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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 1-18 of U.S. Patent No. 11,932,230 ("the '230 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 1-18 of the '230 Patent is directed to subject matter that was routine, conventional, and well known in the prior art before the '230 Patent's earliest alleged priority date. As would be readily appreciated by one of skill in the art, each of these claims of the '230 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. 11,932,230 to Langlotz ("the '230 Patent") (TESLA-1001)
- Excerpts from the Prosecution History of the '230 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 '230 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 '230 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 1-10 of the ’230 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 ’230 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

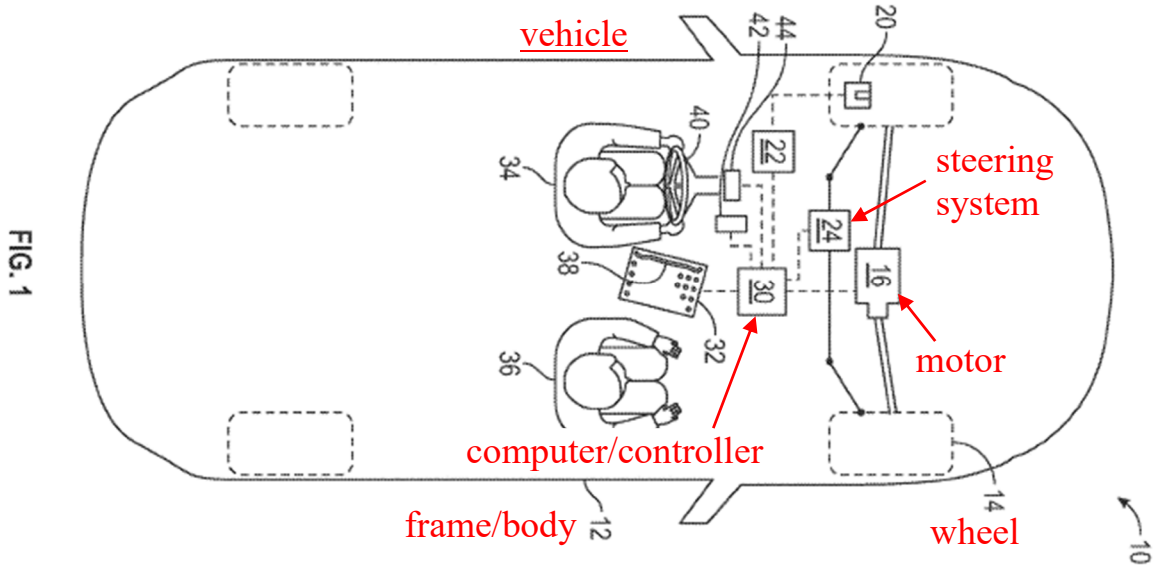
invention. I also understand it is the Patent Owner who has the burden of proving that a nexus exists, and I understand that secondary considerations will not overcome a strong showing of obviousness.

V. OVERVIEW OF THE '230 Patent

A. Overview of the Specification

35. From my review, the '230 Patent purportedly relates to "motor vehicles and operational control systems." TESLA-1001, 1:17-18. According to the '230 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, 1:25-28. The '230 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, 1:35-38. The '230 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 ’230 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 ’230 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

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

to adjust direction while reversing, then shifts to drive, steers the other direction, then straightens out to proceed." TESLA-1001, 2:61-3:6. The '230 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, 3:14-18.

