1004, [0031]; TESLA-1003, ¶¶74-75.

Joos discloses the ***motor vehicle having a steering control***. TESLA-1003, ¶76. For example, Joos's motor vehicle further includes a "**steering wheel**" and a "**steering system**." TESLA-1004, [0014]-[0016], [0033]. Joos's steering wheel and steering system each individually or together provide a "***steering control***" as claimed. TESLA-1003, ¶76. For example, the steering system controls steering by "orient[ing] the steerable wheels" and the steering wheel controls steering by effecting changes in the steering angle of the wheels. *Id*.

Joos discloses a ***drive system*** including ***a controller***. TESLA-1003, ¶77. For example, Joos discloses that a "driver assistance system" (***drive system***) "can for example comprise a controller or an electronic control unit" (***controller***). TESLA-1004, [0021]; TESLA-1003, ¶77.

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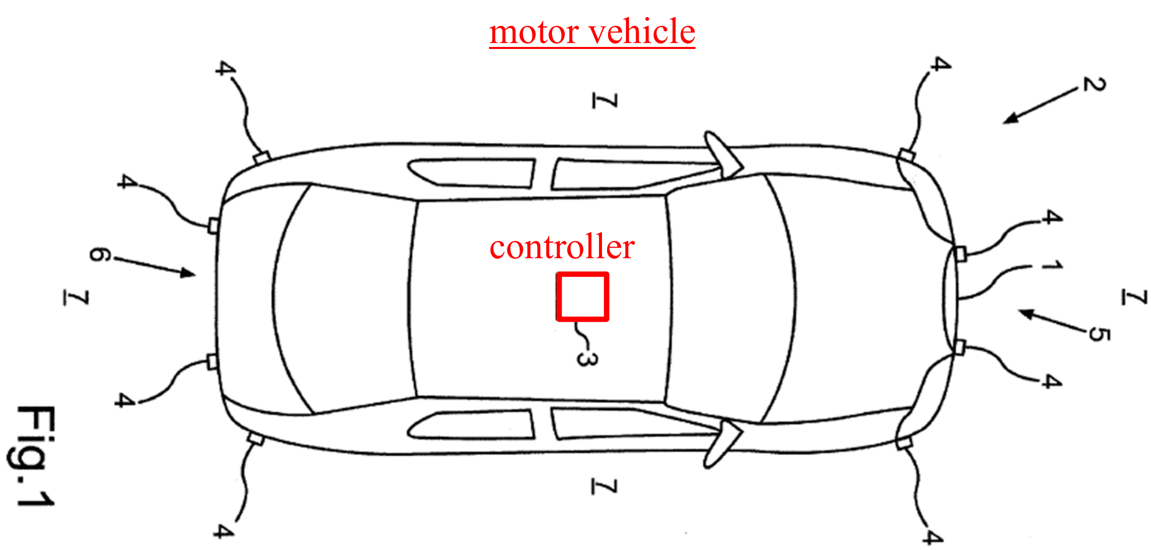
[3] All emphases added unless otherwise noted.

Joos further discloses that the ***controller*** of the driver assistance system (***drive system***) is ***operable to selectably drive wheels in a drive mode and in a reverse mode***. TESLA-1003, ¶78. For example, Joos 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], [0020]. "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]. Because the ***controller*** of the driver assistance system (***drive system***) "can change from the reverse gear into the forward gear" to move the vehicle "back and forth," Joos's drive system/controller is ***operable to selectably drive wheels in a drive mode and in a reverse mode***. TESLA-1003, ¶78.



TESLA-1004, FIG. 1 (rotated)

(b) Elements 1[a] and 12[a]

Joos discloses the ***drive system/controller monitoring the steering control***. *Id.* For example, Joos discloses that the "driver assistance system 2 is [] embodied to continuously detect a movement of the motor vehicle 1 by means of odometry. The controller 3 can thus also receive data from… a steering angle sensor." 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; TESLA-1003, ¶¶79-80. 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, ¶80 (citing TESLA-1027, [0010], [0015]).

The steering angle sensor is part of a steering system (***steering control***) because 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, ¶81 (citing TESLA-1028, [0033]-[0036]). Therefore, Joos's disclosure of the drive system/controller "receiv[ing] data from… a steering angle sensor" involves ***monitoring the steering control*** as claimed. *Id.* For example, monitoring the steering angle sensor allows the ***controller*** of the driver assistance system (***drive system***) to determine when "a steering angle is set that enables collision-free forward movement." TESLA-1004, [0014]; *see also id.*, [0010], [0015]-[0018].

As another example, Joos's ***controller*** of the driver assistance system (***drive system***) monitors the steering control by detecting signals from the steering system that allow the driver assistance system to intervene in steering. TESLA-1004, [0002], [0008]-[0009], [0021], [0033], [0037]-[0038]. Accordingly, monitoring the steering control in Joos not only includes monitoring real-time measurements of steering angles but also includes monitoring signals that allow the driver assistance system to determine steering interventions and issue steering control signals that are applied to steer the vehicle during Joos's unparking maneuver. *Id.*; TESLA-1003, ¶82.

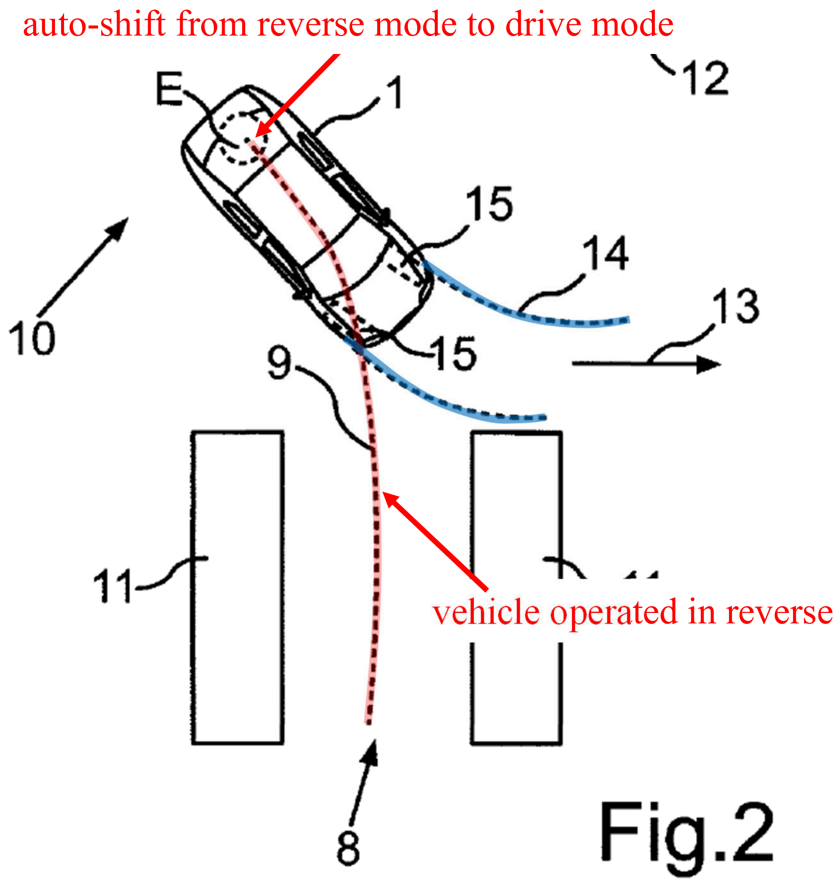
Joos discloses that the drive system/controller monitors the steering control ***while driving in a first direction***. TESLA-1003, ¶83. For example, Joos discloses that "the motor vehicle is [maneuvered] or is controlled at least semi-autonomously along the unparking trajectory in the reversing direction" (***while driving in a first direction***) and "during the unparking manoevre," the driver assistance system outputs "control signals… to the steering system of the motor vehicle and possibly to the brake system and/or the drive motor." TESLA-1004, [0009], [0021], [0031]. Joos's drive system/controller thus monitors the steering control, as described above, ***while driving in a first*** (reverse) ***direction*** in order to continuously detect a movement of the motor vehicle by means of odometry, to determine control signals to issue to the steering system, to maneuver the vehicle in the reversing direction along the unparking trajectory, and to determine when the vehicle reaches the end position that results in an auto-shift from reverse mode to drive mode. TESLA-1004, [0016], [0021], [0031], [0033], [0037]-[0038], FIG. 2; TESLA-1003, ¶83.

