IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Bennet Langlotz	
U.S. Patent No.:	12,240,457	Attorney Docket No. 49649-0061IP1
Issue Date:	March 4, 2025	
Appl. Serial No.:	18/928,134	
Filing Date:	October 27, 2024	
Title:	VEHICLE GEAR SELECTION CONTROL	

DECLARATION OF JASON A. JANET, Ph.D.

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I, Jason A. Janet, of Raleigh, North Carolina, declare that:

I. INTRODUCTION

1. I have been retained as an independent expert witness by Telsa, Inc. ("Petitioner" or "Tesla") in the above-captioned *Inter Partes* Review ("IPR") proceeding, in which Tesla has requested that the U.S. Patent and Trademark Office ("USPTO" or "Office") cancel as unpatentable claims 1-22 of U.S. Patent No. 12,240,457 ("the '457 patent").

2. This declaration sets forth my analyses and opinions based on my knowledge, experience, and the materials I have considered. As I explain below, it is my opinion that each of claims 1-22 of the '457 patent is directed to subject matter that was routine, conventional, and well known in the prior art before the '457 patent's earliest alleged priority date. As would be readily appreciated by one of skill in the art, each of these claims of the '457 patent is rendered obvious by the prior art references discussed herein.

II. QUALIFICATIONS AND COMPENSATION

3. I have a Ph.D. in Electrical & Computer Engineering from North Carolina State University (or "NCSU"), which I earned in 1998. Prior to that I received a M.S. in Integrated Manufacturing Systems Engineering from North Carolina State University in 1994 and a B.S. in Mechanical Engineering from the University of Virginia in 1990.

4. Since 1991, I have been active in the robotics, sensors, artificial intelligence, pattern analysis, computer vision, image/video processing, and automation fields. I have authored numerous publications and have co-authored a textbook entitled *Computational Intelligence*. My PhD dissertation is entitled *Pattern Analysis, Tracking and Control for Autonomous Vehicles Using Neural Networks*. It described the use of unsupervised training (i.e., the Hyper-Ellipsoid Clustering Neural Network, or "HECNN"), and supervised training (i.e., the Region-Feature Neural Network, or "RFNN") for dissimilar mobile robots to learn aspects of their common environments through multiple types of sensors (e.g., acoustic rangefinding, infrared proximity, tactile and imaging), build knowledge libraries, and then transfer knowledge between for operational use and/or refinement. Among other outputs, the robots learned to recognize spaces, landmarks within those spaces, and then plan and track motion from the accumulated and shared knowledge. Efficiency and accuracy were shown to increase significantly with the combined unsupervised and supervised learning, and knowledge transfers.

5. I have designed, built, and marketed robots, automated systems, and components thereof, including ground mobile robots, unmanned aerial vehicles (UAV), unattended sensors automated storage and retrieval systems (ASRS), submersible mobile robots, proof-of-concept extra-terrestrial robots, manually manipulated (“twiddled”) submersible foils, wall climbing mobile robots, and

augmented reality systems.

6. I have taught the following courses: Introduction to Robotics and Automation (Duke and NCSU); Introduction to Control Theory (Duke and NCSU); Distributed Real-Time Controls (NCSU); and myriad independent studies courses in the areas of robotics, automation, artificial intelligence, autonomy, pattern analysis, and control systems. I have also served on several MS- and PhD-level graduate student committees, designed qualifying exam problems, served on the NCSU IMSEI Board, and participated in curriculum development for undergraduate and graduate level programs.

7. I have also started, sponsored, and advised multiple champion student teams for international robot competitions including, but not limited to, the NASA/ASCE Extra-Terrestrial Robotics Competition, the DARPA Grand Challenge, the AUVSI/ONR Autonomous Underwater Vehicle Competition, and the European CLAWAR Wall-Climbing Robot competition.

8. I have initiated multiple unmanned aerial vehicle (UAV) projects at both academic and industry levels. Academic UAVs include, but are not limited to, Quadcopters with Hybrid Remote and Autonomous Control, Marsupial UAVs that Deploy and Recover Unmanned Ground Vehicles, and Wall-Climbing UAVs. Additionally, the AngelFish Cross-Domain Submersible UAV, a DARPA ASW program that I incubated and procured funding for at Teledyne, included a

partnership with North Carolina State University.

9. In 1999, while I was employed by Nekton Research ("Nekton"), I captured and managed multiple programs sponsored by the Department of Defense (DoD) and private-sector companies that focused primarily on autonomous underwater vehicles (AUV), remotely operated vehicles (ROV), TwiddleFish toys, and indirect-fire projectiles. During my tenure, Nekton entered into a joint venture agreement with the founders of what eventually became known as Parata Systems – a pharmacy automation solutions company, which I supported launching.

10. After leaving Nekton in March 2002, I joined a then New Jersey-based company called Avionic Instruments, Inc. ("Avionic"). While at Avionic, I continued developing and marketing robots and supported engineering related to various design, manufacturing, quality and assembly issues on the core aerospace product lines. Avionic product lines include, but are not limited to, ducted fans, transformer rectifier units (TRU), regulated TRU (RTRU), auxiliary power unit (APU) control systems, power distribution systems (PDU), frequency converters, corner clamps, and VRAM attractors/thrusters. Customers included DoD, NASA, Boeing, Sikorsky, Augusta-Westland, Dassault, and Lockheed-Martin.

11. In late 2004, soon after Avionic was sold, I, along with others from Avionic, secured funding to develop an alpha-level multi-dispenser robotic system which afforded me time to write the RxMedic business plan and raise multiple

rounds of venture capital. In late 2006, RxMedic (called "APDS" until November 2006) was launched as a stand-alone, sole-focus venture. After the operational launch of RxMedic, I served as General Manager and eventually Chief Technical Officer. Through my roles at RxMedic, I oversaw the development of the RxMedic ADS robot, managed the intellectual property portfolio, coordinated sales and marketing, and provided strategic, fiscal, and operational leadership. In May 2010, J.M Smith Corporation acquired RxMedic, and in an effort to assist in the change of ownership, I served as a director of RxMedic until May 2011.

12. Also in late 2004, after Avionic was sold, I, along with others from Avionic, secured funding for Vortex HC through DoD contracts and robot sales, to continue developing the VRAM Mobile Robot Platform (VMRP – a wall-climbing robot), the ARTEMIS AUV (a holonomic submersible robot for counter-mine and counter-obstacle operations), the submersible crawler, the nuclear-grade boiler water reactor (BWR) inspection robot, and other robot products centered around the VRAM. Some DoD programs were/are classified, for which I maintained a SECRET clearance at both the personal and facilities level, and served as the facilities security officer (FSO). In late 2006, corresponding to the full launch of RxMedic, Vortex HC technologies were largely licensed to Teledyne SeaBotix, SeaRobotics, and HDT.

13. However, I have continued to support Vortex HC licensees and customers to date. After the sale of RxMedic, and after fulfilling my 12-month

employment obligation, I joined Teledyne Technologies in summer 2011. I served as the Senior Manager for the RTP division of Teledyne Scientific, and supported multiple DoD sponsored robotic-focused programs. Some of these programs were/are classified, for which I maintained a personal SECRET clearance. Among these programs, were cargo unmanned ground vehicles (CUGV), squad-level autonomous unmanned ground vehicles (UGV), autonomous underwater vehicles (AUV), unmanned underwater vehicles (UUV), and a cross-domain autonomous vehicle capable of transitioning between air-, surface- and underwater-domains. Cross-domain vehicles that were evaluated, designed and prototyped included, but were not limited to, the AngelFish (later called "EagleRay") submersible AUV for anti-submarine warfare, and a ball-shaped robot for countermine operations on the ground, in the beach zone and in the surf zone. Sensor design, refinement and signal processing was a major component of each program. Sensors employed include, but are not limited to: proximity sensors; ranging sensors; electro-optical imaging; long-, short- and mid-wave infrared (IR); inertial measurement units (IMU); optical flow; and radiofrequency (RF). Additionally, control systems were designed, refined and integrated into the aforementioned systems. Most control systems were closed-loop, in that they utilized sensor-based feedback; others were open-loop, where states were estimated with little or no feedback.

14. In late 2013, Avionic, a Transdigm business unit at that point, requested

that I return to turn around a supply-chain issue, and assume management of its Sikorsky S97 Raider helicopter program. The S97 Raider is purported to be the fastest, most maneuverable helicopter, due to its coaxial, counter-rotating variable pitch wings, and an aft-based push-propeller. Avionic also controlled two business units named Acme Aerospace (Acme) and Aerospace Cooling Solutions (ACS). Avionic, Acme and ACS supported the S97 program, which has met milestones and continues to produce multiple successful demonstrations. In 2013, Transdigm expanded my role to include directorship of the Avionic, Acme and ACS sales and marketing team, and to report operational and financial status at six-week intervals. Transdigm required that I move my family to New Jersey in late 2014, which influenced my decision to resign and assume the CEO role of Delta Five Systems in Raleigh, NC.

15. As CEO of Delta Five, I led a private-equity backed, hospitality-focused venture, coordinating the company's launch and strategic path including an early stage pivot. Initially focused on back-end robotics and automation, Delta Five shifted to address the rampant bed bug problem—a top priority for hoteliers—with a novel unattended sensor and trap, called the Telemetered Pest Monitoring System (TPMS), which is based on computer vision and internet of things (IoT), and has proven capable of scaling to other pests. In addition to the TPMS, Delta Five developed a novel means to mass produce a natural, unscented aggregation

pheromone that, in concert with placement and heat, lured invertebrates to the TPMS. After leading Delta Five and serving on its Board for four years, I resigned to join ARA, but continue serving Delta Five as an investor and supportive transition agent.

16. In 2018, I joined ARA as sector CTO. In this role, my primary responsibilities included leading the commercialization and technology transition efforts, which require technical, business and corporate development, as well as the raising of capital and managing matrixed rosters. I assumed my other current role at ARA, Corporate Director of IP and Product Commercialization, in 2020. In this role, I evaluate, quantify, present, and recommend portfolios of IP, product lines, and ventures on the basis of competitive landscapes, addressable markets, sales strategy, resource availability and technology readiness. I also spearhead investments and provide general venture oversight.

17. My curriculum vitae is attached as Appendix A to this declaration, and provides further information about my experience, expertise, and presentations.

18. Through my professional experience, I have gained extensive expertise in robotics, sensors, artificial intelligence, automation, computer vision, and image/video processing.

19. I am being compensated at my standard rate of $500/hour. My compensation is in no way contingent upon my opinions or the outcome of the

proceeding.

III. Materials Considered

20. In preparing this Declaration, I have considered the following: my own knowledge and experience, including my work experience in robotics, computer vision, and machine-learning; my experience in teaching those subjects; and my experience in working with others involved in those fields. In addition, I have analyzed the following publications and materials, in addition to other materials I cite in my declaration:

- U.S. Patent No. 12,240,457 to Langlotz ("the '457 patent") (TESLA-1001)
- Excerpts from the Prosecution History of the '457 patent (TESLA-1002)
- U.S. Patent Application Publication No. 2019/0233009 to Joos et al. ("Joos") (TESLA-1004)
- European Patent No. EP2135788B1 to Kischkat ("Kischkat"), English Translation, Original Document, and Certification (TESLA-1005)
- U.S. Patent Application Publication No. 2019/0161086 to Bettger ("Bettger") (TESLA-1006)
- U.S. Patent Application Publication No. 2007/0282502 to Bayer et al. ("Bayer") (TESLA-1007)
- Abdallah et al., *Real-Time Vehicle Localization Using Steering Wheel Angle in Urban Cities*, 2023 IEEE International Conference on Mobility,

Operations, Services and Technologies ("Abdallah") (TESLA-1008)

- U.S. Patent No. 10,077,073 to Allexi et al. ("Allexi") (TESLA-1009)
- U.S. Patent Application Publication No. 2014/0222252 to Matters et al. ("Matters") (TESLA-1010)
- U.S. Patent Application Publication No. 2018/0201319 to Rogers (TESLA-1011)
- U.S. Patent Application Publication No. 2020/0369140 to McCarron et al. (TESLA-1012)
- U.S. Patent Application Publication No. 2018/0093655 to Healy et al. (TESLA-1013)
- U.S. Patent Application Publication No. 2022/0355636 to Harmon et al. (TESLA-1014)
- U.S. Patent Application Publication No. 2019/0178998 to Pacala et al. (TESLA-1015)
- U.S. Patent Application Publication No. 2019/0146500 to Yalla et al. (TESLA-1016)
- U.S. Patent Application Publication No. 2020/0180633 to Wu (TESLA-1017)
- U.S. Patent Application Publication No. 2020/0369262 to Suzuki et al. ("Suzuki") (TESLA-1018)

- U.S. Patent Application Publication No. 2014/0200769 to Noh ("Noh") (TESLA-1019)
- U.S. Patent No. 11,753,000 to Tashiro et al. ("Tashiro") (TESLA-1020)
- U.S. Patent Application Publication No. 2007/0291130 to Broggi et al. ("Broggi") (TESLA-1021)
- U.S. Patent Application Publication No. 2019/0291721 to Sakano et al. ("Sakano") (TESLA-1022)
- U.S. Patent Application Publication No. 2021/0122387 to Hoop et al. ("Hoop") (TESLA-1023)
- Parking & Reversing In & Out of Angled Spaces, A1 Driving School (Nov. 23, 2022), *available at* https://www.a1drivingschool.co.nz/guides/parking-and-reversing-in-and-out-of-angled-spaces/ (TESLA-1024)
- How to Back Up, Safe2Drive (Sept. 26, 2023), *available at* https://web.archive.org/web/20230926120717/https://www.safe2drive.com/how-to/how-to-backup (TESLA-1025)
- U.S. Patent No. 11,932,230 ("Langlotz-230") (TESLA-1026)
- U.S. Patent Application Publication No. 2020/0133272 to Chong ("Chong") (TESLA-1027)
- U.S. Patent Application Publication No. 2022/0297744 to Watanabe ("Watanabe") (TESLA-1028)

- U.S. Patent Application Publication No. 2019/0317516 to Zhu ("Zhu") (TESLA-1029)

IV. LEGAL STANDARDS

A. Claim Construction

21. It is my understanding that the numbered paragraphs at the end of the disclosure of a U.S. patent are the patent "claims" that define the metes and bounds of the alleged invention. I understand that the claims of the '457 patent are what is being challenged in the present IPR proceeding.

22. I have been informed that, in this proceeding, the Board must determine the scope of the claims by giving the claims their ordinary and customary meaning in light of the specification, as the claims would be interpreted by one of ordinary skill in the art.

23. I understand that patent claims generally include a "transitional" term or phrase, such as "consisting" or "comprising," which may connect the preamble of the claim to the body of the claim. I have been informed that if a claim uses the term "consisting" as a transition term, that means that the claim is a "closed" claim, which means that the claim is limited to the claim features that follow the transition term and nothing else. On the other hand, I understand that the transition term "comprising" denotes an "open" claim, which means that the claim is not limited to only the features recited in the claim, and could encompass the listed elements as

well as other unrecited elements.