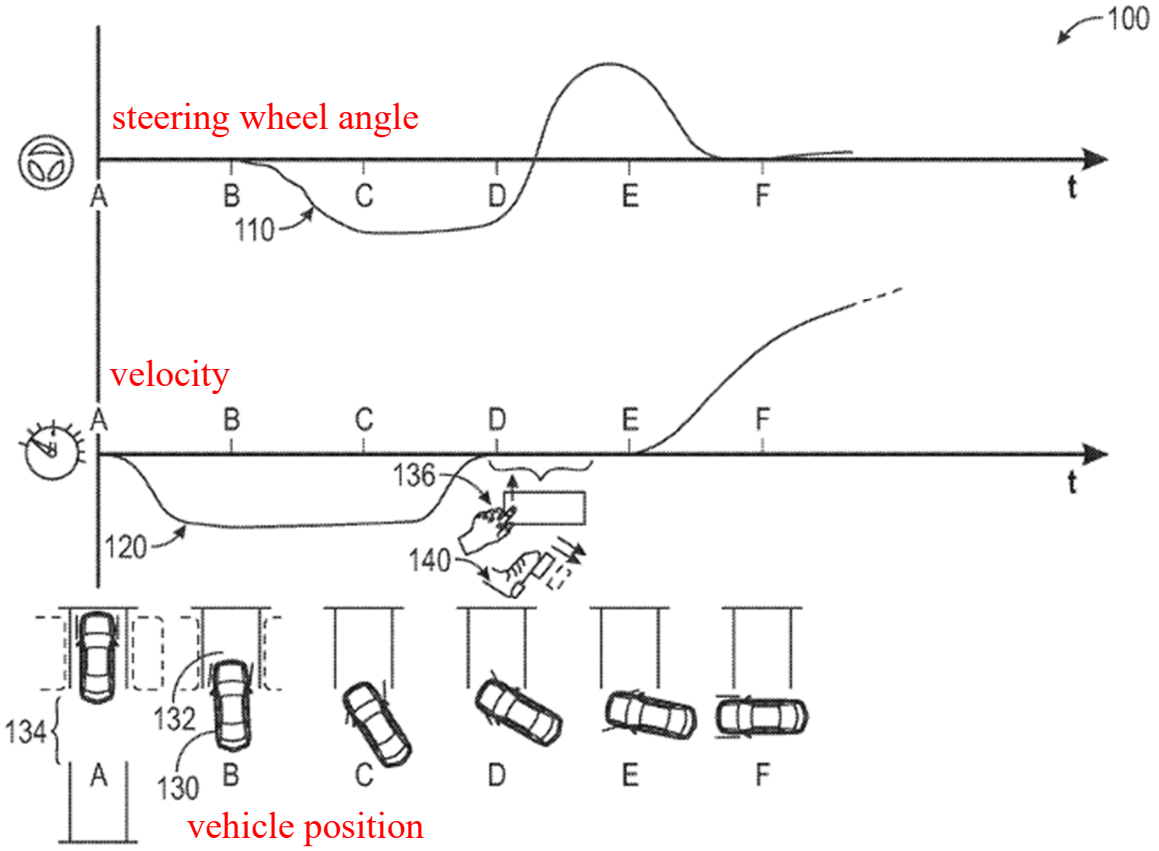


FIG. 2

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 '230 Patent

39. From my review of the file history, I understand that the application that issued as the '230 Patent was allowed with no prior art rejections. As reasons for allowance, the examiner stated that no prior art discloses "a motor vehicle including the drive system operable to select a direction for driving the wheels in response to a pattern of steering angle movements, without operator indication of a direction." TESLA-1002, 155. The examiner noted that some prior art was made of record but not relied upon in a rejection. *Id.*, 155-156.

C. Person of Ordinary Skill in the Art

40. I have been asked to review the '230 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 '230 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 ’230 Patent. The opinions I provide in this declaration are provided using the viewpoint of the POSITA as of that date.