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 because 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, ¶84 (citing TESLA-1029, [0072]-[0073]; *cf.*, TESLA-1001, 2:32-36, 2:48-56 (substantially similar features disclosed in the '457 Patent's preferred embodiments).

(c) Elements 1[b] and 12[b]

Joos discloses the ***controller*** of the ***drive system changing from the reverse mode to the drive mode based on the steering control***. *Supra*, III.A.1. Kischkat discloses ***offering a driver a change from the reverse mode to the drive mode***. *Supra*, §III.A.2. In the resulting Joos-Kischkat combination, the vehicle includes a drive system/controller that ***offers a driver a change from the reverse mode to the drive mode based on the steering control***. *Supra*, §III.A.3; TESLA-1003, ¶¶85-86.

In more detail, Joos discloses that "the motor vehicle shall be unparked from a cross-parking space at least semi-autonomously." TESLA-1004, [0007]. "During this, the motor vehicle is [maneuvered] along the unparking trajectory" "in the **reversing direction** or carries out a **reversing movement**." TESLA-1004, [0008]. "The motor vehicle is moved along the unparking trajectory until it has reached an end position" (*e.g.,* end position E, in Fig. 2 below). TESLA-1004, [0008]. "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]. Joos thus teaches the drive system/controller ***changing from reverse mode to drive mode*** after the vehicle reaches the end position of the unparking process. TESLA-1003, ¶87.



TESLA-1004, FIG. 2

Joos further discloses that changing from the reverse mode to the drive mode is ***based on the steering control***. TESLA-1003, ¶88. For example, Joos discloses that the steering control is turned to right while reversing to reach end position E, and discloses that the end position E must be reached before the vehicle is shifted from reverse to drive. TESLA-1004, [0008], [0017]-[0018], [0036]-[0038], FIG. 2. Joos's auto-shift from reverse mode to drive mode is thus based on the steering control being steered correctly as needed for the vehicle to reach the calculated end position E. TESLA-1003, ¶88.

As another example, Joos explains that the driver assistance system sets the steering angle of the vehicle to “a predetermined or adjusted steering angle,” e.g., “a maximum steering angle,” at the end position E, before the assisted unparking procedure is ended and control handed back to the driver. TESLA-1004, [0010], [0014], [0015], [0016]-[0018], [0037]-[0038]. Thus, upon reaching the end position and before control of the vehicle is returned to the driver, Joos’s ***drive system/controller*** signals the ***steering control*** to adjust the steering angle of the vehicle to “a predetermined or adjusted” (*e.g.*, “maximum”) steering angle that allows the driver to pull forward while avoiding collisions with nearby vehicles or objects (*e.g.*, vehicle in adjacent parking spaces). *Id.* In the example of Fig. 2, that means that although the steering angle is turned to the right while the vehicle is in reverse, the drive system/controller signals the steering control to turn the steering angle to the left (either a maximum left angle or a predetermined or adjusted left angle) such that the car would pull forward without hitting vehicle 11 in the adjacent space. TESLA-1003, ¶89.

Joos’s disclosure also makes clear that the ***controller*** of the driver assistance system (***drive system***) auto-shifts to drive (***changing from reverse mode to drive mode***) at the end position of the unparking maneuver only after and in response to the steering control being steered in the opposite direction to set the pull-forward steering angle (***based on the steering control***) while the vehicle is stopped at the end position. TESLA-1003, ¶90. For example, 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 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, ¶90. 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]; *see also id.*, [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, ¶91.

Conditioning Joos's auto-shift to drive (***changing from reverse mode to drive mode***) at the end position E of the unparking trajectory on a determination that the steering system's pull-forward steering angle has been set (***based on the steering control***) also would have been obvious. TESLA-1003, ¶92. For example, implementing the system in this manner would have been obvious and beneficial to ensure full control of the vehicle could be handed back to the driver 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 is clear that the driver assistance system sets the pull-forward steering angle at the end position E specifically to avoid collisions and to allow the vehicle to properly orient in the lane of travel when the driver pulls forward while maintaining the set steering angle. TESLA-1004, [0010], [0014]-[0016], [0036]-[0038]. Indeed, if the pull-forward steering angle were not set, the driver could be surprised by driving in the direction opposite from what she expected upon shifting to drive. Allowing the driver to pull forward before the desired steering angle is set would thus fail to meet driver expectations, increase the risk of collisions with other vehicles, and prevent the vehicle from being properly oriented when pulling forward in the lane of travel without further action by the driver, all of which would compromise safety and convenience contrary to Joos's express objectives. *Id.*; TESLA-1004, [0010], [0014]-[0016], [0036]-[0038].

In this context, a POSITA would have sought to implement Joos's drive system/controller to auto-shift to drive (***changing from reverse mode to drive mode***) based on the pull-forward steering angle first being set (***based on the steering control***) 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, ¶93. Allowing the driver to more quickly assume control of the vehicle 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 pre-setting the 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). TESLA-1004, [0014]; TESLA-1003, ¶93.

Requiring that the pull-forward steering angle be set before shifting to drive is also consistent with ordinary driving practices. Indeed, even basic driver's education materials instruct drivers to set the pull-forward steering angle before shifting to drive upon exiting a parking space. *See, e.g.*, TESLA-1003, ¶94; TESLA-1024, 1; TESLA-1025, 3. A POSITA would have configured Joos's drive system/controller to follow similar procedures to those instructed to human drivers, which reflect best safety practices. TESLA-1003, ¶94.

Moreover, configuring the drive system/controller to auto-shift to drive (***changing from reverse mode to drive mode***) based on setting the steering angle (***based on the steering control***) would have been obvious to try. TESLA-1003, ¶95. Joos discloses both setting the steering angle and shifting to drive as two actions that 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, ¶95. Namely, the steering angle could only be set before, during, or after the auto-shift to drive of the vehicle. TESLA-1003, ¶95. 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. TESLA-1003, ¶95. A POSITA would have reasonably expected success because implementing the system in this manner would merely involve integrating 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. *Id.*; TESLA-1004, FIG. 2.