24. I understand that 35 U.S.C. § 112(f) created an exception to the general rule of claim construction called a "means plus function" limitation. These types of terms and limitations should be interpreted to cover only the corresponding structure described in the specification, and equivalents thereof. I also understand that a limitation is presumed to be a means plus function limitation if: (a) the claim limitation uses the phrase "means for"; (b) the "means for" is modified by functional language; and (c) the phrase "means for" is not modified by sufficient structure for achieving the specified function.

25. I understand that a structure is considered structurally equivalent to the corresponding structure identified in the specification only if the differences between them are insubstantial. For instance, if the structure performs the same function in substantially the same way to achieve substantially the same result. I further understand that a structural equivalent must have been available at the time of the issuance of the claim.

B. Invalidity

26. I understand that Tesla bears the burden of proving that the challenged claims of the '457 patent are invalid, and must prove this by a preponderance of the evidence, which means that invalidity must be shown to be more likely than not.

1. Anticipation

27. I have been asked to consider the question of whether claims 1-22 of the ’457 patent would have been anticipated by certain prior art references. I understand that determining anticipation of a patent claim requires a comparison of the claim language to the prior art on a limitation-by-limitation basis.

28. I understand that a prior art reference “anticipates” an asserted claim, and thus renders the claim invalid, if all elements of the claim are disclosed in that prior art reference, either explicitly or inherently (i.e., necessarily present or implied), as those elements are arranged in the claim so that the disclosure effectively puts the public in possession of the invention. I understand that a prior art reference anticipates an asserted claim when each and every element of the claim is disclosed in a single embodiment as arranged in the claim. The mere fact that a certain outcome may result from a given set of circumstances is insufficient for inherency; rather, inherency requires that the claimed product or process at issue must be a necessary result from the operation as taught by the prior art reference. I understand that, although references cannot be combined for anticipation, additional references may be used to interpret an anticipating reference and shed light on what it would have meant to those skilled in the art at the time of the invention.

29. In order to anticipate a claimed invention, a prior art reference must enable one of ordinary skill in the art to make the invention without undue

experimentation, i.e., provide an enabling disclosure. A prior art reference need not enable its full disclosure; it only needs to enable the portions of its disclosure alleged to anticipate the claimed invention.

2. Obviousness

30. I have been asked to consider the question of whether the challenged claims of the ’457 patent would have been obvious. I understand that this analysis must be conducted from the perspective of the person of ordinary skill in the art, and whether the skilled artisan would consider any differences between the prior art and what is claimed to have been obvious. To make this assessment, I have been informed that the concept of patent obviousness involves four factual inquiries: (1) the scope and content of the prior art; (2) the differences between the claimed invention and the prior art; (3) the level of ordinary skill in the art; and (4) secondary considerations of non-obviousness. I have been instructed that one must not engage in hindsight. Rather, I understand that one should instead consider what the person of ordinary skill in the art would have reason to pursue further, and steps that were routinely done, such as in response to known problems, or obstacles.

31. It is my understanding that the following is a non-exhaustive list of rationales that may support the obviousness of an invention: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; use of a

known technique to improve a similar device (method, or product) in the same way; applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

32. It is my understanding that the motivation to combine prior art references may be implicit and may be found in the knowledge of one of ordinary skill in the art, or in the nature of the problem to be solved. Specifically, it is my understanding that an implicit motivation to combine exists not only when a suggestion may be gleaned from the prior art as a whole, but when the "improvement" is technology-independent and the combination of references results in a product or process that is more desirable, for example because it is stronger, cheaper, cleaner, faster, lighter, smaller, more durable or more efficient. It is my further understanding that the motivation to combine references may be found in the nature of the problem to be solved where prior art references are directed to precisely the same problem.

33. I also understand that prior art may be relied on for its express disclosure and teachings. I also understand that the prior art may be relied upon for

a teaching of features that are necessarily present in the prior art reference even if that specific feature is not expressly or explicitly disclosed.

34. I understand that before reaching any final conclusion on obviousness, the obviousness analysis requires consideration of objective indicia of nonobviousness, if any such indicia are offered. These must be considered to ensure that, for example, there were not some unanticipated problems, obstacles or hurdles that may seem easy to overcome in hindsight, but which were not readily overcome prior to the relevant invention date of the patents/claims at issue here. I understand that these objective indicia are also known as "secondary considerations of nonobviousness," and may include long-felt but unmet need and unexpected results, among others. I also understand, however, that any offered evidence of secondary considerations of non-obviousness must be commensurate with the scope of the challenged claims. This means that for any offered evidence of secondary considerations of non-obviousness to be given substantial weight, I understand the proponent of that evidence must establish a "nexus," or a sufficient connection or tie between that evidence and the merits of the claimed invention, which I understand specifically incorporates any novel element(s) of the claimed invention. If the secondary consideration evidence offered actually results from something other than the merits of the claim, then I understand that there is no nexus or tie to the claimed invention. I also understand it is the Patent Owner who has the burden of proving

that a nexus exists, and I understand that secondary considerations will not overcome a strong showing of obviousness.

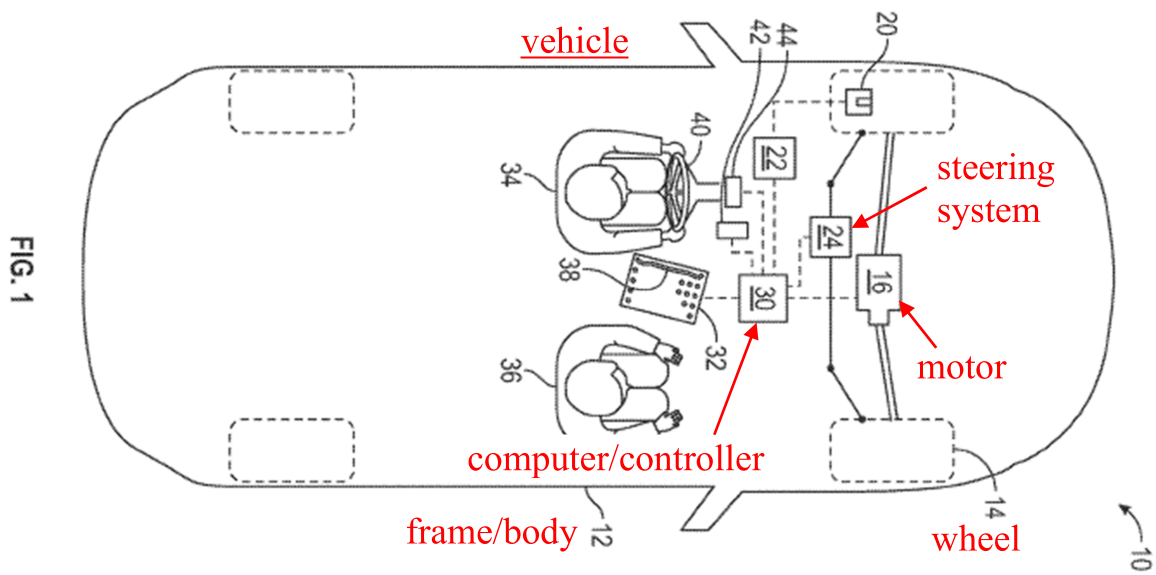
V. OVERVIEW OF THE ’457 PATENT

A. Overview of the Specification

35. From my review, the ’457 patent purportedly relates to “motor vehicles and operational control systems.” TESLA-1001, 1:17-18. According to the ’457 patent, “[t]raditional motor vehicles have gear selection controls” that “have a direction or element associated with each direction, and the driver indicates by the control operation which direction is desired.” TESLA-1001, 1:22-28. The ’457 patent also acknowledges that some vehicles “may select a direction automatically when initially proceeding from a parked condition,” and the “system may then offer the driver that proposed direction, and the driver then for safety reasons indicates (such as by a tap on the brake) that the proposed direction is safe and correct.” TESLA-1001, 1:29-38. The ’457 patent notes that “the automated vehicle-proposed direction system is limited to starting from a stopped condition, when the vehicle initially is not in gear or being operated” and that these gear direction systems “have an opportunity for automation,” for example, “during routine parking when backing out of a parking space, stopping, then selecting the forward drive direction.” TESLA-1001, 1:48-2:3.

36. The ’457 patent describes a system operating in “a vehicle 10 having a

frame or body 12 having wheels 14 that are driven by a motor 16," and a "steering system 24 steers the front wheels," as shown in FIG. 1 below. TESLA-1001, 2:27-31. "A computer or controller 30 is connected to each of the above systems, including sensors to monitor operation of each system, and cameras or other sensors (not shown) that gather information about the vehicle's environment to enable autonomous or assisted driving." TESLA-1001, 2:32-36.



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

37. 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,

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

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.

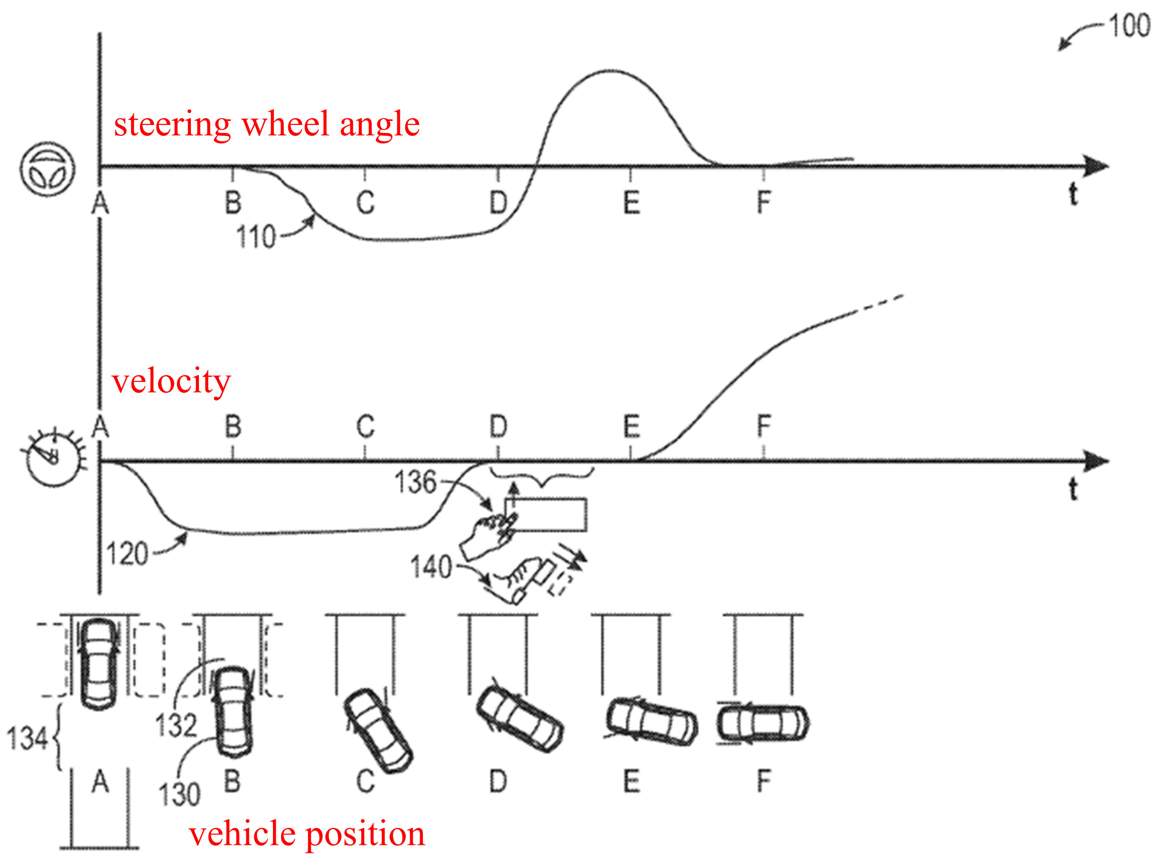


FIG. 2

TESLA-1001, FIG. 2

38. 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 of the '457 Patent

39. From my review of the file history, I understand that 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. The examiner noted that some prior art was made of record but not relied upon in a rejection. *Id.*

C. Person of Ordinary Skill in the Art

40. I have been asked to review the '457 patent from the perspective of a person of ordinary skill in the art ("POSITA") as of the earliest claimed priority date for the patent—June 5, 2023.

41. It is my opinion that a POSITA relevant to the ’457 patent would have had at least: (1) a Bachelor’s degree in electrical engineering, computer engineering, computer science, physics, or a related field, and (2) two years of experience in the research, design or development of autonomous systems for motor vehicles, or the equivalent. Increased educational experience can make up for less work experience, and vice versa.

42. Based on my education, training and experience, it is my opinion that I can accurately represent the views of a POSITA as of the earliest claimed priority date of June 5, 2023 for the ’457 patent. The opinions I provide in this declaration are provided using the viewpoint of the POSITA as of that date.

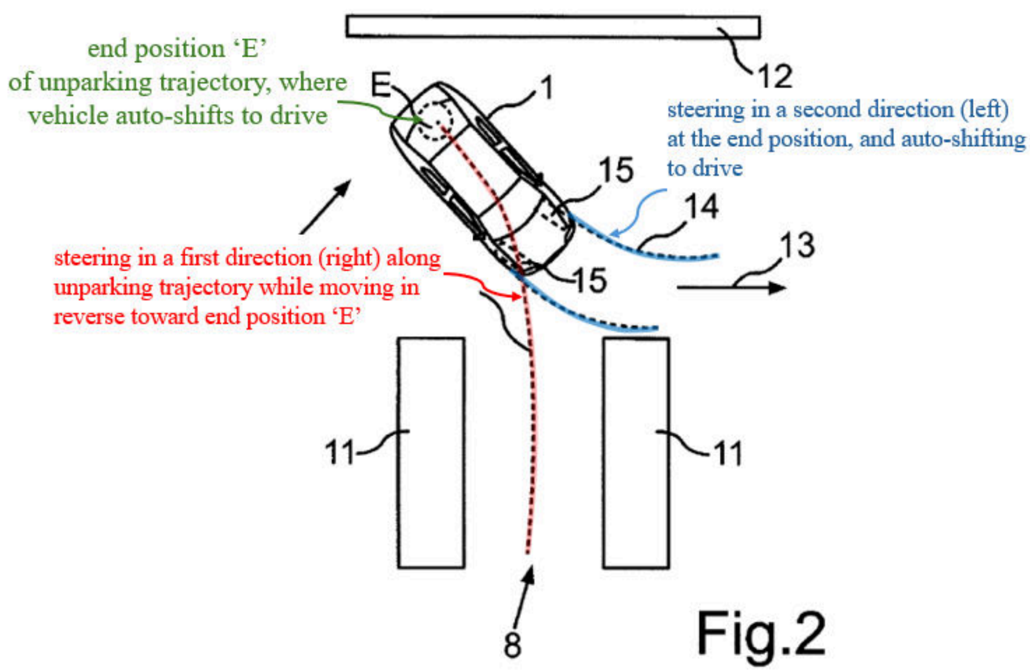
VI. THE PRIOR ART

A. Joos[2]

43. From my review, Joos describes “a method for unparking a motor vehicle from a cross-parking space, with which the motor vehicle is manoeuvred along an unparking trajectory at least semi-autonomously from the cross-parking space onto a road bounding on the cross-parking space, wherein during said semi-

[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.

autonomous manoeuvring the motor vehicle carries out at least one reversing movement along the unparking trajectory, an end position is determined and the semi-autonomous manoeuvring of the motor vehicle along the unparking trajectory is ended at the end position." TESLA-1004, [0001], [0008]. "During manoeuvring of the motor vehicle, the position of the motor vehicle can be defined continuously by means of odometry. In addition, objects, in particular objects bounding on the cross-parking space, can be detected with the sensors of the motor vehicle. This enables the position of the motor vehicle relative to the objects to be continuously determined." TESLA-1004, [0009].