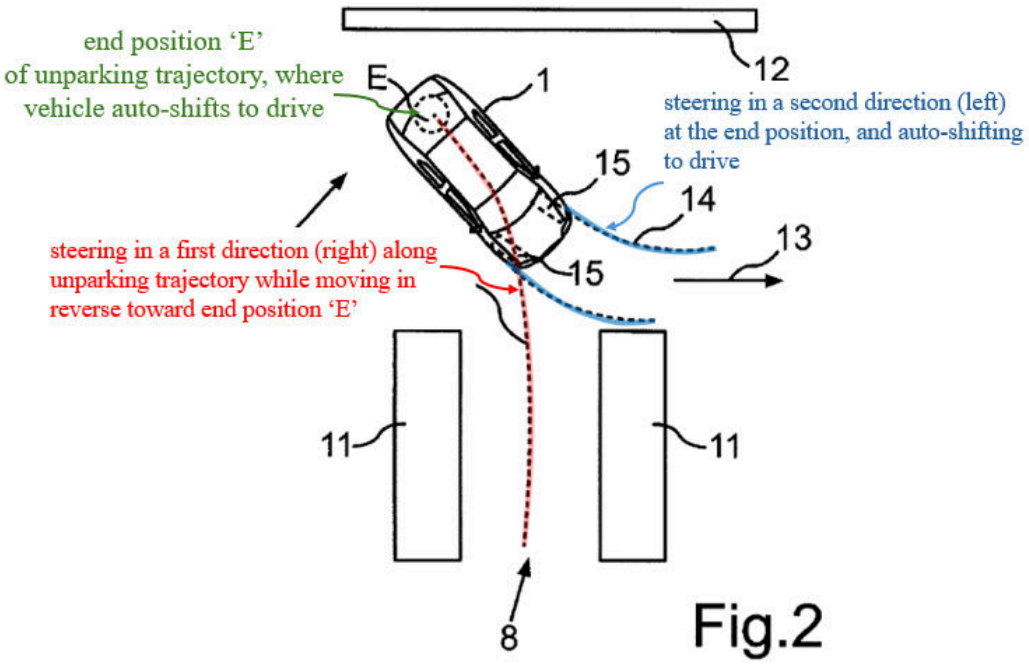
VI. THE PRIOR ART

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-autonomous manoeuvring the motor vehicle carries out at least one reversing

[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.

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 '230 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 '230 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. Allexi

48. From my review, 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.

49. 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 456 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.

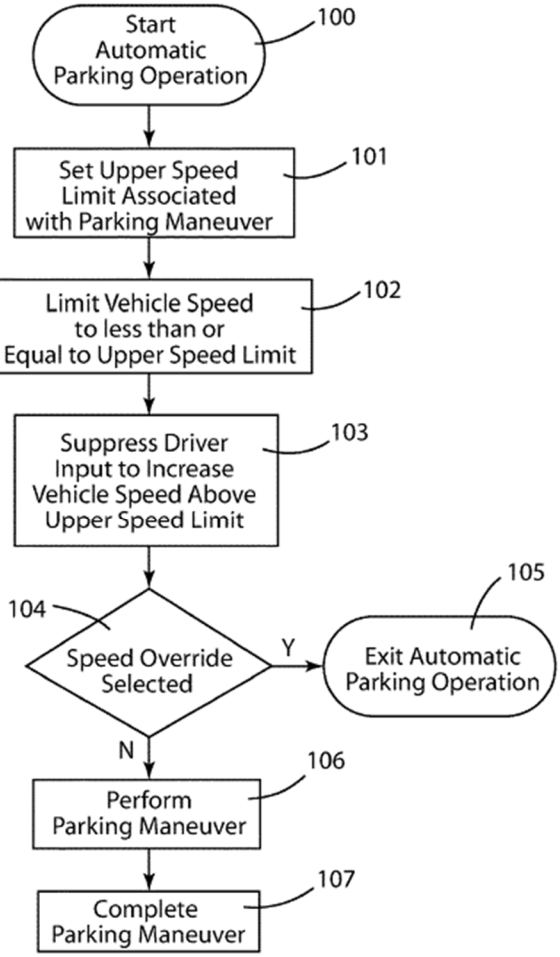


Fig. 2

TESLA-1009, FIG. 2

50. 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.

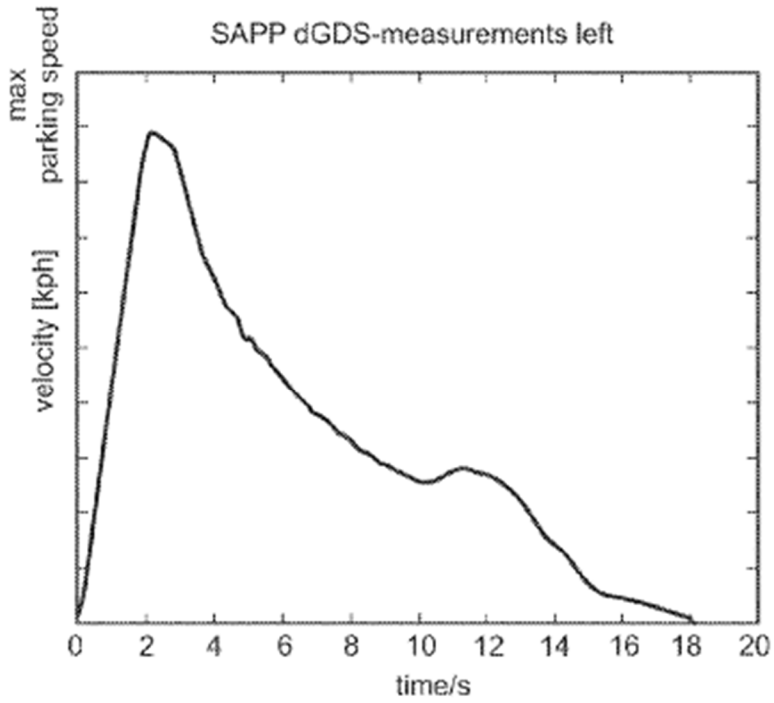


Fig. 6

TESLA-1009, FIG. 6

51. 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 '184 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").