To the extent Joos does not expressly disclose ***offering the driver a change from reverse mode to drive mode***, Kischkat discloses this feature. *Supra*, §III.A.2; TESLA-1003, ¶96. For example, 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]; *see also id.*, [0001]. 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 **the assistance system asks 'Change direction?'**, the driver simply has to answer 'yes'." TESLA-1005, [0016]. "In order to inform the driver that he must give a shift signal, an optical and/or acoustic and/or haptic information signal is expediently given to him." TESLA-1005, [0019].

As discussed above , it would have been obvious to combine Joos and Kischkat. *Supra*, §III.A.3. In the resulting Joos-Kischkat combination, once stopped at the end position E of the unparking trajectory, the drive system/controller ***offers a driver a change from the reverse mode to the drive mode*** as taught in Kischkat (*e.g.*, by requesting a driver confirmation response), and the drive system/controller makes this offer ***based on the steering control*** movements described above as taught in Joos. TESLA-1005, [0009], [0016], [0019]; TESLA-1003, ¶97.

(d) Elements 1[c] and 12[c]

As discussed above in §III.A.3 and 1[b], the Joos-Kischkat combination renders obvious a ***controller*** of a driver assistance system (***drive system***) offering a driver a change from the reverse mode to the drive mode as taught in Kischkat (*e.g.*, by requesting a driver confirmation response), and the ***drive system/controller changing from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode in response to an approval by the driver of the offered change***. TESLA-1005, [0009] \, [0001], [0016], [0019]; *supra*, 1[b]; §III.A.2-3; TESLA-1003, ¶¶98-99.

(e) Claims 2 and 13

As explained above, Joos-Kischkat's ***controller*** of the driver assistance system (***drive system***) ***offers the driver the change from one mode*** (reverse) ***to the other*** (forward) ***based on a pattern of steering control movements*** made during an autonomous or semi-autonomous unparking procedure. *Id.* Joos discloses a ***pattern of steering control movements*** that includes (1) steering in a first direction while reversing to reach the end position of the unparking trajectory (e.g., in Fig. 2, reversing with the steering angle turned all the way to the right) and (2) steering in the opposite direction at the end position of the unparking trajectory to attain "a predetermined or adjusted steering angle," e.g., "a maximum steering angle," for the anticipated forward movement of the vehicle after unparking is complete (e.g., in Fig. 2, turning the steering angle to a maximum or predetermined left angle, such that it can move forward without hitting the adjacent vehicle).[4] TESLA-1004,

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[4] The pattern of steering control movements described in this example is the same pattern recited in dependent claim 11 ("changing drive direction in response to driving the first direction with steering angle in a first steering direction, then to

[0010], [0014], [0015], [0037]-[0038]; TESLA-1003, ¶¶100-101. The system turning the steering angle in one direction and then in the opposite direction to set it to a predetermined or maximum angle for the anticipated forward movement of the vehicle constitutes ***a pattern of steering control movements***. *Id.*

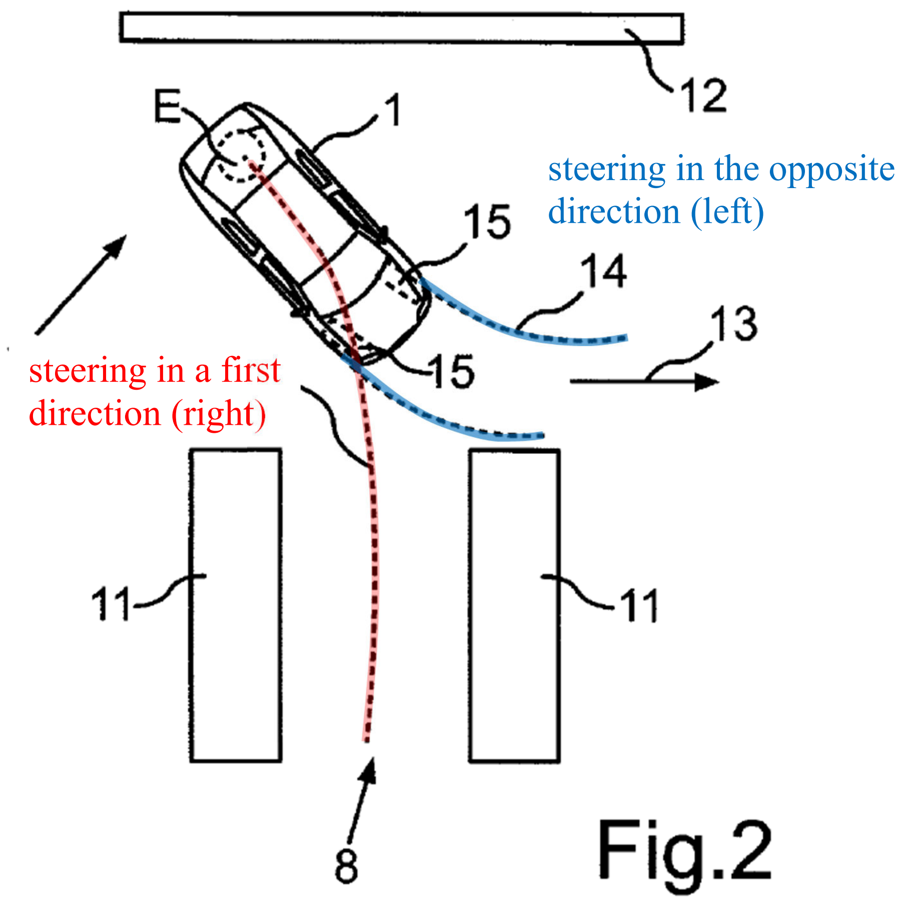

Fig.2

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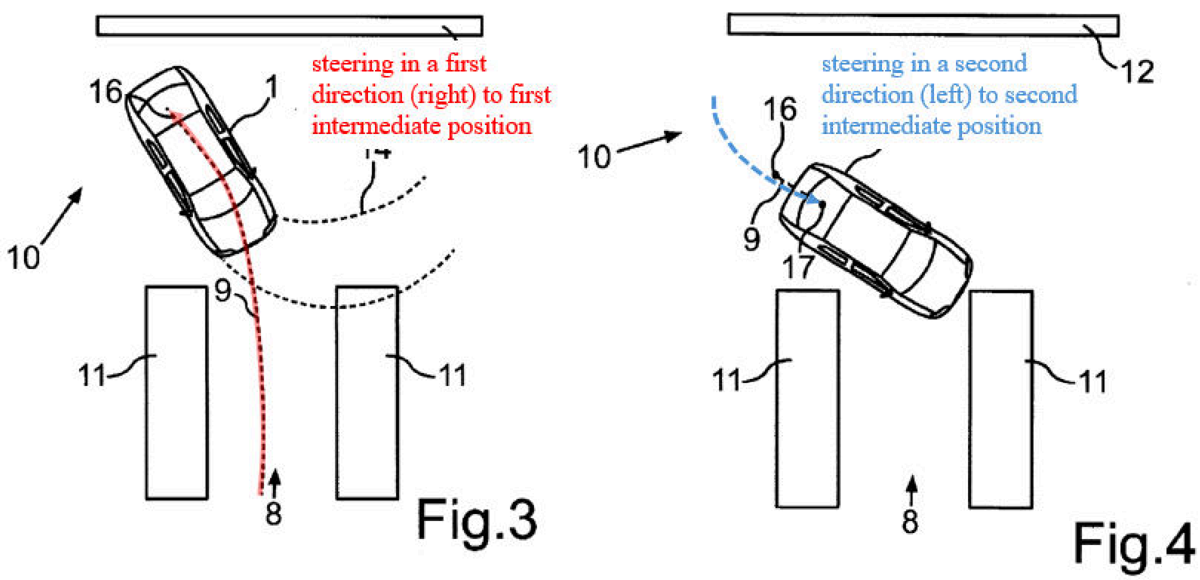
changing steering to an opposite second steering direction"). *Infra*, Claim 11. This pattern is also recited in claim 4 of related U.S. Patent No. 11,932,230 (TESLA-1026).