TESLA-1004, FIG. 2 (annotated)

44. Joos describes 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," and the "set steering angle is in particular selected so that the driver can carry out the collision-free forward movement without changing the adjusted steering angle." TESLA-1004, [0015]-[0016], [0037]-[0038]. 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 manoeuvring 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].

45. From my review, Joos is from the same field of endeavor (e.g., motor vehicle operational control systems) and is reasonably pertinent to the problem the '457 patent was trying to solve (e.g., distracting or non-intuitive gear shifters and vehicle controls). 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").

B. Kischkat

46. Like Joos, 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], 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]. "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].

47. From my review, Kischkat is from the same field of endeavor (e.g., motor vehicle operational control systems) and is reasonably pertinent to the problem the '457 patent was trying to solve (e.g., distracting or non-intuitive gear shifters and vehicle controls). 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-1005, [0001] ("park-steer assist system").

C. Hoop

48. 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. More specifically, the vehicle 10 may be slowed or braked via releasing the accelerator pedal 34 alone without an application or depression of the brake pedal 36." TESLA-1023, [0022]. Even with one-pedal driving, however, the brake pedal 36 can still be depressed to apply the friction brakes 38 and further slow the vehicle. TESLA-1023, [0017], FIGs. 1-2.

49. From my review, Hoop is from the same field of endeavor (e.g., motor vehicle operational control systems) and is reasonably pertinent to the problem the '457 patent was trying to solve (e.g., distracting or non-intuitive gear shifters and vehicle controls). 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-1023, [0002] (“vehicles may include one-pedal drive systems”).

D. Allexi

50. Allexi describes an “assisted parking procedure [that] includes entering and leaving a parking space in the forward and reverse direction relative to the direction of travel; and may include a parallel and perpendicular street parking process.” 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.

51. As shown in Allexi’s FIG. 2 (below), “step 101 sets an upper speed limit typically in a range of 5 to 15 km/h, generally 10 km/h. Thus, excessive speed cancels or prevents the parking function.” TESLA-1009, 4:61-63. Step 102 limits “the parking speed to less than or equal to the upper speed limit.” TESLA-1009, 5:1-3. Step 104 monitors “an override function,” and activation of the override function

"results in the system exiting the automatic or autonomous parking operation." TESLA-1009, 5:19-23. "One example of an override function is based on activation or additional pressure on the accelerator by the vehicle operator such that it exceeds a predetermined or default value." TESLA-1009, 5:24-27. "If the override function is not engaged," the assisted parking procedure is "performed fully automatically or semi-automatically at suitable parking speeds." TESLA-1009, 5:23-24, 5:45-47. Step 107 "illustrates completion of the assisted parking maneuver. In this case, at the end of the parking process, the speed of the vehicle continually reduces to a hold point." TESLA-1009, 6:33-43. In Allexi, "two ways to end a parking maneuver include using distance information, for example provided by ultrasonic sensors 4; and having information about the distance to be traveled or distance-to-travel, provided by the PAM 3 available." TESLA-1009, 6:44-48. "[T]hese signals can be used as input for the speed limiter 6 to control the velocity and ramp it down to 0 km/h in a smooth and comfortable way." TESLA-1009, 6:60-67.

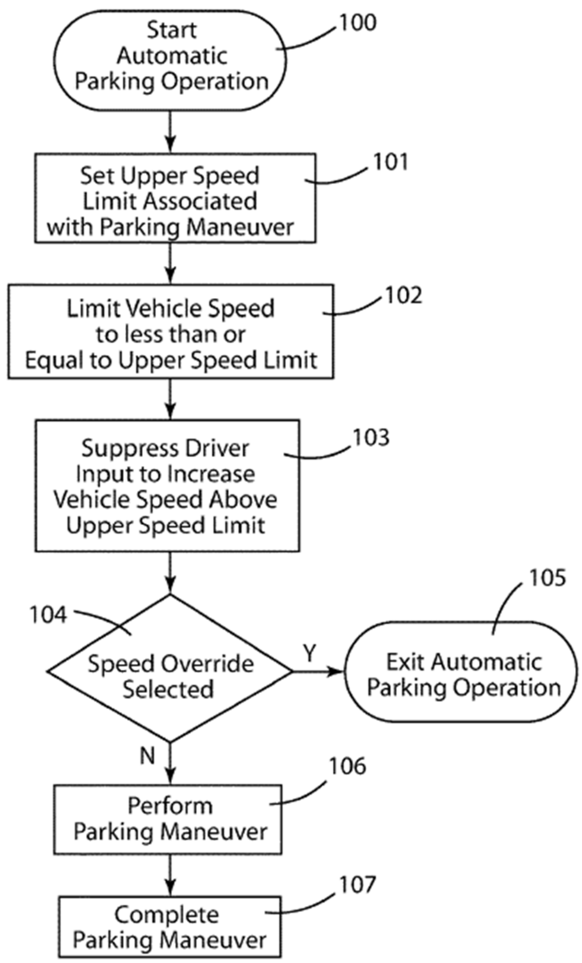


Fig. 2

TESLA-1009, FIG. 2

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

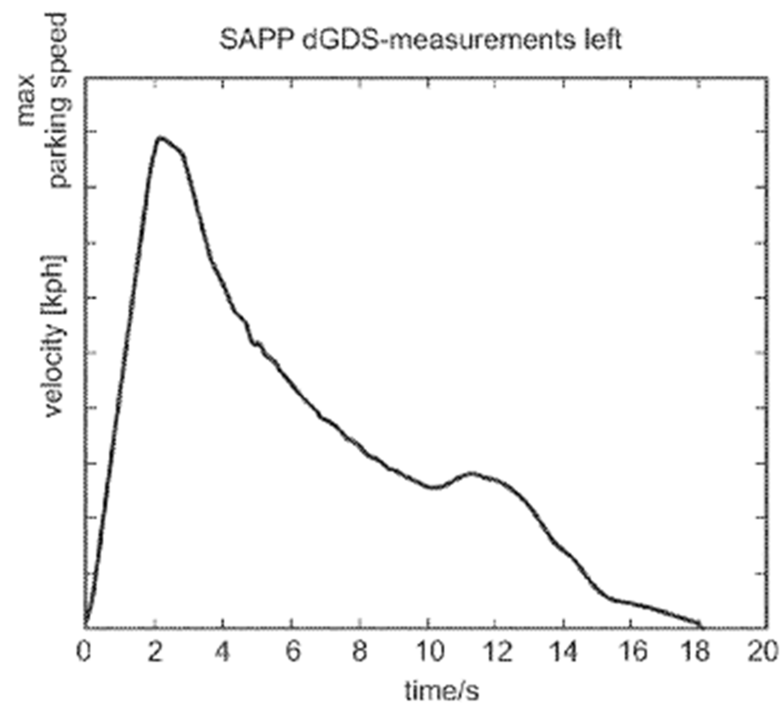


Fig. 6

TESLA-1009, FIG. 6

53. From my review, Allexi is from the same field of endeavor (e.g., motor vehicle operational control systems) and is reasonably pertinent to the problem the ’457 patent was trying to solve (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-1009, 1:51-65 (“assisted parking procedure of a vehicle”).

E. Bettger

54. 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. The instructions may comprise a route to be followed by the vehicle to perform the maneuver." TESLA-1006, [0045], [0017]. "The processing unit 14 may further output to a vehicle dynamics controller 18 of vehicle steering angles, steering torques and/or engine or vehicle speeds necessary for traversing the determined route" such that the vehicle can "operate in a partially or fully autonomous manner … [in] perform[ing] the reverse-turning maneuver." TESLA-1006, [0045]. 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].

55. From my review, Bettger is from the same field of endeavor (e.g., motor vehicle operational control systems) and is reasonably pertinent to the problem the

’457 patent was trying to solve (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-1006, [0008] (“a driver can be assisted when reversing”).

F. Bayer

56. 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.*, [0024]. “If the driver follows the handling instructions for

steering, *i.e.*, correctly implements the corresponding steering instructions applied through the additional steering torque, the driver will certainly be in agreement with the steering operation." TESLA-1007, [0014].

57. In Bayer, "the additional steering torque applied to the steering wheel generates at least an artificial steering stop, preferably one or two steering stops." TESLA-1007, [0016]. "The 'artificial steering stop' here means that beyond a certain position of the steering wheel, a sharply increasing steering torque is applied, so the driver senses a relatively great resistance, a 'counter torque,' when he turns the steering wheel further in this direction." TESLA-1007, [0017]. "This indicates to the driver that he should not turn the steering wheel further in this direction." TESLA-1007, [0018]. "This means that through a continuous change in the additional steering torque applied, during the parking procedure the driver is constantly being given an indication of the point, *i.e.*, the steering wheel position, beyond which he should not attempt to steer the steering wheel further in a certain direction if the driver is steering 'correctly' if the driver then follows the handling instructions for steering, he will not sense any increased resistance in his steering maneuvers. In this way the driver can park the vehicle himself safely and deliberately." TESLA-1007, [0020]-[0021]. The vehicle can also "be braked as a function of the driver recognition" and "as soon as the driver's torque has exceeded a threshold value." TESLA-1007, [0065]. "In this case the vehicle is stopped until

the correct steering torque prevails again," which "makes it difficult to or even prevents the driver from unintentionally departing from the preselected trajectory." *Id.*; *see also id.*, [0043], [0056]-[0057].

58. From my review, Bayer is from the same field of endeavor (e.g., motor vehicle operational control systems) and is reasonably pertinent to the problem the '457 patent was trying to solve (e.g., distracting or non-intuitive gear shifters and vehicle controls). 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-1007, [0001]-[0006] ("driver steering assistance").

VII. SUMMARY OF OPINIONS

59. This declaration explains the conclusions that I have formed based on my analysis. To summarize those conclusions:

- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 1-4, 6-15, and 17-22 of the '457 patent are obvious over Joos in view of Kischkat (Ground 1A).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5 and 16 of the '457 patent are obvious over Joos in view of Kischkat and Hoop (Ground 1B).

- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 7-8 and 18-19 of the ’457 patent are obvious over Joos in view of Kischkat and Allexi (Ground 1C).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 1-4, 6-15, 17-22 of the ’457 patent are obvious over Joos in view of Kischkat and Bettger (Ground 2A).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5 and 16 of the ’457 patent are obvious over Joos in view of Kischkat, Bettger, and Hoop (Ground 2B).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 7-8 and 18-19 of the ’457 patent are obvious over Joos in view of Kischkat, Bettger, and Allexi (Ground 2C).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 1-4, 6-15, 17-22 of the ’457 patent are obvious over Joos in view of Kischkat and Bayer (Ground 3A).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5 and 16 of the ’457 patent are obvious over Joos in view of Kischkat, Bayer, and Hoop (Ground 3B).

- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 7-8 and 18-19 of the ’457 patent are obvious over Joos in view of Kischkat, Bayer, and Allexi (Ground 3C).

VIII. ANALYSIS OF JOOS AND KISCHKAT

A. A POSITA Would Have Combined Joos and Kischkat

60. 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.

61. 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.

62. 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 offer different levels of driver involvement.

63. 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*, §VI.B. Multiple reasons would have prompted a POSITA to pursue a Joos-Kischkat combination that expands Joos's described options for shifting gears according to the known techniques described in Kischkat.

64. 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 where "after reaching the end position a forward gear is engaged." TESLA-1004, [0017], [0038]. Considering these distinct benefits, a POSITA would have expected Kischkat's option to be compatible with to Joos's shifting and preferred by a significant subset of drivers. 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].

65. Kischkat's approach would also beneficially afford an opportunity for the driver to independently assess whether a collision-free forward movement can successfully be carried out from the end position E or whether a further reverse movement may be necessary. TESLA-1004, [0015]-[0016], [0037]-[0038]. The driver confirmation to change gears would have provided a valuable precaution, further reducing the risk of costly collisions and enhancing safety by mitigating the possibility that the vehicle changes a critical operating parameter such as the transmission gear/vehicle direction before control of the vehicle is returned to the driver without the driver's awareness. Further, Joos discloses such a request for driver input disclosing that "after reaching the end position . . . an instruction to engage the forward gear is issued to the driver of the motor vehicle." TESLA-1004, [0017], [0038].

66. <u>Second</u>, 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, where "an instruction to engage the forward gear is issued to the driver of the motor vehicle" 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-1004, [0017], [0038].

67. 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. 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] ("parking process can also be much faster than before"), [0016] ("driver then only has to give a confirmation response"), [0019]. As mentioned above, the simplicity provided by the application of an automatic gear shift based on simplified input universalizes and simplifies the controls of the vehicle for those who are new to the system such as valets, and new drivers.

68. 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. 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. In fact, Kischkat's option complements Joos's description of prompting the driver for a gear shift. Kischkat's techniques would have benefitted these drivers for each of the reasons described above.

69. Fifth, POSITA would have been motivated to combine the automated unparking trajectory of Joos with the simplified gear-switching controls of Kischkat due to a documented design need to enhance driver comfort and reduce operational time during multi-stage automated maneuvers. TESLA-1005, [0003]-[0004], Joos describes a semi-autonomous unparking process that requires a transition from reverse to manual forward driving once an "end position" is reached. TESLA-1004, [0017], [0038]. Kischkat explicitly identifies that requiring a driver to manually operate a traditional selector lever during such automated maneuvering leads to "a loss of comfort" and "a loss of time" because the driver must divert their attention to engage the correct gear. TESLA-1005, [0003].

70. I am informed by counsel that "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp." In this instance, a POSITA would have been motivated to address the transition requirements in Joos by applying Kischkat's

teaching that an a brake or accelerator pedal, can be "reconfigure[d]" to provide the gear-switching signal. TESLA-1005, [0010]. This combination directly addresses the market-driven objective of making the unparking process "much faster" and "easier" for the operator. TESLA-1005, [0013].

71. Sixth, a POSITA would have been further motivated to combine Joos and Kischkat because the resulting system is a predictable use of prior art elements according to their established functions. Joos provides the necessary structural framework for an unparking trajectory, including reversing movements and the identification of an end position where forward motion is required. Kischkat provides a specific technical solution for triggering gear shifts in "shift-by-wire" systems using "simple acknowledging action[s]" via existing pedals or steering wheel buttons. TESLA-1005, [0010]-[0011].

72. I am informed by counsel that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." Because Kischkat explicitly describes using these alternate triggers for multiple maneuvering and direction change during automatic processes, it would be entirely predictable for an artisan to apply this shifting method to Joos's unparking sequence to facilitate the shift from reverse to forward motion. TESLTA-1005, [0013]; TESLA-1004, [0008]-[0013]. Such integration of these teachings is a product of ordinary skill and common sense rather than true innovation, as it merely

fits the teachings of multiple patents together like pieces of a puzzle.