D. Matters

52. Matters describes a "parking assistance system." TESLA-1010, [0002].

Like Joos, Matters's parking assistance system implements "an unparking mode" in which the system "unparks the vehicle 1 out of the parking space." TESLA-1010, [0041], [0055]-[0056]. In Matters, "the distance of the vehicle can be measured via sensors inside the vehicle. As soon as a defined distance in the forwards direction or the reverse direction has been reached or exceeded, the vehicle is preferably automatically halted by braking without user interaction. In this way, the action radius of the vehicle is limited in order to minimize the potential risk." TESLA-1010, [0076]. Matters discloses that in parking and unparking, "the vehicle always only travels a maximum, specific distance, for example a maximum of 1.2 times the length of the vehicle." TESLA-1010, [0054]. Accordingly, in Matters, "a check is made as to whether the vehicle 1 has already exceeded a maximum allowing movement distance during the parking procedure," and if so, further movement is "halted." TESLA-1010, [0069], [0076], [0054].

E. Bettger

53. 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].

54. 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 '230 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

55. From my review, 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 … if the driver keeps the steering constantly directly at the steering stop and follows it." 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].

56. 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].

57. 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 '184 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

58. 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, 13, 15, and 17 of the '230 Patent are obvious over Joos (Ground 1A).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5, 9-12, and 18 of the '230 Patent are obvious over Joos in view of Kischkat (Ground 1B).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5, 7, and 15-16 of the '230 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 5, 8, and 13-14 of the ’230 Patent are obvious over Joos in view of Kischkat and Matters (Ground 1D).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 1-4, 13, 15, and 17 of the ’230 Patent are obvious over Joos in view of Bettger (Ground 2A).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5-6, 9-12, and 18 of the ’230 Patent are obvious over Joos in view of Bettger and Kischkat (Ground 2B).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5, 7, and 15-16 of the ’230 Patent are obvious over Joos in view of Bettger, Kischkat, and Allexi (Ground 2C).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5, 8, and 13-14 of the ’230 Patent are obvious over Joos in view of Bettger, Kischkat, and Matters (Ground 2D).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 1-4, 13, 15, and 17 of the ’230 Patent are obvious over Joos in view of Bayer (Ground 3A).

- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5 and 9-12 of the ’230 Patent are obvious over Joos in view of Bayer and Kischkat (Ground 3B).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5, 7, and 15-16 of the ’230 Patent are obvious over Joos in view of Bayer, Kischkat, and Allexi (Ground 3C).
- Based upon my knowledge and experience and my review of the prior art publications listed above, claims 5, 8, and 13-14 of the ’230 Patent are obvious over Joos in view of Bayer, Kischkat, and Matters (Ground 3D).

VIII. ANALYSIS OF JOOS

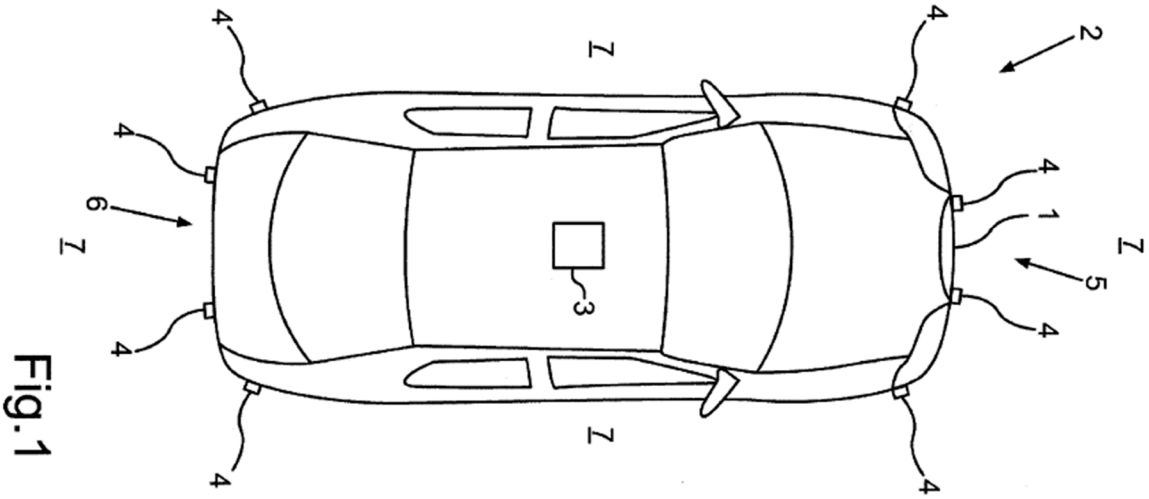
A. Claims 1-4, 13, 15, and 17 are Rendered Obvious by Joos (Ground 1A)