TESLA-1004, FIG. 2 (annotated)

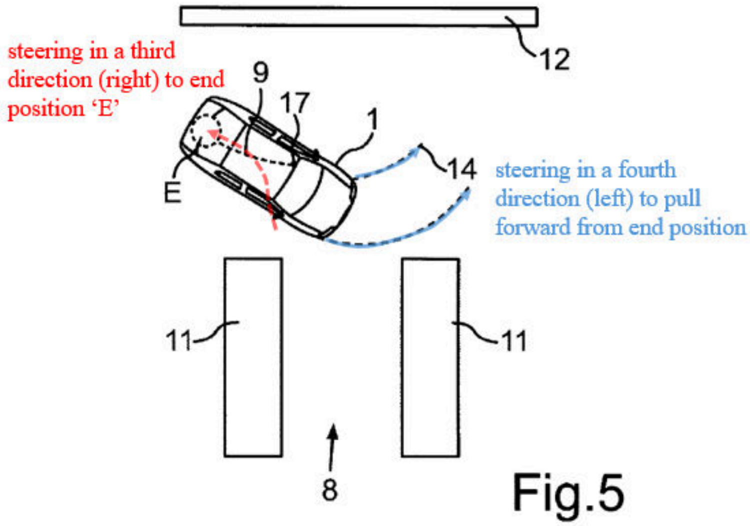
In more detail, Joos discloses that the motor vehicle is steered in a first direction of the ***pattern of steering control movements*** "along the **unparking trajectory**" "in the reversing direction" "until it has reached an end position" where "the autonomous parking [maneuver] is ended." TESLA-1004, [0008]. At the end position, the motor vehicle is then steered in the opposite direction of the ***pattern of steering control movements*** such that "a predefined steering angle, in particular a maximum steering angle, is set" "so that the driver can carry out the collision-free forward movement without changing the adjusted steering angle." TESLA-1004, [0015], [0037], [0018]. Joos explains that "it is advantageous if the specified steering angle at the end position is set by means of a driver assistance system of the motor vehicle. If the end position is reached, 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], [0038]. For the reasons described above with respect to 1[b]/13[b], Joos discloses or at least renders obvious setting the steering angle at the end position of the unparking trajectory as a condition for automatically shifting from the reverse to forward gear. *Supra*, Element 1[b]; TESLA-1003, ¶102.

Because the vehicle is steered in a first direction while reversing to reach the end position of the unparking trajectory and is then steered in the opposite direction to achieve the specified steering angle that will allow the driver to safely pull the vehicle forward, and because this ***pattern of steering control movements*** must be applied before the controller auto-shifts to drive, Joos's ***controller*** of the driver assistance system (***drive system***) ***changes from one mode to the other based on a pattern of steering control movements*** comprising steering in a first direction then steering in the opposite direction. TESLA-1003, ¶103. Joos's FIG. 2 (reproduced above) "shows the motor vehicle… being unparked in reverse from a cross-parking space" according to this ***pattern of steering control movements***. TESLA-1004, [0028]. As shown in FIG. 2, the vehicle is reversed and follows a prescribed unparking trajectory while applying a ***steering control movement*** in the first direction (turned to the right) until it reaches the end position E. At "the end position, "a predefined steering angle, in particular a maximum steering angle, is set." TESLA-1004, [0015], [0038]. Also shown in FIG. 2, the maximum steering angle set at the end position is a ***steering control movement*** 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]; *see also id.*, [0037], [0009]-[0010], FIG. 2.

Joos also discloses scenarios that require additional steering inputs to be provided in a sequence of alternating directions (***pattern of steering control movements***) to travel back and forth between intermediate positions until the end position E is reached. TESLA-1004, [0039]-[0040], FIGs. 3-5. As illustrated below, the series of reversing and forward movements of the vehicle to reach the end position E while providing steering inputs that include steering to the right while reversing to a first intermediate point, steering to the left while driving forward to a second intermediate point, and steering to the right while reversing to end position E (***pattern of steering control movements***) exemplifies how Joos's vehicle finally changes the drive direction only in response to a pattern of steering control movements in opposite directions further teaches this limitation. TESLA-1003, ¶104.



TESLA-1004, FIGs. 3-4



TESLA-1004, FIG. 5

Further, as discussed above, based on Kichkat's teaching to request a driver confirmation response for shifting from reverse to drive, the drive system/controller of the Joos/Kischkat combination ***offers a driver a change from the reverse mode to the drive mode based on the pattern of steering control movements*** described in Joos. TESLA-1005, [0009], [0016], [0019]; *supra*, §III.A.3; TESLA-1003, ¶105.

(f) Claims 3 and 14

As discussed above for claim 2, each pattern of steering control movements described above is also ***a sequence of steering control movements***. For example, each pattern provides a distinctive sequence of steering control movements that culminates in the vehicle automatically changing from the reverse mode to the drive mode (*e.g.*, by shifting from a reverse gear to a forward gear). *Supra*, §III.A.4(d); TESLA-1003, ¶¶106-107. Joos explains that the auto-shift to drive does not occur until the vehicle reaches the end position E. TESLA-1004, [0016]-[0018]. Because the movement of the vehicle must comply with a ***sequence of steering control movements*** to follow a prescribed unparking trajectory to reach the end position E, and because it is necessary to reach the end position E for the controller to select the forward direction for driving the wheels through an auto-shift to drive, the ***drive system/controller changes between modes*** from reverse to drive ***based on a sequence of steering control movements***. TESLA-1003, ¶107. Indeed, the vehicle would not properly arrive at the end position E if the controller does not steer the vehicle by following a ***sequence of steering control movements*** for the trajectory (*e.g.*, a predetermined trajectory) indicated by the drive system/controller. TESLA-1007, [0008], [0057], [0065].

(g) Claims 4 and 15

Joos discloses ***a brake control operable… by a driver to generate a brake input***. *Id.* For example, Joos discloses that the "driver of the motor vehicle… operate[s]… the **brakes**." TESLA-1004, [0002], [0008]-[0009]; TESLA-1003, ¶¶108-109.

Joos also discloses that ***the brake control is connected to the controller of the drive system and the brake input is transmissible to the controller of the drive system***. TESLA-1003, ¶110. For example, 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 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, ¶110. 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 (***changing between modes***) includes ***actuation of the brake control***. TESLA-1003, ¶111. For example, 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.A.3), 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 ***generate a brake input transmissible to the controller of the drive system*** to provide the approval indication for ***changing between [reverse and drive] modes in response to actuation of a brake control or pedal***. TESLA-1005, [0009], [0011] ("switching of the transmission is realized by a simple acknowledging action"), [0016]; *supra*, §§III.A.2-3; TESLA-1003, ¶111.