73. 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. 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. Notably, Kischkat explicitly states that its techniques can be "easily" implemented "because motor vehicles usually have a central signal or data bus, often the CAN bus, via which all signals or data are exchanged" and "[a]s a result, it is easily possible to 'reconfigure' an element … as a gearshift signal." TESLA-1005, [0010]. Moreover, considering the substantial similarities between Joos's system and Kischkat's, a POSITA would have expected the benefits provided by Kischkat's teachings to apply with equal force when combined with Joos.

B. Claims 1-4, 6-15, and 17-22 are Rendered Obvious by Joos in view of Kischkat (Ground 1A)

Claim 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:
Claim 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:

74. From my analysis of the references, the Joos-Kischkat combination

renders obvious 1[p] and 12[p].

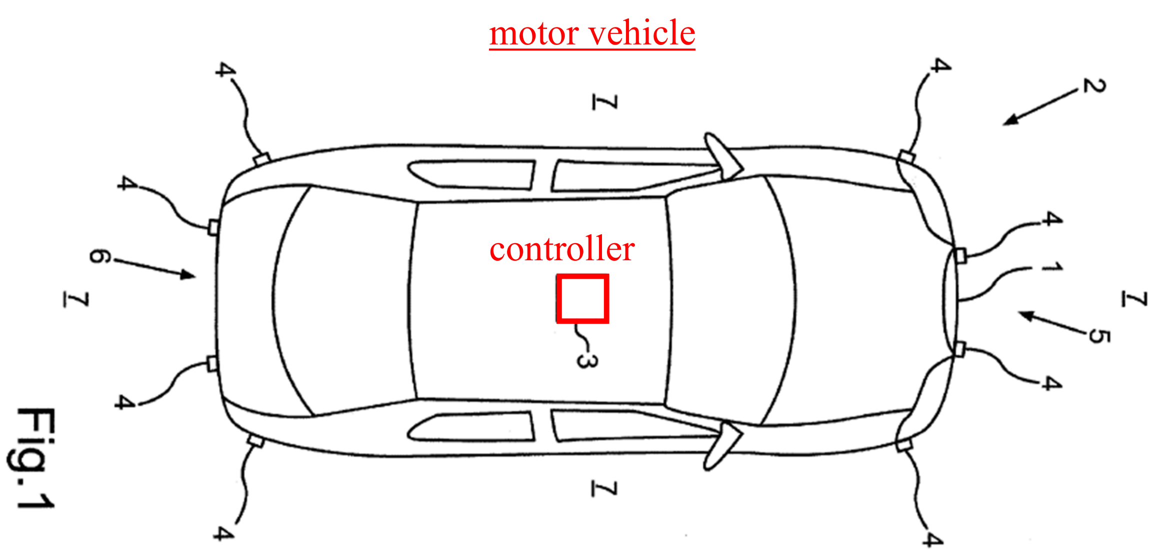
75. Joos discloses ***a method of operating a motor vehicle***. For example, Joos discloses "a **method** for unparking **a motor vehicle** from a cross-parking space."[3] TESLA-1004, Abstract, [0001], [0005], FIG. 1. FIG. 1, reproduced below, depicts a top view of Joos's ***motor vehicle***. TESLA-1004, [0031].

76. Joos discloses the ***motor vehicle having a steering control***. 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. 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*.

77. Joos discloses a ***drive system*** including ***a controller***. 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]. Joos "driver assistance system" includes substantially similar features as the '457 patent's drive "system" that "operates in a vehicle 10." *Compare* TESLA-1004, [0031]-[0033] *with* TESLA-1001, 2:27-42.

[3] All emphases added unless otherwise noted.

78. 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***. 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-1004, FIG. 1 (rotated)

Claim 1[a]: the drive system monitoring the steering control while driving in a first direction;
Claim 12[a]: the controller monitoring the steering control while driving in a first direction;

79. From my analysis of the references, the Joos-Kischkat combination renders obvious 1[a] and 12[a].

80. Joos discloses the ***drive system/controller monitoring the steering control***. For example, Joos discloses that the "driver assistance system 2 . . . continuously detect[s] 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. 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-1008, 9 (discussing "a navigation method that combines steering wheel angle, odometer, and reference points for accurate real-time vehicle localization without the use of sensors" when GPS is potentially unavailable); TESLA-1027, [0010] ("the odometry data is used to determine location coordinates of the vehicle"), [0015] ("odometry data includes a speed, a steering angle, a longitudinal acceleration, or a lateral acceleration").

81. 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-1008, 4-8, 1 ("Combining this information with steering wheel angle sensors and wheel speed sensors, the relative change in the vehicle's position is calculated making localization possible even when satellite connection malfunctions."), 2 ("Therefore, it comes to no surprise that research work has used smartphone sensors such as gyroscopes to estimate steering wheel angle."); TESLA-1028, [0033]-[0036] ("control unit 15 computes a target steering angle based on the steering angle detected by the steering angle sensor" and "performs a feedback control of the steering actuator"). 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].

82. 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.*

83. Joos discloses that the drive system/controller monitors the steering control ***while driving in a first direction***. For example, Joos discloses that "the motor vehicle is manoeuvred 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.

84. 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-1029, [0072]-[0073] ("The steering controller 304 may include a steering outer loop nominal controller 318, a steering inner loop nominal controller 320, and a steering control allocation module 322, a steering outer loop feedback controller 324, and a steering inner loop feedback controller 326. … Each of the feedback controllers 314, 316, 324, 326 may comprise a closed-loop tracking error controller that stabilizes a tracking error in a corresponding control signal and/or state."); *cf.*, TESLA-1001, 2:32-36, 2:48-56 (substantially similar features disclosed in the '457 patent's preferred embodiments).

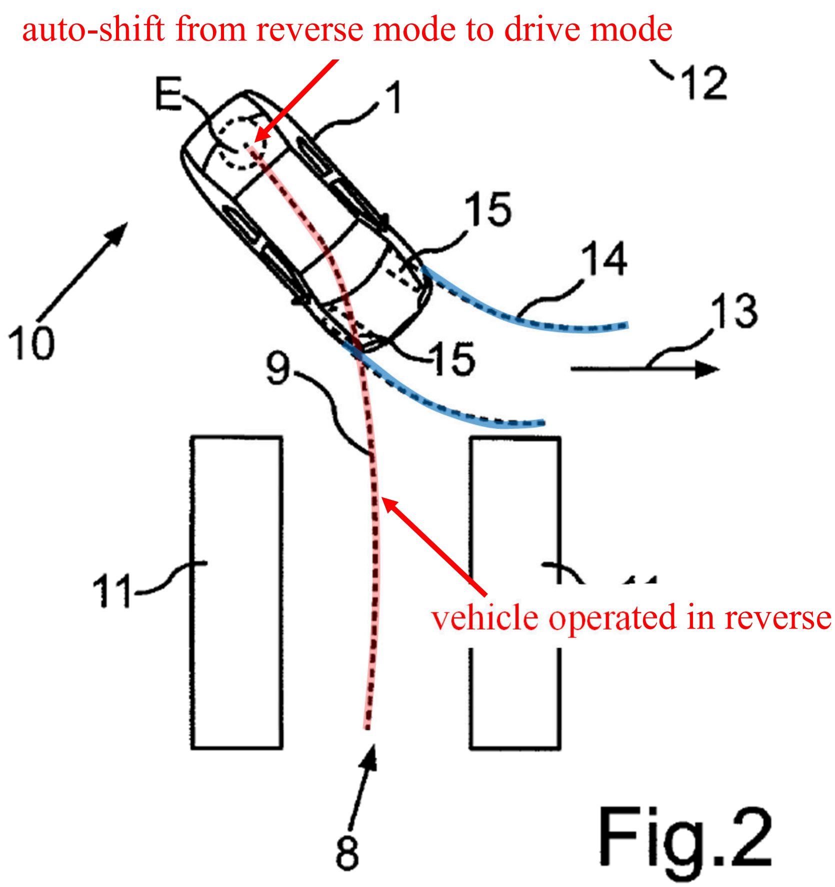
Claim 1[b]: the drive system offering a driver a change from one of the drive mode and reverse mode to the other of the drive mode and reverse mode based on the steering control; and
Claim 12[b]: the controller offering a driver a change from one of the drive mode and reverse mode to the other of the drive mode and reverse mode based on the steering control; and

85. From my analysis of the references, the Joos-Kischkat combination renders obvious 1[b] and 12[b].

86. In particular, Joos discloses the ***controller*** of the ***drive system changing from the reverse mode to the drive mode based on the steering control***. *Supra*, §VI.A. Kischkat discloses ***offering a driver a change from the reverse mode to the drive mode***. *Supra*, §VI.B. 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*, §VIII.A.

87. 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 manoeuvred 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-1004, FIG. 2

88. Joos further discloses that changing from the reverse mode to the drive mode is ***based on the steering control***. First, for example, Joos discloses that the steering control is turned to the 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 at least in part on the steering control being steered correctly as needed for the vehicle to reach the calculated end position E.

89. 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] ("on reaching the end position a steering angle is set that enables collision-free forward movement"), [0015] ("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"), [0016]-[0018] ("semi-autonomous manoeuvring 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."), [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.

90. 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. 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 be set before the drive system/controller auto-shifts to drive for the driver to "take over directly and rapidly" as disclosed.

91. Joos also describes how the drive system/controller can issue an "output" that "advise[s] the driver of the vehicle that he should engage the forward gear" and "that the automatic or autonomous unparking manoeuvre is now ended." TESLA-1004, [0017]-[0018]. This description makes clear that the assisted unparking maneuver ends with the forward gear being engaged, meaning that the pull-forward steering angle must have been set before the forward gear is engaged since the pull-forward steering angle is set *during* the unparking maneuver (and thus before the unparking maneuver is ended). TESLA-1004, [0015] ("Said set steering angle is in particular selected so that the driver can carry out the collision-free

forward movement without changing the adjusted steering angle."), [0009], [0011]-[0012], [0014]-[0015], [0037]-[0039]. Because the drive system/controller engages the forward gear in the same manner as the driver (*see* TESLA-1004, [0018]), a POSITA would have understood and found obvious that the drive system/controller's auto-shifting to drive and ending the unparking maneuver are likewise contingent on the pull-forward steering angle being set earlier.

92. To the extent not expressly disclosed, 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***) would have been obvious for additional reasons as well. 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] ("driver … take[s] over directly and rapidly"); *Id.* Joos is clear that the driver assistance system sets the pull-forward steering angle 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]. Allowing the driver to pull forward before the steering angle is set would introduce an unnecessary risk of collisions with other

vehicles and would prevent the vehicle from being properly oriented when pulling forward in the lane of travel, all of which would compromise safety contrary to Joos's express objectives. *Id.*; TESLA-1004, [0010], [0014]-[0016], [0036]-[0038].

93. 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. 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].

94. 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-1024, 1 ("We keep reversing until the car is fully straight … Once straight, we straighten up the wheel and stop. We select Drive."); TESLA-1025, 3 ("7. Straighten your wheels and stop.

8. Shift your car into 'Drive' and accelerate slowly."). 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.

95. 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. 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. Namely, the steering angle could only be set before, during, or after the auto-shift to drive of the vehicle. 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. 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.

96. To the extent Joos does not expressly disclose ***offering the driver a change from reverse mode to drive mode***, Kischkat discloses this feature. *Supra*, §VI.B. 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].

97. As discussed above, it would have been obvious to combine Joos and Kischkat. *Supra*, §VIII.A. 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].

Claim 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 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.

98. From my analysis of the references, the Joos-Kischkat combination renders obvious 1[c] and 12[c].

99. As discussed above in §VIII.A 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] ("the signal for shifting … 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"), [0001], [0016], [0019] (describing the driver providing a confirmation response to the offer); *supra*, 1[b]; §VI.B; §VIII.A.

Claim 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 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.

100. From my analysis of the references, the Joos-Kischkat combination renders obvious claims 2 and 13.

101. In particular, 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, [0010], [0014] ("on reaching the end position a steering angle is set that enables collision-free forward movement"), [0015] ("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"), [0037]-[0038]. 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.*

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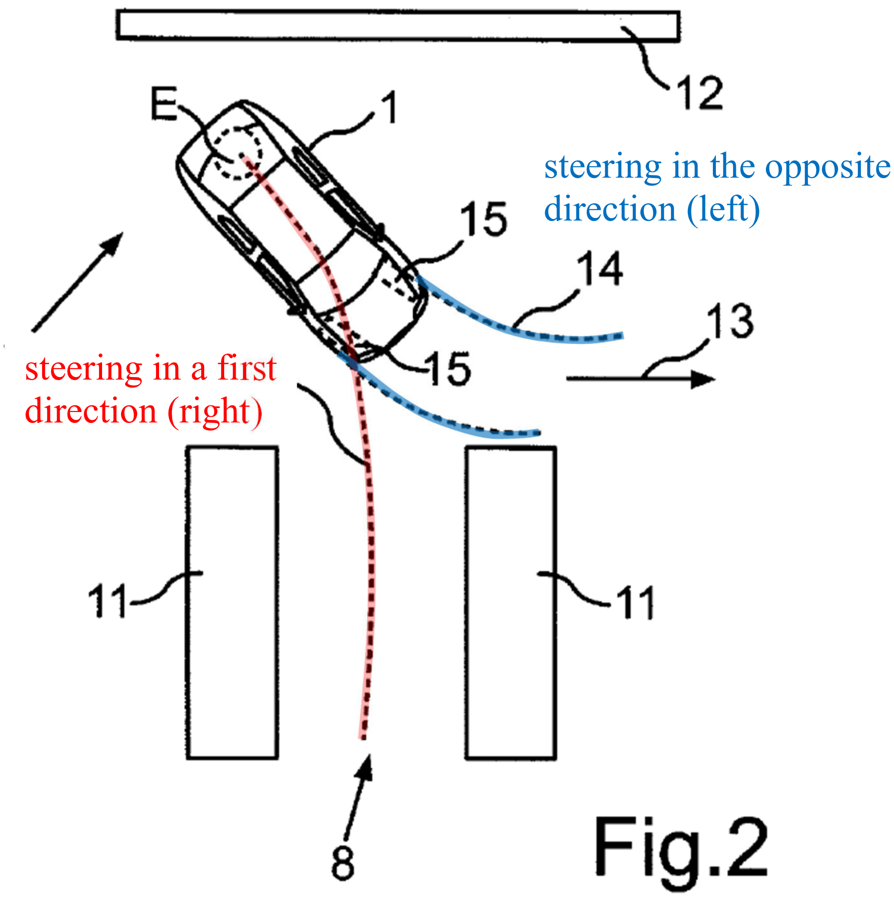
[4] The pattern of steering control movements described in this example is the same pattern recited in dependent claim 11 ("changing drive direction in response to driving the first direction with steering angle in a first steering direction, then to changing steering to an opposite second steering direction").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