(h) Claims 6 and 17

For the reasons discussed above in 1[b], Joos-Kischkat teaches ***the drive system/controller offering the driver a change from reverse mode to drive mode in response to a steering input***. *Id.* 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.* For example, 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[b] and Claim 2, 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[b], Claim 2; TESLA-1003, ¶¶112-113. 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 applies a threshold to determine whether the steering input suffices to auto-shift to drive. TESLA-1003, ¶114. 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, ¶114 (citing TESLA-1006, [0044]).

(i) Claims 7 and 18

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, ¶¶115-116. 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. TESLA-1003, ¶116. 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.A.3.

(j) Claims 8 and 19

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]; *see also id.*, [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, ¶¶117-118.

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). TESLA-1004, [0008], [0013]-[0014], [0035]. Because the drive system/controller does not offer to change the drive direction to the forward gear until the vehicle reaches the end position E, which is determined and arrived at based on measurements of distance traveled, the drive system/controller ***offers the driver the change from reverse mode to drive mode based at least in part on distance traveled***. TESLA-1003, ¶119.

(k) Claims 9 and 20

For reasons discussed above for Claims 2/13 and below for Claims 10/21, the Joos-Kischkat combination renders obvious ***a drive system/controller changing the drive direction without driver indication of a direction other than approval of the offered change in direction***. TESLA-1003, ¶¶120-121; *supra*, §III.A.4(e); *infra*, §III.A.4(l). In the Joos-Kischkat combination, the 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.* For instance, 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, ¶122. Kischkat's confirmation responses are substantially the same as the approval indications disclosed in the specification of the '457 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, ¶122.

(l) Claims 10 and 21

As discussed above for 1[b]-[1c] and Claims 2 and 9, 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[b]-[1c] and Claims 2 and 9. TESLA-1003,

¶¶123-124; *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 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 instead auto-shifts to drive without the driver's operation of a selector. *See* TESLA-1004, [0017]; *supra*, Claims 9, 20; TESLA-1003, ¶124. 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. TESLA-1003, ¶124.

(m) Claims 11 and 22

As addressed above with respect to Claims 2/13 and 4/15, the Joos-Kischkat combination would have rendered obvious the additional features recited in Claims 11 and 22 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 Claims 2/13 (§III.A.4(e))—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 2/13 (§III.A.4(e)) and 4/15 (§III.A.4(g)). TESLA-1003, ¶¶125-126.

B. GROUND 1B— Obvious based on Joos in view of Kischkat and Hoop (Claims 5, 16)

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]. 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." 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.B.1; TESLA-1023, [0002], [0022]; TESLA-1003, ¶127. 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, ¶127; *supra*, §III.B.1. After the maximum or other pre-defined steering angle is set as taught in Joos, the driver assistance system would offer an auto-shift to drive as taught in Kischkat. TESLA-1003, ¶127; 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 4, 15 (§III.A.4(g)); TESLA-1005, [0010]-[0013], [0016]-[0019]; TESLA-1003, ¶127.

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, ¶128.

<u>First</u>, 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, ¶129. 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, ¶130.

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, ¶131.

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, ¶132. 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, ¶133.

A POSITA likewise would have reasonably expected success implementing the combination. TESLA-1003, ¶134. 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. TESLA-1003, ¶134.

3. Claim Element Analysis

(a) Claims 5 and 16

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], [0021]. Joos's ***controller*** of the driver assistance system (***drive system***) would be understood to include ***an accelerator pedal*** to the same extent as the '457 Patent because the 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, ¶¶135-136. Providing an accelerator pedal in Joos's controller also would have been obvious to facilitate control of the vehicle via actuation of the accelerator pedal by each of the driver and the driver assistance system during autonomous or semi-autonomous operations (*e.g.*, during Joos's assisted unparking procedure). TESLA-1003, ¶136.

As discussed in §III.B.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, ¶137; *supra*, §III.B.1. After the maximum or other pre-defined steering angle is set as taught in Joos, the driver assistance system would offer an auto-shift to drive as taught in Kischkat. TESLA-1003, ¶137; 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 to auto-shift to drive as taught in Kischkat. *Supra*, Claims 4, 15 (§III.A.4(g)); TESLA-1005, [0010]-[0013], [0016]-[0019]; TESLA-1003, ¶137. 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, ¶137.

C. GROUND 1C—Obvious based on Joos in view of Kischkat and Allexi (Claims 7, 8, 18, 19)

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. 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, 4:61-6:67, FIGs. 2, 6.

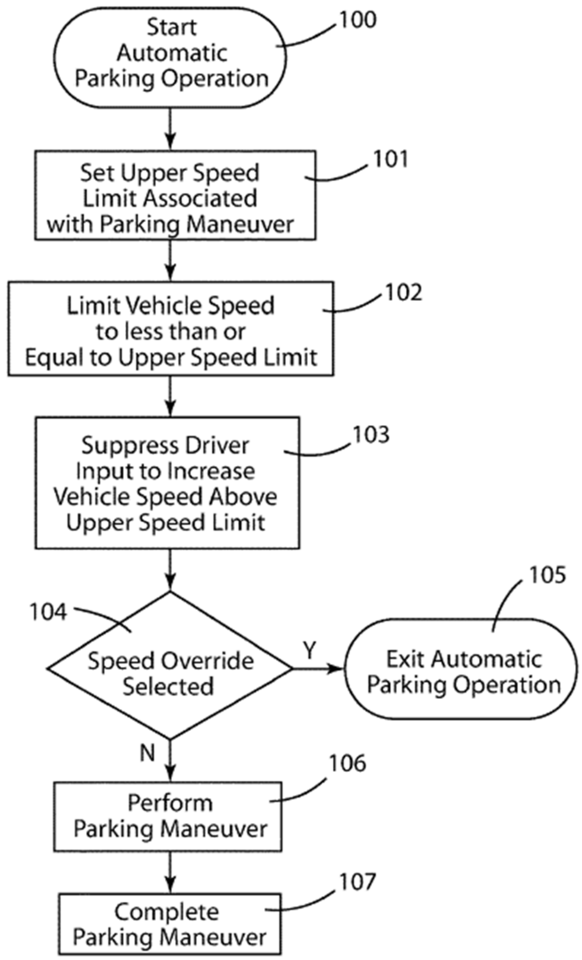


Fig. 2

TESLA-1009, FIG. 2

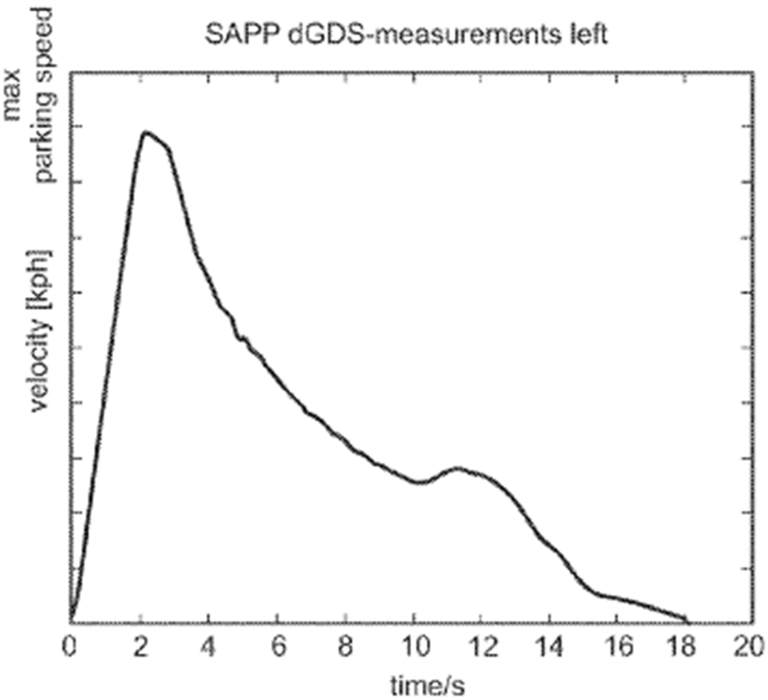


Fig. 6

TESLA-1009, FIG. 6

2. Combination of Joos, Kischkat, and Allexi

A POSITA would have found it obvious to modify Joos-Kischkat's vehicle from Ground 1A 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.C.1; TESLA-1009, 3:18-29, 1:51-2:49, FIG. 2; TESLA-1003, ¶138. In the Joos-Kischkat-Allexi combination, the 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, ¶138. Thus, the 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 is made, if the vehicle's velocity does not exceed the speed limit. *Supra,* §III.C.1; TESLA-1009, 3:18-29, 5:19-29, 6:16-28, FIG. 6; *see also id.*, 4:9-15, 2:14-18, 3:18-29, 6:22-28; TESLA-1003, ¶138.

A POSITA would have been motivated to pursue the combination for multiple reasons. TESLA-1003, ¶139. 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, ¶139. 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, ¶139 (citing TESLA-1006, [0003], [0026], [0035]).

Applying Allexi's techniques in combination with Joos also 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. A POSITA would have reasonably expected success implementing the combination. TESLA-1003, ¶140. Indeed, Joos 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 capabilities of a POSITA. *Id.*

3. Claim Element Analysis

(a) Claims 7 and 18

As discussed above in §III.C.2, a POSITA would have implemented the combination's 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.C.1-2; TESLA-1009, 3:18-29, 1:51-2:49, 4:54-5:18, FIG. 2; TESLA-1003, ¶¶141-142. In this combination, the 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, ¶142. Thus, the unparking procedure is maintained, and the vehicle only successfully reaches the target (end) position of the unparking trajectory where the auto-shift to drive occurs, if the vehicle's velocity does not exceed the speed limit (***changing 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, ¶142. Requiring the vehicle to reach the end position by following a trajectory while maintaining vehicle speeds less than the selected limit is also consistent with Joos's teaching that the vehicle should be stopped before shifting gears. TESLA-1004, [0016]-[0018]; TESLA-1003, ¶142.

(b) Claims 8 and 19

To the extent Joos-Kischkat does not explicitly disclose the additional features recited in Claims 8 and 19, they still would have been rendered obvious by the Joos-Kischkat-Allexi combination based on the additional teachings from Allexi. TESLA-1003, ¶143. For instance, 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, ¶144. 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. TESLA-1003, ¶144 (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 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 ***offers the driver the change from reverse mode to drive mode based at least in part on distance traveled***. TESLA-1003, ¶144.

D. GROUND 2A—Obvious based on Joos in view of Kischkat and Bettger (Claims 1-4, 6-15, 17-22)

1. Overview of Bettger

Bettger describes "assisted performance of a reverse-turning maneuver of a vehicle." TESLA-1006, [0002], [0036]. 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, Kischkat, and Bettger

It would have been obvious to further modify the Joos-Kischkat vehicle from Ground 1A in view of Bettger's teachings for the driver to confirm initiation of an assisted reverse-turning maneuver based on the driver's steering input to the steering control. TESLA-1003, ¶145. Based on Bettger's teachings, 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. 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 drive 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."[5] 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" while parked or while beginning to reverse from the parking space that "corresponds to the steering movement" for carrying out the unparking maneuver (*e.g.*, corresponds to a 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- Kischkat-Bettger vehicle offers (as taught

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[5] In the combination, the offered maneuver is Joos's autonomous or semi-autonomous unparking maneuver. TESLA-1003, ¶¶145-146.

in Kischkat) to shift gears from reverse to drive as taught in each of Joos, Bettger, and Kischkat. TESLA-1004, [0017], [0038]; TESLA-1006, [0045], [0047]; TESLA-1005, [0009]; *generally id.*, [0001]-[0025], FIGs. 1-2. Because the offer to change from reverse mode to drive mode as taught in Joos and Kischkat occurs at the end of an assisted unparking maneuver as taught in Joos—that was confirmed via an earlier initiating steering input applied as taught in Bettger—the controller of the driver assistance system in the Joos- Kischkat-Bettger vehicle initiates the assisted unparking maneuver and offers a change from the reverse mode to the drive mode in response to the initiating steering input to the steering control. TESLA-1003, ¶146. Multiple reasons would have prompted a POSITA to implement Joos-Kischkat further in accordance with Bettger's teachings in this manner. TESLA-1003, ¶146.

First, Bettger's approach would promote safety and improve the user experience by allowing the driver to confirm via an initiating steering input that an assisted reverse-turning unparking maneuver should be performed. 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 reverse-turning unparking maneuver before the driver assistance system initiates operations for performing the maneuver, rather than leaving the determination entirely up to the vehicle. TESLA-1003, ¶147.

Second, a POSITA would have applied Bettger's suggestion for driver confirmation to initiate a reverse-turning 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 reverse- turning of 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 a reverse-turning maneuver via a steering input while reversing 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 integrated Bettger's techniques in the combination because it merely involves the application of known techniques (*e.g.*, Bettger's confirmatory response to initiate a reverse-turning unparking maneuver) to improve a conventional system (*e.g.*, Joos-Kischkat's autonomous or semi-autonomous unparking assistant) to achieve predictable results. *KSR*, 550 at 421; *Intel*, 61 F.4th at 1380-81. A POSITA would have reasonably expected success implementing the combination, because Joos and Bettger each describes driver assistance systems designed for use in similar contexts (*e.g.*, reverse-turning unparking maneuvers). TESLA-1003, ¶150. Considering that the Joos-Kischkat 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 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-Kischkat, Ground 2A relies on the combined teachings of Joos, Kischkat, and Bettger. Integration of Bettger in Joos-Kischkat does not disturb the aspects of Joos-Kischkat mapped to each of the claim elements in claims 1-4, 6-15, and 17-22 addressed in Ground 1A but not addressed below. To avoid repetition, and because the analysis of all other claim elements is substantively the same, only claim elements whose mappings are materially affected by the integration of Bettger in the combination are addressed below. TESLA-1003, ¶151. Ground 2A relies on the mappings from Ground 1A for all other elements of claims 1-4, 6-15, and 17-22 not addressed below. *Id.*

(a) Elements 1[a] and 12[a]

In the Joos-Kischkat-Bettger combination, Joos's ***controller*** of the driver assistance system (***drive system***) ***monitors the steering control while driving in a first direction***. TESLA-1003, ¶¶152-153. As discussed above in §III.D.2, when in a reverse mode (***while driving in a first direction***), the Joos-Kischkat-Bettger controller initiates the assisted unparking maneuver disclosed in Joos only following confirmation by the driver. TESLA-1006, [0021]. As disclosed in Bettger, 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 and which corresponds to the steering movement that is necessary for carrying out the reverse-turning maneuver." TESLA-1006, [0044]. The Joos-Kischkat-Bettger controller thus ***monitors the steering control*** to detect this steering movement to determine that the driver provided the confirmation to initiate the assisted reverse-turning unparking maneuver. *Id.*; TESLA-1003, ¶153. Upon detecting the steering input to initiate the assisted reverse-turning unparking maneuver, the Joos-Kischkat-Bettger controller begins autonomously or semi-autonomously controlling aspects of the vehicle's operations (*e.g.*, driving, steering, and/or braking) as needed to carry out the assisted reverse-turning unparking maneuver. TESLA-1006, [0043]-[0047], [0017]; TESLA-1004, [0008].