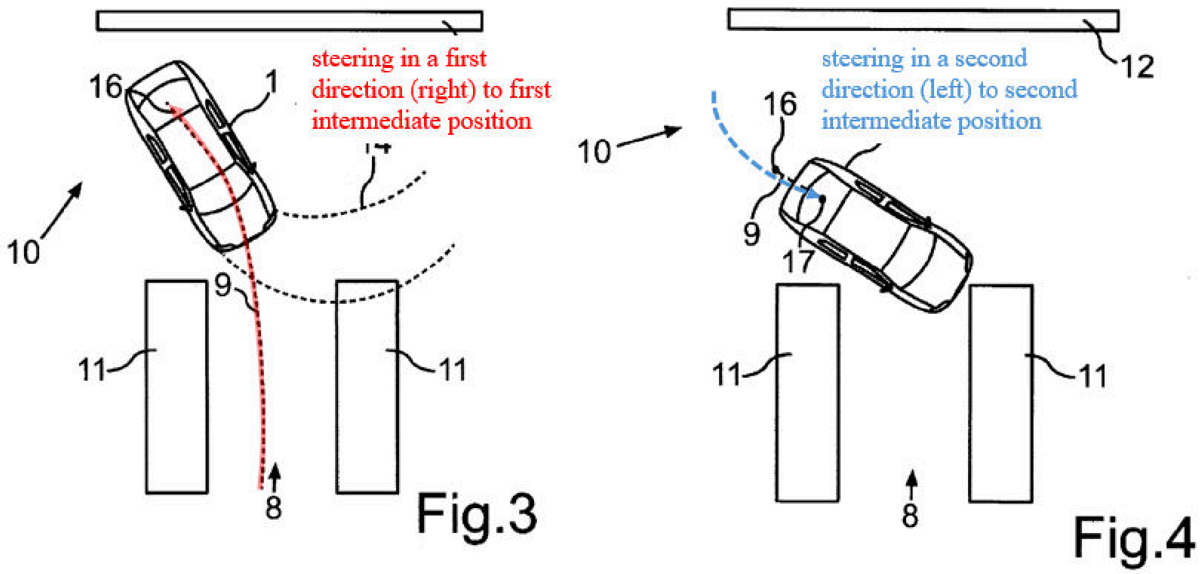
102. In more detail, Joos discloses that the motor vehicle is steered in a first direction of the ***pattern of steering control movements*** "along the **unparking trajectory**" "in the reversing direction" "until it has reached an end position" where "the autonomous parking manoeuvre is ended." TESLA-1004, [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].

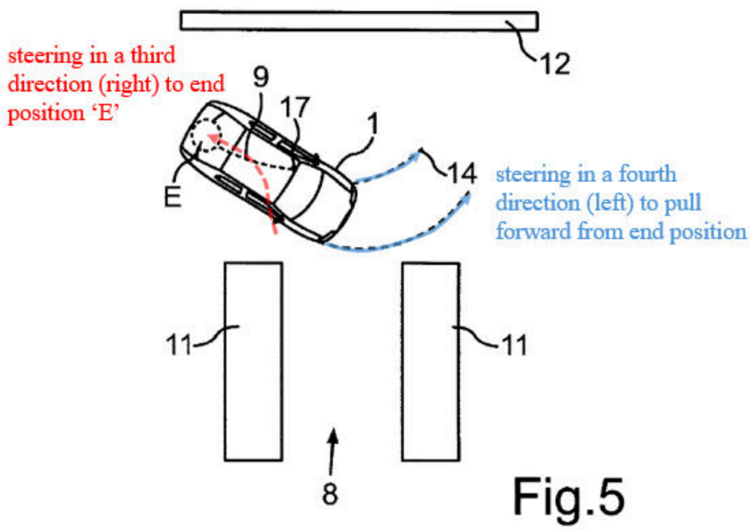
103. Because the vehicle is steered in a first direction while reversing to reach the end position of the unparking trajectory and is then steered in the opposite direction to achieve the specified steering angle that will allow the driver to safely pull the vehicle forward, and because this ***pattern 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. 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.

104. 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-1004, FIGs. 3-4



TESLA-1004, FIG. 5

105. 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*, §VIII.A.

> ***Claim 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 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.***

106. From my analysis of the references, the Joos-Kischkat combination renders obvious Claims 3 and 14 for reasons similar to those discussed above for claim 2. *Supra*, Element 1[b], Claim 2.

107. 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). 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***. 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].

> ***Claim 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 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.***

108. From my analysis of the references, the Joos-Kischkat combination renders obvious Claims 4 and 15.

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

110. 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. 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 manoeuvre 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]. 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.

111. Kischkat teaches that an approval indication for an automated gear shift (***changing between modes***) includes ***actuation of the brake control***. 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*, §VIII.A), 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*, §§VI.B, VIII.A.

> ***Claim 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 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.***

112. From my analysis of the references, the Joos-Kischkat combination renders obvious Claims 6 and 18.

113. 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***. 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***. 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. 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.*

114. Joos's drive system applies a threshold to determine whether the steering input suffices to auto-shift to drive. 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-1006, [0044] ("a steering movement of an angle which lies above a certain threshold value").

Claim 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 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.

115. From my analysis of the references, the Joos-Kischkat combination renders obvious Claims 7 and 18.

116. For example, 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] ("stopped at the end position"), [0018] ("forward gear" not engaged until vehicle reaches end position). 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.

Claim 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 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.

117. From my analysis of the references, the Joos-Kischkat combination renders obvious Claims 8 and 19.

118. For example, 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].

119. 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***.

Claim 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 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.

120. From my analysis of the references, the Joos-Kischkat combination renders obvious Claims 9 and 20.

121. 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***. *supra*, § Claim 2; *infra*, Claim 10. 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].

122. 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. 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] ("gear change can thus be carried out by the driver assistance system"); *supra*, claim 2.

Claim 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 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.

123. For reasons discussed above for 1[b]-[1c] and Claims 2 and 9, the Joos-Kischkat combination renders obvious Claims 10 and 21.

124. For example, 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-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. 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.

> ***Claim 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 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.***

125. From my analysis of the references, the Joos-Kischkat combination renders obvious Claims 11 and 22 for the reasons addressed above with respect to Claims 2/13 and 4/15. *Supra*, Claims 2/13 and 4/15.

126. For example, 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—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. *Id*.

IX. ANALYSIS OF JOOS, KISCHKAT, AND HOOP

A. A POSITA Would Have Combined Joos, Kischkat, and Hoop

127. 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*, §VI.C; TESLA-1023, [0002], [0022]. 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] ("It can continue to be left to the operator of the vehicle to operate the gas pedal and the brake pedal."), 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. *supra*, §VI.C. 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-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; TESLA-1005, [0010]-[0013], [0016]-[0019].

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

129. First, a POSITA would have applied Hoop's suggested use of one-pedal control to the Joos-Kischkat vehicle to achieve a convenient method of activating regenerative braking, particularly in the hybrid- or fully-electric implementations of Joos's vehicle. 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 was a well-known technique and 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].

130. Second, a POSITA would have applied Hoop's suggested use of one-pedal control in 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). The reduced use of the friction brakes would beneficially increase the life of the vehicle's friction brake parts (e.g., rotors, pads) and reduce costs of maintaining or replacing the friction brake parts. This benefit is in addition to the fact that energy is returned to and stored in the battery rather than wasted to heat in the friction brakes.

131. 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.

132. 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. 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. As discussed in the Joos-Kischkat combination, a POSITA would have sought such simplification of controls for the benefit of new drivers by increasing to speed at which the vehicle is

controlled (e.g., rather than rapidly apply the brakes, the vehicle slows when the accelerator is no longer depressed).

133. Fifth, applying Hoop's techniques in combination with Joos and Kischkat would have been obvious because the combination merely involves combining prior art elements according to known methods to yield predictable results.

134. A POSITA likewise would have reasonably expected success implementing the combination. 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 (demonstrated at least by Hoop's filing date). Moreover, Joos's and Kischkat's techniques are fully compatible with electric and hybrid-electric vehicles of the type that would use Hoop's one-pedal driving techniques. Adding a capability for braking in response to releasing the accelerator pedal to a similar system as proposed in the combination would have been well within the capabilities of a POSITA.

B. Claims 5 and 16 are Rendered Obvious by Joos in view of Kischkat and Hoop (Ground 1B)

Claim 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 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.

135. From my analysis of the references, the Joos-Kischkat-Hoop combination renders obvious Claims 5 and 16.

136. Joos discloses that the "driver of the motor vehicle… operate[s] the **gas pedal** and the brakes" (***an accelerator pedal*** and ***brake***) and that "the driver assistance system also carries out the intervention into a brake system and a drive motor of the motor vehicle." TESLA-1004, [0002], [0008]-[0009]. "The **driver assistance system** can for example comprise a **controller** or an electronic control unit, with which during the unparking manoeuvre **control signals are output** to the steering system of the motor vehicle and possibly to **the brake system and/or the drive motor**." TESLA-1004, [0021]. Joos's ***controller*** of the driver assistance system (***drive system***) would be understood to include ***an accelerator pedal*** 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] (Hoop also disclosing use of accelerator and brake pedals). 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).

137. As discussed in §IX.A, *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. *supra*, §VI.C. 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-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; TESLA-1005, [0010]-[0013], [0016]-[0019]. 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]. Accordingly, the Joos-Kischkat-Hoop combination further renders obvious the drive system/controller ***changing between modes [from reverse to drive] in response to the driver's foot shifting from the accelerator pedal to tap a brake control***. *Id.*

X. ANALYSIS OF JOOS, KISCHKAT, AND ALLEXI

A. A POSITA Would Have Combined Joos, Kischkat, and Allexi

138. A POSITA would have found it obvious to modify Joos'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, §VI.D; TESLA-1009, 3:18-29, 1:51-2:49, FIG. 2. In the Joos-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. Thus, the unparking procedure is maintained, and the Joos-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, §VI.D; 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.

139. A POSITA would have been motivated to pursue the combination for multiple reasons. 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. 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. Bettger, filed prior to the Critical Date, supports this position and recites that

> . . . vehicles are reversed (operated to travel in a rearward direction, also known as 'backing up') at speeds lower than when travelling. The low speed is appropriate because the rearward visibility of the vehicle driver is limited or restricted, as compared to driving in a forward direction. In addition, the stability of the vehicle may be reduced as compared with forward driving, because the steerable front wheels become, in effect, the rear wheels when reversing. These considerations generally cause vehicle manufacturers to provide electronic speed limiting during reversing.

TESLA-1006, [0003] (emphasis added), see also [0026], [0035].

140. Applying Allexi's techniques in combination with Joos also would have been obvious because the combination merely involves combining prior art elements according to known methods to yield predictable results. A POSITA would have reasonably expected success implementing the combination. Indeed, Joos and Allexi each describe autonomous or semi-autonomous parking/unparking systems and adding a velocity limiter to a similar system was practiced in the industry as evidence by Bettger and would have been well within the capabilities of a POSITA.

B. Claims 7-8 and 18-19 are Rendered Obvious by Joos in view of Kischkat and Allexi (Ground 1C)

Claim 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 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.

141. From my analysis of the references, the Joos-Kischkat-Allexi combination renders obvious Claims 7 and 18.

142. As discussed above in §X.A, 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,* §§VI.D, X.A; TESLA-1009, 3:18-29, 1:51-2:49, 4:54-5:18, FIG. 2. 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. 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. 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].

Claim 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 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.

143. From my analysis of the references, the Joos-Kischkat-Allexi combination renders obvious 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. 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 ("Distance sensors … can be used to determine the stopping point of the vehicle."), 6:33-53 ("the hold point of the vehicle is based on… distance-to-travel calculated from planned trajectory and current vehicle position"), 2:14-18 ("rate/speed versus the distance or time results in a typical curve"), 2:31-42 ("parking trajectory required steering angle and distance may use existing signals generated by, for example, radar or ultrasound"), FIG. 5.

144. 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. 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. Matters corroborates this teaching that "the vehicle always only travels a maximum, <u>specific distance</u>, for example a maximum of 1.2 times the length of the vehicle. Then the gear position P is selected, the vehicle is no longer ready for movement, and the ignition is switched off." TESLA-1010, [0002], [0041], [0069], [0054]-[0056], [0076]. Matters also teaches that "a check is made as to whether the vehicle **1** has already exceeded <u>a maximum allowing movement distance</u> during the parking procedure" further explaining that measuring the distance a vehicle has travelled was well known. TESLA-1010, [0069]. 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***.

XI. ANALYSIS OF JOOS, KISCHKAT, AND BETTGER

A. A POSITA Would Have Combined Joos, Kischkat, and Bettger

145. It would have been obvious to 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 while reversing the vehicle. Based on Bettger's teachings, the Joos-Kischkat-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, the driver may begin reversing from a parking space, and if the

driver's steering movement while reversing "corresponds to the steering movement" for carrying out an unparking maneuver (*e.g.*, corresponds to a "predetermined" "unparking trajectory"), the vehicle's driver assistance system would assume control of 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].

146. 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 changes from the reverse mode to drive mode by auto-shifting from a reverse gear to a drive gear as taught in each of Joos and Bettger. TESLA-1004, [0017], [0038]; TESLA-1006, [0045], [0047]. Because the 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 initiating steering input applied while reversing 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. Multiple reasons would have prompted a POSITA to implement Joos-Kischkat further in accordance with Bettger's teachings in this manner.

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

148. 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.

149. 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.

150. 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. 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). Because Joos's motor vehicle already includes a driver assistance system and associated steering controls, it would be well suited to implement Bettger's techniques. 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. The combination entails no more than predictable electromechanical and software adaptations that were well within the skill of a POSITA by the Critical Date.

B. Claims 1-4, 6-15, and 17-22 are Rendered Obvious by Joos in view of Kischkat and Bettger (Ground 2A)

151. 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. 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.

Claim 1[a]: the drive system monitoring the steering control while driving in a first direction;
Claim 12[a]: the controller monitoring the steering control while driving in a first direction;

152. From my analysis of the references, the Joos-Kischkat-Bettger combination renders obvious 1[a] and 12[a].

153. 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***. As discussed above in §XI.A, 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.* 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].

> ***Claim 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***
> ***Claim 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***

154. From my analysis of the references, the Joos-Kischkat-Bettger combination renders obvious 1[b] and 12[b].

155. 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.

156. 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*, §VIII.B (Elements 1[a]-1[c]). 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.*

> ***Claim 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 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.***

157. From my analysis of the references, the Joos-Kischkat-Bettger combination renders obvious 1[c] and 12[c].

158. As discussed above in §§VIII.A, VIII.B, 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] ("the signal for shifting … 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"), [0001], [0016], [0019] (describing the driver providing a confirmation response to the offer); *supra*, 1[b]; §§VIII.A-B.

> ***Claim 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 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.***

159. From my analysis of the references, the Joos-Kischkat-Bettger combination renders obvious claims 2 and 13.

160. As discussed above in Elements 1[b]-1[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*, §VIII.B (Elements 1[b]-Claim 2). The steering control movement for initiating the assisted reverse-turning maneuver followed by additional steering control

movements to reach the end position E and set the pull-forward steering angle 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].