(b) Elements 1[b] and 12[b]

Because the offer to auto-shift from reverse mode to drive mode in the Joos-Kischkat-Bettger vehicle only occurs at the end of the assisted reverse-turning unparking maneuver that is initiated via a confirmatory steering input of the ***steering control*** as taught in Bettger, ***the controller of the drive system offers the driver a***

change from the reverse mode to the drive mode in response to the steering control. TESLA-1003, ¶¶154-155.

The Joos-Kischkat-Bettger drive system/controller also offers to change from reverse to drive ***based on the steering control*** movements disclosed in Joos that are part of Joos's assisted unparking maneuver for the reasons discussed above in Ground 1A. *Supra*, §III.A.4(d); TESLA-1003, ¶156. These additional steering control movements include steering in a first direction while reversing to reach end position E of the unparking trajectory and steering in a second direction to set the desired pull-forward steering angle at the end position E before the vehicle shifts to drive, thereby ending the assisted unparking maneuver. *Id.*

(c) Elements 1[c] and 12[c]

As discussed above in §III.A.3 and 1[b], the Joos-Kischkat-Bettger combination provides a ***controller*** of a driver assistance system (***drive system***) offering a driver a change from the reverse mode to the drive mode as taught in Kischkat (*e.g.*, by requesting a driver confirmation response), and the ***drive system/controller changing from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode in response to an approval by the driver of the offered change***. TESLA-1005, [0009], [0001], [0016], [0019]; *supra*, 1[b]; §III.A.2-3; TESLA-1003, ¶¶157-158.

(d) Claims 2 and 13

As discussed above in §§III.D.3(b)-III.D.3(c), the drive system/controller of the Joos- Kischkat-Bettger vehicle monitors the ***steering control*** to detect movements for initiating the assisted reverse-turning maneuver as taught in Bettger and detects additional movements of the ***steering control*** disclosed in Joos that are part of Joos's assisted unparking maneuver for the reasons discussed above in Ground 1A, including steering in a first direction while reversing and steering in the opposite direction at the end position E to set the pull-forward steering angle. *Supra*, §§III.A.4(c)-III.A.4(e); TESLA-1003, ¶¶159-160. The steering control movement for initiating the assisted reverse-turning maneuver as taught in Bettger followed by additional steering control movements to reach the end position E and set the pull-forward steering angle as taught in Joos constitute ***a pattern of steering control movements*** that culminate in the offer to auto-shift to drive being made for the reasons discussed above with respect to Ground 2A at 1[b]-1[c] and Ground 1A at 1[b]-1[c]. TESLA-1003, ¶160.

(e) Claims 3 and 14

As discussed above for claim 2, each pattern of steering control movements described above is also ***a sequence of steering control movements***. For example, each disclosed pattern provides a distinctive sequence of steering control movements that culminates in the vehicle automatically changing from the reverse mode to the drive mode (*e.g.*, by shifting from a reverse gear to a forward gear). *Supra*, §III.D.3(d); TESLA-1003, ¶¶161-162.

(f) Claims 6 and 17

As disclosed in Bettger, the driver provides confirmation to initiate the assisted reverse-turning unparking maneuver 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, [0043]-[0044]. Because the offer to auto-shift from reverse to drive as taught in Bettger is made in the Joos-Bettger-Kischkat vehicle only as part of and at the end of the assisted reverse-turning unparking maneuver that is initiated via Bettger's confirmatory steering input which lies above a selected threshold value, ***the controller of the drive system offers the driver a change from reverse mode to drive mode only in response to detecting a steering input greater than a selected steering angle threshold***. TESLA-1003, ¶¶163-164.

(g) Claims 11 and 22

As discussed above in Ground 1A (claims 4/15), the Joos-Kischkat-Bettger vehicle includes a brake control connected to the controller/drive system and operable by the drive to generate a brake input transmissible to the drive system. *Supra*, §III.A.4(g). The Joos-Kischkat-Bettger vehicle also changes and also offers to change directions from the reverse mode to the drive mode in response to driving in reverse with steering angle in a first direction (e.g., right), then changing to steer to an opposite second steering direction (e.g., left to set the pull-forward steering angle at the end position E), and to operation of the brake control to approve the offer to auto-shift as taught in Kischkat. *Supra*, §§III.A.4(c)-III.A.4(e); TESLA-1003, ¶¶165-166.

E. GROUND 2B—Obvious based on Joos in view of Kischkat, Bettger, and Hoop (Claims 5, 16)

It would have been obvious to combine Joos (as modified by Kischkat and Bettger (*supra*, §§III.A.3, III.D.2)) with Hoop for the reasons described above in Ground 1B. *Supra*, §III.B.2; TESLA-1003, ¶167. The resulting Joos-Kischkat-Bettger-Hoop combination would have provided the additional features recited in claims 5 and 16 for each of the reasons described above for the same claims in Ground 1B. *Supra*, §III.B.3 (Claims 5, 16); TESLA-1003, ¶167.

F. GROUND 2C—Obvious based on Joos in view of Kischkat, Bettger, and Allexi (Claims 7, 8, 18, 19)

It would have been obvious to combine Joos (as modified by Kischkat and Bettger (*supra*, §§III.A.3, III.D.2)) with Allexi for the reasons described above in Ground 1C. *Supra*, §III.C.2; TESLA-1003, ¶168. The resulting Joos-Kischkat-Bettger-Allexi combination would have provided the additional features recited in claims 7, 8, 18, and 19 for each of the reasons described above for the same claims in Ground 1C. *Supra*, §III.C.3 (Claims 7, 8, 18, 19); TESLA-1003, ¶168.

G. GROUND 3A—Obvious based on Joos in view of Kischkat and Bayer (Claims 1-4, 6-15, 17-22)

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]. 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]; *see also id.*, [0014], [0016]-[0018], [0020]-[0021], [0024], [0043], [0056]-[0057].

2. Combination of Joos, Kischkat, 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, ¶169; *supra*, §§III.A.1, III.G.1. In the resulting combination, Joos's "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, ¶169. Based on 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]; *see also id.*, [0001]-[0006], [0049], [0054], [0064]-[0065], Abstract; TESLA-1003, ¶169. The vehicle in the proposed combination would further include a "driver recognition module" which "determine[s] 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]; *see also id.*, [0046], [0057]-[0058], [0065]; TESLA-1003, ¶169. Bayer thus provides details of a known option for a "driver assistance system [that] interven[es] in the steering" as contemplated in Joos. TESLA-1004, [0008].

Multiple reasons would have motivated a POSITA to pursue the combination before the earliest priority date of the '457 Patent. TESLA-1003, ¶170.

<u>First</u>, a POSITA would have applied Bayer's steering assistance techniques 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, ¶171. 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. TESLA-1003, ¶171. Bayer's steering assistance techniques would have been well-suited to 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].

<u>Second</u>, a POSITA would have applied Bayer's steering assistance techniques in Joos to increase safety by ensuring the driver remains engaged during the unparking maneuver. TESLA-1003, ¶172. 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 techniques in Joos to increase safety by monitoring 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, ¶173; TESLA-1007, [0064]-[0070].

Fourth, a POSITA would have pursued the Joos-Kischkat-Bayer combination because 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 those problems (and provided the other benefits discussed above). TESLA-1003, ¶174.

A POSITA would have reasonably expected success implementing the Joos-Kischkat-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-Kischkat's semi-autonomous parking system) to achieve predictable results. *KSR*, 550 at 421; *Intel*, 61 F.4th at 1380-81; TESLA-1003, ¶175.

3. Claim Element Analysis

Ground 3A is substantively identical to, and incorporates the analysis of, Ground 1A in all but one respect. In particular, where Ground 1A relies on the teachings of Joos-Kischkat to address 1[a]-1[c] and 12[a]-12[c], Ground 3A relies on the combined teachings of Joos, Kischkat, and Bayer to satisfy this feature. Integration of Bayer does not disturb the aspects of Joos-Kischkat mapped to other claim elements in claims 1-4, 6-15, and 17-22, except that the steering control movements for Joos's unparking maneuver are assisted, monitored, and regulated as taught in Bettger and described above in §III.G.1. To avoid repetition, and because the analysis of all other claim elements is otherwise unchanged, only 1[a]-1[c] and 12[a]-12[c] are addressed below. TESLA-1003, ¶176.

(a) Elements 1[a] and 12[a]

In the Joos-Kischkat-Bayer combination, the driver assistance system (***drive system***) ***monitors the steering control*** as operated by the driver guided by Bayer's steering assistance. TESLA-1003, ¶¶177-178; *supra*, §III.G.1-2.

As discussed above, Joos discloses that the "driver assistance system intervenes in the steering" of a semi-autonomous unparking procedure, and Bayer discloses a steering assistance technique that allows the driver to steer while guided along a prescribed trajectory by steering stops and haptic feedback. *Supra*, §§III.G.1-2; TESLA-1007, [0001]-[0003], [0006], [0012]-[0014], [0016]-[0018], [0020]-[0021], [0024], [0043], [0056]-[0057], [0065]; TESLA-1003, ¶179.

As discussed above in §III.G.2, it would have been obvious to implement Joos-Kischkat in accordance with Bayer's steering assistance techniques. TESLA-1003, ¶180. Joos-Kischkat's steering system and controller would aid the driver in steering the vehicle by ***monitoring the steering control*** as taught in Bayer, including by use of a driver recognition module, to follow Joos's unparking trajectory to the end position E (where the vehicle is stopped and the controller selects to drive the wheels in a forward direction by auto-shifting to drive). TESLA-1004, [0016]-[0018]; TESLA-1007, [0017]-[0018], [0020]-[0021], [0020]-[0021], [0045] [0056]-[0058], [0065]; *supra*, §III.G.2. The steering angles set according to Bayer's steering assistance for following the unparking trajectory augment Joos's "***steering control***" at least because they provide a distinctive sequence of steering control movements indicative of proper operation of the vehicle. TESLA-1003, ¶180; TESLA-1007, [0020]-[0021], [0043].

(b) Elements 1[b], 1[c], 12[b], and 12[c]

Joos discloses "it is advantageous if the specified steering angle at the end position is set by means of a driver assistance system of the motor vehicle. If the end position is reached, the driver assistance system can intervene in the steering… 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]. The driver assistance system in the combination implements Bayer's steering assistance techniques such that the driver, at the end position E of the trajectory, provides the new steering angle before the vehicle auto-shifts or offers to auto-shift to drive.

Supra, §§III.G.1-2. In this example, the drive system/controller ***offers a driver a change from the reverse mode to the drive mode based on the steering control*** (*e.g.*, based on the driver's assisted steering inputs to the steering control). TESLA-1003, ¶¶181-182. The drive system/controller further ***changes from the one of the drive mode and reverse mode to the other of the drive mode and reverse mode in response to an approval by the driver of the offered change***. TESLA-1005, [0001], [0009], [0016], [0019] (describing the driver providing a confirmation response to the offer); *supra*, 1[b]; §III.A.2-3; TESLA-1003, ¶182.

Joos explains that the auto-shift to drive does not occur until the vehicle reaches the end position E and the steering angle in the opposite direction is set. TESLA-1004, [0016]-[0018]. Because the driver of the vehicle in the Joos-Kischkat-Bayer combination must comply with the assisted ***steering control*** to reach the end position E, and because it is necessary to reach the end position E and to set the steering angle in the opposite direction for ***the controller to offer the driver the change from the reverse mode to the drive mode*** through an auto-shift to drive, the Joos-Kischkat-Bayer controller would monitor the steering control while driving in the reverse direction and ***offer the driver the change from the reverse mode to the drive mode based on the steering control*** monitored in accordance with Bayer's techniques. TESLA-1003, ¶183. Indeed, the vehicle would not make it to the end position E if the driver does not properly steer the vehicle by following the steering guidance for the trajectory indicated by the controller. TESLA-1007, [0057], [0065]. Moreover, because the controller selects the forward direction and implements a shift to drive automatically, these actions are done without operator indication of a direction. TESLA-1003, ¶183.

H. GROUND 3B—Obvious based on Joos in view of Kischkat, Bayer, and Hoop (Claims 5, 16)

It would have been obvious to combine Joos (as modified by Kischkat and Bayer (*supra*, §§III.A.3, III.G.2)) with Hoop for the reasons described above in Ground 1B. *Supra*, §III.B.2; TESLA-1003, ¶184. The resulting Joos-Kischkat-Bayer-Hoop combination would have provided the additional features recited in claims 5 and 16 for each of the reasons described above for the same claims in Ground 1B. *Supra*, §III.B.3 (Claims 5, 16); TESLA-1003, ¶184.

I. GROUND 3C—Obvious based on Joos in view of Kischkat, Bayer, and Allexi (Claims 7, 8, 18, 19)

It would have been obvious to combine Joos (as modified by Kischkat and Bayer (*supra*, §§III.A.3, III.G.2)) with Allexi for the reasons described above in Ground 1C. *Supra*, §III.C.2; TESLA-1003, ¶185. The resulting Joos-Kischkat-Bayer-Allexi combination would have provided the additional features recited in claims 7, 8, 18, and 19 for each of the reasons described above for the same claims in Ground 1C. *Supra*, §III.C.3 (Claims 7, 8, 18, 19); TESLA-1003, ¶185.

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 '457 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 '457 Patent.

The '457 Patent is one of seven related patents that Bulletproof asserts in the Texas Litigation. Petitioner is concurrently filing IPR petitions on related patents in the following proceedings:

Patent No.	IPR Proceeding No.
12,221,104	IPR2026-00219
12,227,184	IPR2026-00204
12,233,871	IPR2026-00222
12,240,457	IPR2026-00205

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. Petitioner consents to electronic service by email at IPR49649-0061IP1@fr.com and gcremona@tesla.com.

Respectfully submitted,

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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 13,954 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated: January 20, 2026

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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 21, 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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