> ***Claim 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 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.***

161. From my analysis of the references, the Joos-Kischkat-Bettger combination renders obvious claims 3 and 14 for similar reasons discussed above for claim 2. *Supra*, Element 1[c].

162. 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).

> ***Claim 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 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.

163. From my analysis of the references, the Joos-Kischkat-Bettger combination renders obvious claims 6 and 17.

164. 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]. Because the auto-shift from reverse mode to drive mode only occurs at the end of the assisted reverse-turning unparking maneuver that is initiated via a confirmatory steering input which lies above a threshold value as taught in Bettger, ***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***.

Claim 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 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.

165. From my analysis of the references, the Joos-Kischkat-Bettger combination renders obvious claims 11 and 22.

166. 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*, §VIII.B (Claim 4). 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*, §VIII.B (Element 1[b]-Claim 2).

XII. ANALYSIS OF JOOS, KISCHKAT, BETTGER, AND HOOP

A. Claims 5 and 16 are Rendered Obvious by Joos in view of Kischkat, Bettger, and Hoop (Ground 2B)

167. It would have been obvious to combine Joos (as modified by Kischkat and Bettger (*supra*, §§VIII.A, XI.A)) with Hoop for the reasons described above in Ground 1B. *Supra*, §IX.A. 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*, §IX.B

(Claims 5, 16).

XIII. ANALYSIS OF JOOS, KISCHKAT, BETTGER, AND ALLEXI

A. Claims 7-8 and 18-19 are Rendered Obvious by Joos in view of Kischkat, Bettger, and Allexi (Ground 2C)

168. It would have been obvious to combine Joos (as modified by Kischkat and Bettger (*supra*, §§VIII.A, XI.A)) with Allexi for the reasons described above in Ground 1C. *Supra*, §X.A. 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*, §X.B (Claims 7, 8, 18, 19).

XIV. ANALYSIS OF JOOS, KISCHKAT, AND BAYER

A. A POSITA Would Have Combined Joos, Kischkat, and Bayer

169. A POSITA would have found it obvious to integrate Bayer's "driving steering assistance" techniques in the Joos-Kischkat semi-autonomous vehicle and unparking system. *supra*, §§VI.F, VIII.A. 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. 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. 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]. 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].

170. Multiple reasons would have motivated a POSITA to pursue the combination before the earliest priority date of the '457 patent.

171. <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. Joos explains that "[d]uring the unparking, the motor vehicle is manoeuvred from a parked position in the cross-parking space onto the road bounding on the cross-parking space" by following a "predetermined" unparking trajectory. TESLA-1004, [0008]. "The motor vehicle is moved along the unparking trajectory until it has reached an end position," which is "defined at least

as a position such that in the event of further movement from the end position …, manual driving of the motor vehicle can be carried out by a vehicle driver in a driving direction determined by the road." *Id.*, [0006], [0008]-[0009]. Joos requires the motor vehicle to reach the targeted end position for the unparking maneuver to be completed, meaning that it is important for the vehicle to reliably reach the end position if Joos's unparking procedure is to be successfully completed. 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] ("prevents the driver from unintentionally departing from the preselected trajectory"), [0049], [0054], [0064], [0075].

172. Second, 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. 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].

173. 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). For example, Bayer explains that "[t]he vehicle may … be braked as a function of the driver recognition … as soon as the driver's torque has exceeded a threshold value." TESLA-1007, [0065]. "The … procedure is also terminated if the maximum torque of the artificial steering stop has been exceeded and the vehicle has come to a stop." *Id.*, [0068], [0064]-[0070].

174. 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.

175. 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. Furthermore, Joos and Bayer both describe driver steering

assistance systems designed for use in similar contexts (*e.g.*, parking/unparking maneuvers). Because Joos's motor vehicle already includes a driver assistance system and associated steering and braking controls, it would be well suited to implement Bayer's techniques. The combination entails no more than predictable electromechanical and software adaptations that were well within the skill of a POSITA by the Critical Date.

B. Claims 1-4, 6-15, and 17-22 are Rendered Obvious by Joos in view of Kischkat and Bayer (Ground 3A)

176. 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 Bayer and described above in §XIV.A. 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.

Claim 1[a]: the drive system monitoring the steering control while driving in a first direction;
Claim 12[a]: the controller monitoring the steering control while driving in a first direction;

177. From my analysis of the references, the Joos-Kischkat-Bayer combination renders obvious 1[a] and 12[a].

178. 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. *supra*, §§VI.F, XIV.A.

179. 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*, §§VI.A, VI.F; TESLA-1007, [0001]-[0003], [0006], [0012]-[0014], [0016]-[0018], [0020]-[0021], [0024], [0043], [0056]-[0057], [0065].

180. As discussed above in §XIV.A, it would have been obvious to implement Joos-Kischkat in accordance with Bayer's steering assistance techniques. 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*, §VI.F. 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-1007, [0020]-[0021] ("through a continuous change in the additional steering torque applied, … the driver is constantly being given an indication of the point, *i.e.*, the steering wheel position"), [0043].

Claim 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
Claim 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 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
Claim 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.

181. From my analysis of the references, the Joos-Kischkat-Bayer combination renders obvious 1[b], 1[c], 12[b], and 12[c].

182. For example, 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*, §§VI.F, XIV.A. 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). 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]; §§ VI.B, VIII.A.

183. 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. 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.

XV. ANALYSIS OF JOOS, KISCHKAT, BAYER, AND HOOP

A. Claims 5 and 16 are Rendered Obvious by Joos in view of Kischkat, Bayer, and Hoop (Ground 3B)

184. It would have been obvious to combine Joos (as modified by Kischkat and Bayer (*supra*, §§VIII.A, XIV.A)) with Hoop for the reasons described above in Ground 1B. *Supra*, §IX.A. 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*, §IX.B (Claims 5, 16).

XVI. ANALYSIS OF JOOS, KISCHKAT, BAYER, AND ALLEXI

A. Claims 7-8 and 18-19 are Rendered Obvious by Joos in view of Kitschkat, Bayer, and Allexi (Ground 3C)

185. It would have been obvious to combine Joos (as modified by Kischkat and Bayer (*supra*, §§VIII.A, XIV.A)) with Allexi for the reasons described above in Ground 1C. *Supra*, §X.A. 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*, §X.B

(Claims 7, 8, 18, 19).

XVII. ADDITIONAL REMARKS

186. I currently hold the opinions set expressed in this declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

187. I hereby declare that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of the Title 18 of the United States Code.

Dated: 01/20/2026 By: ______________________

Jason Janet, Ph.D.

APPENDIX A

Jason A. Janét, Ph.D.

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Education

- Ph.D. Electrical & Computer Engineering, North Carolina State University, 1998
- M.S. Integrated Manufacturing Systems Engineering, North Carolina State University, 1994
- B.S. Mechanical Engineering, University of Virginia, 1990

Employment History

Applied Research Associates (ARA): 2018 - present

- **Corporate Director of IP and Product Commercialization (IP to Product—IP2P) | CTO-SSM:** Corporate/Business development, Intellectual Property Portfolio Build-out/Protection, and IP Transition to Product. Evaluate, quantify, present and recommend portfolios of IP, product lines and ventures on the basis of competitive landscapes, addressable markets, sales strategy, resource availability and technology readiness. Design, propose and mentor organizational structure(s), including cross-department and cross-sector relationships. Relevant technologies include medical technologies, augmented reality, non-GPS, synthetic environments, computer vision, machine intelligence, IoT sensors, robotics, automation, security, photogrammetry, weapons systems, unmanned systems, SaaS, BioTech, and precision agriculture for multiple market domains. Clearance Level: TOP SECRET & SCI.

DeltaFive: 2014 - 2018

- **CEO & Co-Founder:** Lead corporate, business, IP and technical development for spinout focused on IoT sensors, computer vision, machine intelligence, mobile robots, SaaS, and Lure Formulation for hospitality, pest, IT, and security markets. Strategic and tactical direction for sales, marketing and client services teams.
- **Inventor**: Three awarded patents (USPTO) and patents pending.
- **Board of Directors:** Serve on and report to Board of Directors, and chair the Technical Advisory Board.
- **See www.deltafive.com,** https://jgc.outgrow.us/deltafive or www.youtube.com/watch?v=LoQe6_Lxprs.

Transdigm [TDG] (Avionic Instruments | Acme Aerospace | Aerospace Cooling Solutions): 2002 – 2004, 2013 - 2014

- **VP/Director of Development** (2002-2004), **VP/Director of Sales, Program Management** (2013-2014). See www.transdigm.com, www.avionicinstruments.com, www.acme-aero.com, or www.aerospacecoolingsolutions.com.
    - Manage multiple product lines and cross-functional teams including product line managers (PLMs), account managers, inside sales, international sales, marketing, repair, engineers, technicians, distributors, legal, IP and rep organizations. (270 employees)
    - P&L, strategy, reporting, and forecasting for ~$105M/yr, 50% EBITDA, and 10% YOY growth.
    - Product lines comprised ~600 SKUs for advanced aerospace systems.
    - Epicor ERP for standard resource planning, including inventory optimization and workflow.
    - Change-Agent: Sikorsky S97/JMR programs and supply chain for Aerospace Cooling Solutions.
    - Incubation, launch, growth and exits for **ShelfWorks**, **VortexHC** and **RxMedic** (below).
- **Programs:**
    - **S97 Raider Light Tactical Helicopter –** Autonomy, power distribution and electrical system (PDES) for the Sikorsky S97 LTH, including FAA-compliant software development per DO-178B. (2013 – 2014) See http://www.youtube.com/watch?v=qy-Xb3X-bC0.
    - **Joint Multi-Role (JMR) Helicopter –** Leveraging S97, JMR employs a scaled-up level of autonomy/PDES for Sikorsky-Boeing team, under U.S. Army funding. (2014)
    - **Blue Fans –** Aerospace Cooling Solutions supply chain optimization. (2013 – 2014)
    - **DARPA Distributed Micro-Robotics** – PI/PM for "Mobile Robots that Climb Vertical and Inverted Surfaces." sponsored by DARPA – MTO. Develop mobile robots that climb walls and ceilings for surveillance, reconnaissance and breaching. Collaborated with Lockheed-Martin for automatic target recognition and Picatinny Arsenal for *Lamprey* SLAM holder. (2002 – 2004)

Teledyne Technologies [TDY]: 2011 - 2013

- **Senior Manager**

- Lead cross-functional teams of scientists and engineers in CONUS
- M&A due-diligence, identification and recommendation (SeaBotix & BlueView)
- Lead contingents of cross-division teams to secure ~$352M in funding over 24 months.
- Plan and execute CRAD, business development and coordinate with strategic business units

- **ONR/USMC Cargo UGV** – PM for ONR/USMC-sponsored Cargo Unmanned Ground Vehicle (CUGV) Program subcontract (2011-2012). Manage team of engineers and scientists, in coordination with contract prime (Oshkosh) for unmanned combat vehicle control, perception and navigation. Multi-sensor suite included EO/IR Vision, LIDAR, IMU, and GPS.
- **Army LTL** – PM for Army-sponsored Lighten-the-Load (LTL) Program subcontract (2012-2013). Manage team to develop perception system comprised of stereo EO and stereo LWIR cameras to find and track leader(s), perform optical odometry, detect and map obstacles, and enhance SIGINT. Interface with sensors (LIDAR, IMU, GPS), autonomy for ATV-sized unmanned ground vehicles.
- **NASA ESP** – PM for RTP-based tasks for NASA Engineering Services and Prototyping demonstration (2012-2013). Provide Teledyne Engineering Services (lead), SAIC, Oceaneering, and Schafer with robot prototype and vision-based perception to detect, classify and track targets.
- **DARPA EXACTO** – PM for NC-based tasks for DARPA TTO Extreme Accuracy Tasked Ordnance (EXACTO) Program (2012-2013). Program developed first ever guided, small-caliber bullet with MEMS-based actuation, optical bullet tracking, optical target tracking, and bullet guidance to greatly improve accuracy and extend the day and nighttime range over current state-of-the-art sniper systems.
- **DARPA AngelFish/EagleRay** – PI/PM and inventor of the AngelFish Cross-Domain Submersible UAV, a man-portable, floodable airframe with tilt-thrusters capable of operating in and deliberately transitioning between the air, surface and underwater. Designed for optimal balance between hydro-/fluid-dynamics, materials, guidance/navigation/control, power conversion/storage, and perception for wing-in-ground flight.
- **Army PIRST** – Propose and capture the Pursuant In-stride Reconnaissance, Surveillance & Targeting (PIRST) program. By Army Night Vision & Electronics Sensors Directorate (NVESD) in 2013.

RxMedic Systems: 2003 – 2011 (*spinout from **Avionic Instruments***)

- **Co-Founder/General Manager/Board Member** (2004-2007), **CTO** (2007-2010), and **Director of Robotic/Automated Systems** post-acquisition by JM Smith (2010-2011).
    - Manage launch from **Avionic Instruments** (2004)
    - Build and lead nationwide growth of cross-functional teams to 75+ employees
    - Direct product development, manufacturing, field support, sales and marketing
    - Manage IP Portfolio & Legal: Patents include USPTO# 7,726,514 and 8,091,733
    - Oversee P&L, accounting, raising of capital, and accounts receivable
- **RxMedic ADS**: Invent, develop, market and support automated pharmacy dispensation and packaging systems for retail, hospital, mail order and industrial fulfillment organizations.
- **RxMedic ACS**: Integrate, refine, market and support automated pharmacy-counting systems for retail and hospital fulfillment organizations.
- Co-negotiated the acquisition of RxMedic Systems by JM Smith, Inc. in May of 2010, established RxMedic as a division, and coordinated 12-month transition. Supported evaluation and integration of automated systems for JM Smith business units including Smith Drug.

Vortex HC: 2002 - 2009 (*spinout from **Avionic Instruments***)

- **Vice President** (2004-2006), and **Facilities Security Officer (FSO)** (2005-2006)
    - Manage spin-out from **Avionic Instruments** (2004)
    - Lead cross-functional teams for product development, manufacturing, support, sales and marketing
    - Manage business and corporate strategy, execution, licensing, and ITAR/EAR-compliance
    - Support domestic and international legal and IP portfolio management, P&L, AP/AR
- **DARPA ARTEMIS** – PI and PM for "Vortex-Based AUVs for Counter-Mine and Counter-Obstacle Operations" sponsored by DARPA – ATO. Managed development of holonomic AUVs for landing on mines and performing soft-kill neutralization. Integrated CFD, rugged materials, MEMS-sensors for guidance, navigation and control. Collaborated with UT-ARL for development of circular synthetic aperture sonar and Teledyne RD Instruments for DVL. Developed high-precision acoustic underwater tracking system.
- **Products**: Managed development, manufacturing, world-wide marketing, and support of the following to military, law-enforcement, security, rescue, nuclear and entertainment customers:
    - VMRP Wall-Climbing Robot – Man-portable mobile robots that climb walls and ceilings.
    - Submersible Attractor – Rad-hardened attractor for nuclear energy market, BWR inspection
    - Submersible VMRP Robot – Man-portable underwater robots for bulkheads and tank interiors.

    - Lamprey SLAM Holder – Surface-agnostic instant placement mechanism for Picatinny Arsenal's Selectable Land- and Anti-personnel Mine (SLAM) breaching charge.
- **Licensing**: As part of exit strategy, instituted licensing and transition of VRAM technologies:
    - SeaBotix LBC – Little Benthic Crawler Remotely Operated Vehicle (ROV).
    - SeaRobotics HullBUG – Autonomous hull-grooming robot.
    - BDT – Attractors for high-speed, high-efficiency, low-overhead paper & fabric handling.
    - TMI – Attractors for inspection of nuclear boiler water reactor (BWR) facilities
- **ONR & NAVSEA HullBUG VRAM –** PI/Consultant for "Attractor Design for the Hull Biomimetic Underwater Grooming (HullBUG) Technology" and "HullBUG VRAM Design Optimization". (2006–2009).

<u>ShelfWorks Technologies</u>: 2002 – 2006 (*spinout from **Avionic Instruments***)

- **Charter Officer** (2004-2006).
    - Supported launch from **Avionic Instruments** (2002-2004)
    - Direct military product development, support commercial product development, sales & marketing
        - Bed, Bath & Beyond
        - Home Depot
    - Support IP Portfolio & Legal

<u>Nekton Research (iRobot [IRBT])</u>: 1998 - 2002

- **Vice President of R&D** (1998-2000) and **Director of Business Development** (2000-2002).
    - **Lead:** Cross-functional teams in marine-focused product/business development, production, deployment.
    - **IP Portfolio:** Co-inventor on USPTO# 6,378,801 (2002)
    - **Spinout:** Support incubation/launch of Parata Systems, a pharmacy automation company (1999-2002)
    - **M&A:** Provided early-stage due-diligence and introductions for acquisition by iRobot (2006)
- **Principal Investigator and Program Manager:**
    - **DARPA LSALS-SP3** – PI/PM for "3D Plume Tracing using Ranger™ MicroAUVs," sponsored by DARPA – MTO. Joint effort with Sandia National Labs, and Woods Hole Oceanographic Institute. Developed multiple collaborative MicroAUVs that search for and localize plume sources and aircraft blackbox, to rescue and/or recover humans and assets.
    - **DARPA Distributed Micro-Robotics** – PI/PM for "Swimming Arrays for Anti-Submarine Warfare", sponsored by DARPA – ATO. Joint effort with Draper Labs, Johns Hopkins University Applied Physics Lab, and Solers. Mobile acoustic array formations of multiple MicroAUVs. In contrast to towed arrays (e.g., TB-29), *Swimming Arrays* decouple tactical maneuvers from sensing maneuvers; enable protracted sensing, strong source direction discrimination, forward end-fire view, and dynamic array beamforming.
    - **DARPA Distributed Micro-AUVs** – PI/PM for "Aquatic Microbots", sponsored by DARPA – MTO. Under *Distributed Robotics* program, design, build and demonstrate ultra-small AUVs, called "MicroHunters™", which maneuver in 3D using only one moving part. Resulting navigation, called "Helical Klinotaxis" was validated on three different platforms and demonstrated to DARPA. Co-inventor on patent "3D Orientation for Aquatic Robots Using Helical Klinotaxis", USPTO in April 2002.
    - **Forensics ROV** – PM and inventor of porthole-size ROV to perform forensic analyses of sunken assets. Based on a diametrically-opposed, large-diameter, low-velocity, vector thrusters, provide underwater telepresence to search for remains, assets and root-cause indicators. Unique design minimized silt disturbance, and maximized options for ingress and egress. (Private customer)
    - **Deepwater Towfish** – 6500m depth-rated towfish to carry sensor suite for applications in energy sector, telecommunications sector, sub-bottom profiling, and terrain mapping. (Private customer – EdgeTech)
    - **DARPA APLA/MGM** – PI/PM for "MicroHunter Guidance and Control of 60mm Mortars", sponsored by DARPA – ATO. Under *Anti-Personnel Landmine Alternative/Minimally Guided Munitions* (APLA/MGM) program, collaborate with Battelle Memorial Institute to demonstrate feasibility, integrate microelectronic GNC sensors and actuators, and validate performance of single-actuator control force producer and guidance algorithm for indirect-fire munitions. Performance exceeded specifications.

<u>Parata Systems</u>: 1999 – 2002 (*spinout from **Nekton Research*** **serving as VP of Eng and Dir of BD**)

- Supported incubation and launch from **Nekton Research** (1999-2002)
- Robotic System for Retail & Mass-Fulfillment Pharmacy
- Technical & Business Development of Alpha- and Beta-level Products
- Supported initial IP Portfolio

<u>Duke University, Pratt School of Engineering</u>: 1999 - 2021

- **Adjunct Associate Professor** (2005-2021) and **Adjunct Assistant Professor** (1999-2005).
  - Courses Taught Include:
    - Entrepreneurship & Tech Transition (Special Topics)
    - Robotics & Automation (MAE 442, ECE 383, ECE 142/442)
    - Control Theory (ECE 141/441)
- **MS Committee Member:** Serve on graduate student committees and advise research.
- **Advisor** and sponsor for Duke's Wall-Climbing Robot Team, which earned 1st place in the 2004 and 2005 International Climbing and Walking Robot (CLAWAR) Competitions in Madrid, Spain and London, England. Sponsored by the LORD Corporation and VortexHC.
- **Advisor** for Duke's DARPA Grand Challenge Team, in support of the Carnegie Melon Red Team(s), which earned 2nd and 3rd places. Perception included RADAR, LIDAR, IMUs and GPS.
- **Advisor** and sponsor for Duke's Autonomous Underwater Vehicle (AUV) team, which earned finalist standings five times in the AUVSI/ONR International Autonomous Underwater Vehicle Competition. Participated in multiple annual competitions since 2001, with the following rankings: 2nd in 2006, 4th in 2005, 5th in 2004, 3rd in 2003, 4th in 2002, and 7th in 2001. Sponsored by LORD, VortexHC, and SeaBotix.

<u>North Carolina State University, School of Engineering</u>: 1992 - 2021

- **Adjunct Assoc Professor** (2009-2020), **Board Integrated Manufacturing Systems Engineering Institute** (1998 – 2020), **Adjunct Asst Professor** (2000-2009), **Instructor** (1996-1999), **Researcher** (1992-1996).
  - Teaching Experience:
    - Robotics & Automation (ECE 444, ECE 591)
    - Control Theory (ECE 435)
    - Distributed (Non-Deterministic, Network- & Statistics-based) Controls (ECE 492Z)
  - **MS Committee Member:** Serve on graduate student committees, sponsor, and advise research.
  - **Advisor** & **Corporate Sponsor** for NCSU's Autonomous Underwater Vehicle (AUV) team, which began participating in the AUVSI/ONR International AUV Competition. Participated in 2005 and 2006.
- **NASA-HELIOS** – PM for development and demonstration of semi-autonomous robotic system for lunar habitation and transport. Under NASA's Exploration Office, and funding from United Technologies, Caterpillar, and North Carolina Space Grant Consortium. Managed team of 40+ people to build and competitively demonstrate lunar exploration and habitation mission including deployment of lunar lander, UGV, and personnel habitat modules. Mission was demonstrated in full and earned first place and NASA's *1998 Extra Terrestrial Award.* January 1996 to April 1998.
- **DARPA/ONR Outdoor Landmark Recognition** – Researcher for "Outdoor Landmark Recognition Using Hybrid Fractal Vision System and Neural Networks", by DARPA and ONR. Validate new approach to detecting and recognizing outdoor landmarks using the Region-Feature Neural Network. (1993–1996)
- **Other Systems***:* Bipedal robot (*Jenner*), a hexapod colony, an autonomous mobile robot (*Lazarus*), home automation & security based on decentralized control networks.

<u>TMI Robotics</u>: 1998 - 2013

- **President**
  - **Robotic & Automation Systems:** Submersible Robotic Hull Crawlers & Attractors for *General Electric*, *Hitachi*, *Framatome/Areva*, *SeaRobotics*, *SeaBotix*, etc. (2009-2018); wall-climbing robots for *SignalScape* (2009-2013); Pioneer mobile robot end-effector and bipedal robot for *Adept MobileRobots* (1998-2004); decentralized fuel pump control systems for *Gilbarco* (1998); Autonomous Following Golf Caddy for *Caddy Master* (1998-1999); Universal rotary actuator system for *Real World Interface* (*RWI*) and *iRobot* (*IS Robotics*) (1998-2000), etc.
  - **Artificial Intelligence Software and Textbook:** "Computational Intelligence: Supervised and Unsupervised Learning with Neural Networks", J.A. Janét and J.C. Sutton III. Copyright © 1998-2013. ISBN #0-9678493-0-6. Textbook included a time-limited single-user license for neural network software by TMI Robotics, Inc. Software included data, the Region-Feature Neural Network and the Hyper-Ellipsoid Clustering Neural Network for pattern analysis and machine intelligence. End-users/clients include *NCSU*, *National Technological University* (*NTU*) and *Video Based Engineering Education* (*VBEE*), IBM, etc.

Other Professional Highlights:

- **Intellectual Property Litigation Expert Witness**: Provided reports, descriptive imagery and testimony for litigation regarding intellectual property, contracts and trade secrets. Cases are listed below, clients in **bold**:
  - **AIIA** v Plus One Robotics (2025-pres) [CIVIL ACTION NO. 5:25-CV-01197-OLG, W. Dist of TX]
  - **Beatbot** v Zodiac (2025-pres) [USPTO PTAB IPR US Patent 11,003,191, 11,262,766, and 11,880,207]
  - **Tesla** v Bulletproof (2025-pres) [USPTO PTAB IPR US Patents 11,932,230; 12,221,104; 12,227,184; 12,233,871; 12,240,456; 12,240,457; and 12,240,458]
  - Perceptive Automata v. **Tesla** (2025-pres) [NO. 2:25-cv-00742, Eastern District of TX]
  - **Tesla** v Perceptive Automata (2025-pres) [USPTO PTAB IPR US Patents 10,614,344; 11,126,889; 11,467,579; 11,520,346; and 11,753,046]
  - **Hargrave** v. Locus Robotics (2025-pres) [NO. 3:23:CV-01521, Middle District of PA]
  - Spacemaker v. **Frazier** (2025-pres) [Civ. Action No. 3:24-CV-9279, Superior Court of NJ]
  - USA v. **Levchuk** (2025-pres) [8:23-cr-00184, MD District Court]
  - **FORTNA** v. Plus One Robotics (2025) [CIVIL ACTION NO. 5:24-CV-1274 OLG, W. Dist of TX]
  - Apple v. **Haptic** (2024-2025) [USPTO PTAB IPR2024-01475]
  - Apple v. **Haptic** (2024-2025) [USPTO PTAB IPR2024-01476]
  - **Tyson** v Primus (2025) [Civil Action #22-A-04543-10, Superior Ct of Gwinnett County, GA]
  - **Airspace Systems** v. Dedrone (2024-pres) [1-24-cv-01625–7413 [Eastern Dist of VA Alexandria Div]
  - **Tesla** v Autonomous Devices (2023-2025) [USPTO PTAB EX PARTE REEXAM] 11,055,583
  - **Tesla** v Autonomous Devices (2023-2025) [USPTO PTAB EX PARTE REEXAM] 10,452,974
  - **Tesla** v Autonomous Devices (2023-2025) [USPTO PTAB EX PARTE REEXAM] 10,607,134
  - NxtGen v. **ZipString** (2024-pres) [Case IPR2024-01213]
  - **Boston Dynamics** v Ghost Robotics (2024-2025) [1:22-cv-01484, District Court of DE]
  - **ATLeisure** v Treasure Garden (2024-pres) [1:24-cv-02270, Northern District of Georgia]
  - **Stryker** v Ferno-Washington (2024-pres) C.A. No. 1:22-cv-00588-MRB
  - **Squaregles** v Laltitude (2024-pres) Case No. 2:23-cv-09751 (C.D. Cal.)
  - **Demand Vape** v. RAI (2024) [337-TA-1410, U.S. International Trade Commission]
  - Hesai v. **Ouster** (2024) [USPTO PTAB IPR2023-01421]
  - Hesai v. **Ouster** (2024) [USPTO PTAB IPR2023-01456]
  - Hesai v. **Ouster** (2024) [USPTO PTAB IPR2023-01457]
  - Hesai v. **Ouster** (2024) [USPTO PTAB IPR2023-01422]
  - A360 v **Toyota/Bastian** (2024) [No. 1:23-cv-00198-JRS-TAB, Southern District of Indiana]
  - **Motive** v Samsara (2024) [337-TA-1393, U.S. International Trade Commission]
  - **Good Sportsman** v Hangzhou ZH Tech (2024) [USPTO PTAB PGR]
  - **Tesla** v Autonomous Devices (2024-2024) [USPTO PTAB (IPR)] '474 Patent
  - **Becton Dickenson v JFCRx** (2023-2024) [Contract, trade secret compliance/audit]
  - Juul v **NJOY** – (2023-2024) [337-TA-1368, U.S. International Trade Commission]
  - Juul v **NJOY** – (2023-2024) [1:2023cv00917, District Court of DE]
  - **NJOY** v Juul– (2023-2024) [IPR2024-00267 USPTO PTAB]
  - **NJOY** v Juul– (2023-2024) [IPR2024-00268 USPTO PTAB]
  - Textron v **DJI** – (2023-2024) [Case No. 2:22-cv-351-RWS-RSP (E.D. Tex)]
  - Solmetex v. **Dental Recycling** (2023-2024) [Pre-IPR: USPTO]
  - **Daifuku** v. ControlLogix [IPR2024-00475 USPTO PTAB]
  - Autonomous Devices v **Tesla** (2023-pres) [C.A. No. 22-1466 (MN), District Court of DE]
  - **Tesla** v Autonomous Devices (2023-2024) [USPTO PTAB IPR2023-01172] '583 Patent
  - **Tesla** v Autonomous Devices (2023-2024) [USPTO PTAB IPR2023-01055] '344 Patent
  - **Tesla** v Autonomous Devices (2023-2024) [USPTO PTAB IPR2023-01054] '974 Patent
  - **Tesla** v Autonomous Devices (2023-2024) [USPTO PTAB IPR2023-01169] '134 Patent
  - **Tesla** v Autonomous Devices (2023-2024) [USPTO PTAB IPR2023-01170] '449 Patent
  - **Tesla** v Autonomous Devices (2023-2024) [USPTO PTAB IPR2023-01171] '585 Patent
  - **Ouster** v. Hesai et al, Lidar Systems (2023-2024) [337-TA-1363, U.S. International Trade Commission]
  - **Ouster** v. Hesai et al, (2023-pres) [No. 1:23-cv-00406, District Court of DE]
  - **Boston Dynamics** v Ghost Robotics (2023-2025) [1:22-cv-01483-MN, District Court of DE]
  - Vivint v **SkyBell** Technologies (2022-pres) [2:21-cv-09472, Central Dist of DC]
  - Moog v **SkyRyse** (2022-2024) [1:22-cv-00187, Western Dist of NY]
  - Velodyne v **Ouster** (2022-2023) [337-TA-1322, U.S. International Trade Commission]

- **IQRIS** v Point Blank (2022-2023) [21-CV-61976-BB, Southern District of FL]
- **Opex** v HC Robotics/Invata (2022) [337-TA-1293, U.S. International Trade Commission]
- **iAqua** v Cayago (2022) [Reexam-EPR814 of 90/014,995 USPTO]
- Cayago v **iAqua** (2022) [21-CV-61035, Southern District of FL]
- Cayago v **iAqua** (2022) [Civil No. 21-1212, Puerto Rico]
- Bacon Sons v **Perception Robotics** (2021-2022) [Case No: 30-2018-01000372, Orange Co, CA]
- **AutoStore** v Ocado (2021-2023) [IPR2022-00443 USPTO]
- **AutoStore** v Ocado (2021-2022) [IPR2022-00673 USPTO] (pre-institution)
- **AutoStore** v Ocado (2021-2022) [IPR2021-00274 USPTO]
- **AutoStore** v Ocado (2021-2022) [IPR2021-00311 USPTO]
- **AutoStore** v Ocado (2021-2022) [IPR2021-00398 USPTO] (pre-lit)
- **AutoStore** v Ocado (2021-2022) [IPR2021-00412 USPTO] (pre-lit)
- **AutoStore** v Ocado (2021-2022) [PGR2021-00038 USPTO] (pre-lit)
- **AutoStore** v Ocado (2021-2022) [HP-2020-000035, United Kingdom]
- **AutoStore** v Ocado (2021-2022) [Spain – Pre-lit]
- **AutoStore** v Ocado (2021-2022) [Case No. 2:20-cv-494, Eastern District of VA]
- Ocado v **AutoStore** (2021-2022) [1-21-cv-00041, USDC - DNH]
- Ocado v **AutoStore** (2021-2022) [1-21-cv-00806, USDC - DNH]
- **iRobot** v SharkNinja (2021-2022) [337-TA-1252, U.S. International Trade Commission]
- **Airborne Systems** v Wamore – Steerable parachute systems (2019-pres) [Arbitration – NJ]
- **AutoStore** v Ocado (2020-2021) [337-TA-1228, U.S. International Trade Commission]
- Interactive Play Devices v **Spin Master** (2020-2021) [Civil Action File No. 6:20-cv-00066, W.D. TX]
- **DJI** v Autel – (2017-2021) RC UAV Systems [C.A. No. 16-706-LPS-CJB, District Court of DE]
- Velodyne v **RoboSense** (2019-2020) [337-TA-1173, U.S. International Trade Commission]
- Odyssey Marketing v **Spin Master** (2018) Unmanned Air Vehicles [IPR, USPTO]
- Mattel v **Spin Master** (2018) Transformable Devices [IPR2018-01672, USPTO]
- Mattel v **Spin Master** (2018) Transformable Devices [IPR2018-01673, USPTO]
- Mattel v **Spin Master** (2018) Transformable Devices [IPR2018-01674, USPTO]
- MPV v **DJI** – (2018) [Case No. 2:18-cv-02210-RGK-AGR, Central District Court of CA]
- **Samsung** v Cywee – (2017) IMU Pose & AR [Case No. 2:2017cv00140, Eastern District of TX]
- **DJI** v Autel – (2017-2018) [2:17-cv-00776-RAJ, Western District of WA]
- Synergy Drone v **DJI**– (2017-2018) [Case No. 1:17-cv-00242, TX Western District Court]
- **iRobot** v Bissell – (2017-2018) [337-TA-1057, U.S. International Trade Commission]
- **Hayward Industries** – (2015-2016) Evaluate IP and Enabling Technologies for Submersible Systems
- Choirock v **Spin Master** (2016-2018) Transformable Devices [Case No. IPR2017-00030, USPTO]
- **Spin Master** v Sphero, Inc. (2016-2017) [Case No. IPR2017-01272, USPTO]
- Sphero, Inc. v **Spin Master Ltd**. (2017) [New York Southern District Court, Case No. 1:17-cv-05428]
- Razor/Chen/Inventist v **Jetson Electric Bikes** (2016-2017) [337-TA-1000, U.S. Int. Trade Commission]
- Razor/Chen/Inventist v **Powerboard** (2016-2017) [337-TA-1000, U.S. International Trade Commission]
- Segway/DEKA/Ninebot v **Jetson** (2016-2017) [337-TA-1007, U.S. Int. Trade Commission]
- Segway/DEKA/Ninebot v **Powerboard** (2016-2017) [337-TA-1007, U.S. Int. Trade Commission]
- Segway/DEKA/Ninebot v **Jetson** (2016-2017) [337-TA-1021, U.S. Int. Trade Commission]
- Segway/DEKA/Ninebot v **Powerboard** (2016-2017) [337-TA-1021, U.S. Int. Trade Commission]
- **DJI** v Yuneec [No. 5:16-cv-595, U.S. District Court, Central District of CA]
- Rehco LLC v **Spin Master Ltd**. (2015-2020) [No. 1:2013cv02245, Northern District of IL]
- Segway/DEKA v **Ninebot** [Inv. No. 337-TA-935, U.S. International Trade Commission]
- Segway v **Shenzen Inmotion** – [Inv. No. 337-TA-935, U.S. International Trade Commission]
- ScriptPro v **Innovation** – Pharmacy Automation (2015) [2:06-cv-2468-CM-JPO U.S. Dist Court, KS]
- ScriptPro v **Innovation** – Pharmacy Automation (2011-2015) [06-2468-CM U.S. District Court, KS]
- Spinmaster v **YourStoreOnline** – Wall-Climbers (2009-2010) [CV 09-5803 CAS]
- SpinMaster v **YourStoreOnline** – RC Helicopters (2009-2010) [CV 09-2121 CAS]

- **Patent Inventorship:** Other patents pending
  - 6,378,801: Devices and methods for orienting and steering in three-dimensional space.
  - 7,726,514: Automated article dispensation mechanism.
  - 8,091,733: Automated article dispensation mechanism.

- 8,751,035: Automated laundry drop-off and retrieval system.
- 9,664,813: Automated Insect Monitoring
- 9,999,211: Automated Insect Monitoring (Removable Chambers with Transparent Sides for Inspection)
- 9,999,212: Automated Insect Monitoring (Signal Processing to Detect and Recognize Invasive Pest)
- 11,382,324: Insect Traps and Monitoring System (IoT Monitoring System with Detect/Classify Ability)

- **Board of Directors/Advisors Experience:** Provide strategic technology, business and corporate expertise.
  - **Delta Five** – Distributed unattended sensors, automation, SaaS and IoT.
  - **Panacea BioMatx Inc** - Automated customized medications and nutraceuticals. (www.panacea.me)
  - **Lealear** – Automated storage and retrieval systems.
  - **RxMedic** – Automation for preparing prescription orders in retail, government, and hospital pharmacies.
  - **VortexHC** – Non-dexterous gripping, robot climbers (air and underwater), and 6DOF holonomic AUVs.
  - **NCSU Integrated Manufacturing Systems Engineering Institute** – Multi-disciplinary graduate school

Selected Publications (of ~40)

- IoT Solutions Enabling Hotelier's to Monitor for Bed Bugs, www.deltafive.com/wp-content/uploads/2018/06/DeltaFive_BedBugAwarenessWeek2018_PressRelease.pdf, June 2018.
- New York City Challenged by Bed Bugs, www.newswire.com/news/new-york-city-challenged-by-bed-bugs-delta-five-offers-green-solution-20043137, November 2017.
- On the Heels of the Largest Bed Bug Lawsuit Judgement, Delta-Five Has a Proven Green Solution for Hotels, www.newswire.com/news/on-the-heels-of-the-largest-bed-bug-lawsuit-judgement-delta-five-has-a-19990567, October 2017.
- Hoteliers Find Delta Five's Innovative Bed Bug Solution Catches Bugs Faster and More Consistently, www.newswire.com/news/hoteliers-find-delta-fives-innovative-bed-bug-solution-catches-bugs-19940513, September 2017.
- As Hoteliers Look to Combat Bed Bug Rise Delta Five Offers Researched Solution, www.newswire.com/news/as-hoteliers-look-to-combat-bed-bug-rise-delta-five-offers-researched-19846348, August 2017.
- Green Approach to Prevention and Early Detection, www.eprnews.com/delta-five-highlights-green-approach-to-prevention-and-early-detection-during-bed-bug-awareness-week-138925/, June 2017
- Delta Five Raises the Bar in Battle Against Bed Bugs, www.newswire.com/news/delta-five-raises-the-bar-in-battle-against-bed-bugs-19547330, May 2017.
- Automated Bed Bug and Insect Monitoring System, www.newswire.com/news/delta-five-launches-automated-bed-bug-and-insect-19224593, April 2017.
- "Think It, Build It, Win It: Vision-Based Robot Design Secures Teledyne a $350M NASA Engineering Contract" H. Neale. *NASA Tech Briefs* 2013/2014.
- "Automation is Changing Pharmacy: How Reducing Repetition Behind the Counter Improves Over the Counter Care" J. Janét. October 2010. *Insight Magazine.*
- "Automate Your Profits" J. Janét. October 2009. *Insight Magazine.*
- DTIC #ABV 299170 (NATICK/TR-04/013L): "Vortex Regenerative Air Movement: Attraction and Attachment on Vertical and Inverted Surfaces— A Simple Method for Static and Mobile Robots for Climbing Walls and Ceilings" J. Janét, D. Reinfeld, B. Wiedeman. October 2003. (Contract No. DAAD16-00-C-9259; US Army Soldier Systems Command, Natick, MA)
- DTIC #AD B267 288 (NATICK/TR-01/009L): "MicroHunter Control Applications for Elimination of Anti-Personnel Landmines: Low-Cost, Minimally Guided Munitions – A Simple Method for Controlling the Trajectory of Spinning Projectiles" M. Kemp, J. Janét, and C. Pell. May 2001. (Contract No. DAAN02-98-C-4030; US Army Soldier Systems Command, Natick, MA)
- "Development of a Micro Autonomous Underwater Vehicle for Complex 3-D Sensing", *IEEE/MTS Oceans 2001 Conference*; Honolulu, HI; Nov 2001; B. Hobson, B. Schulz, J. Janet, R. Moody, C. Pell, and H. Pinnix.
- "MicroAUVs I: Platform Design and Multi-Agent System Deployment", *Unmanned Untethered Submersible Technology (UUST)*; August 2001; Durham, NH; B. Schulz, B. Hobson, J. Janét, M. Kemp, R. Moody, C. Pell, H. Pinnix, J. Pollard, and H. Crenshaw.
- "Assessing the Performance of Oscillating Fin Thruster Vehicles", *Unmanned Untethered Submersible Technology (UUST)*; August 2001; Durham, NH; M. Kemp, B. Hobson, J. Janét, C. Pell, and E. Tytell.

- "Using Control Networks to Control Multiple Autonomous Mobile Robots: Biped, a Hexapod Colony, and a Complex Autonomous Mobile Robot", *IEEE Int'l Conf. on Robotics & Automation*; Detroit, MI; May 1998; J. Janet, B. Wiseman, R. Michelli, S. Scoggins, and A. Walker.
- "Autonomous Mobile Robot Global Self-Localization Using Kohonen and Region-Feature Neural Networks", *Jnl of Robotic Systems*; Vol. 14, No.4, 1997; J. Janet, R. Gutierrez, T. Chase, M. White, J. Sutton.
- "Combining Self-Organizing Geometric Certainty Maps with the Unscented Kalman Filter", Proc. of *IEEE Int'l Conf. on Robotics & Automation*; Leuven, Belgium; May 1998; J. Janét, J. Brickley, M. Kay, M. White, and J. Sutton.
- "Modeling of Sonar Sensors for Localization of Autonomous Mobile Robots", *IEEE Transactions on Industrial Electronics*; October 1998; R. Gutierrez, J. Janet, and R. Luo.
- "Autonomous Mobile Robot Global Motion Planning and Geometric Beacon Collection Using Traversability Vectors", *IEEE Trans on Robotics & Automation*; Vol.13, No.1, 1997, Pages:132–140; J. Janét, M. Kay, and R. Luo.

Skills Brief

- *Executive Leadership.* Provided fiscal, strategic, IP and operational leadership in application and development of heavily engineered systems for software, robotics and automation, medical, pharmacy, maritime, aviation, government, military, law enforcement, security, entertainment, hospitality, analytics, pattern analysis, and energy markets. Demonstrated ability to develop and implement business plans, integrate emerging technologies, raise capital, be an effective change agent, and transition product and client service concepts to commercial viability. Effective collaborator with companies, academic institutions, military, government and foreign entities. Experienced with legal aspects of launch, operations, equity, M&A, intellectual property & litigation. Successful manager of sales, marketing and finance including, ROI tool development, market research, prospecting, sales presentations, competitive analysis, brand development, multi-media advertising, contract negotiation, deal closure, A/P and A/R.
- *Board Member*. Effective strategic contributor and communicator on behalf of corporations (Delta Five, RxMedic, Panacea Biomatix, Lealear, and VortexHC) and an academic institution (NCSU IMSEI).
- *Engineering and Product Development.* Demonstrated ability to develop and deploy hardware and software products, including automated retrieval systems, fixed-base robots, medical systems, mobile robots, autonomous and remote-control unmanned ground robots, wall-climbing robots, hull inspection & cleaning robots, nuclear vessel inspection robots, autonomous underwater vehicles, non-destructive inspection robots, retail automation, and mine neutralization robots.

Additional

- **Security Clearance.** Personal clearance level – TOP SECRET & SCI. Facilities Security Officer (FSO) for Vortex HC. Coordinated processing of SECRET level Facility Clearances (FCL) and Personnel Clearances (PCL).
- **Institute of Electrical & Electronic Engineers (IEEE):** Robotics, Controls & Pattern Analysis.
- **Autonomous Unmanned Vehicle Systems International (AUVSI)**
- **American Society for Engineering Education (ASEE)**
- **American Society of Mechanical Engineers (ASME)**
- **PADI SCUBA:** Professional diver for underwater mobile robots, hull inspection, underwater video, counter-mine, ASW, etc.
- **Commercial Driver's License:** Class-A CDL, base registrations in North Carolina (and Virginia).
- **USPA Skydiving:** (1991 – 1997) USPA Jumpmaster certification in 1996. D-license with 400 jumps including instruction, tandem master training support, demonstrations, accuracy, and freefall relative work (RW). National collegiate RW championship team in 1994 (Richmond, IN). Carolina Sky Sports Accuracy Champion in 1993 (Louisburg, NC).
- **Pyrotechnician:** Class-A/B levels.
- **Master Mason:** Foundation of ~20 years of construction experience, primarily with ornamental stone, brick, and concrete. Experience initially gained as a youth within family-owned and operated business (Dogwood

Quarries) in DC-metropolitan area; summers and school breaks from 1981 until 1997. Since 1998, all work has been *pro bono* including for Habitat for Humanity.

Computer Tools

Proficient: SalesForce, PowerPoint, Excel, Word, Project, MATLAB
Prior experience: Epicor ERP, QuickBooks, AutoCAD, SolidWorks, OrCAD, LabView, C/C++, Assembly