1[p]: A motor vehicle comprising:

59. From my analysis of the references, Joos renders obvious 1[p].

60. For example, Joos discloses “a ***motor vehicle***” including the motor vehicle 1 depicted in FIG. 1 below. TESLA-1004, Abstract, [0001], [0005]-[0014], [0031], FIG. 1.

motor vehicle

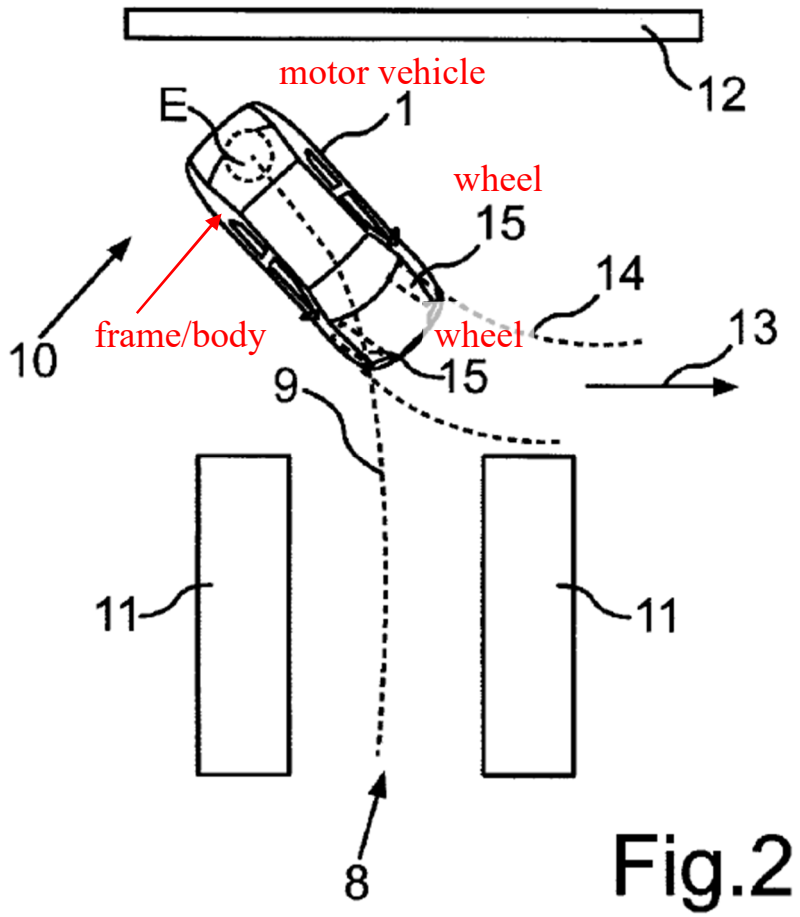


TESLA-1004, FIG. 1 (rotated)

1[a]: a frame having wheels;

61. From my analysis of the references, Joos renders obvious 1[a].

62. Joos discloses that the motor vehicle has a "body" (***frame***) and "wheels." TESLA-1004, [0014] ("the external surface of the **body** of the motor vehicle"), [0016] ("**wheels** of the motor vehicle"). Joos also discloses "orient[ing] the steerable **wheels** of the motor vehicle in such a way that the steering has the predefined steering angle." TESLA-1004, [0016]. FIG. 1 (above) and FIG. 2 (below) shows the motor vehicle 1 having a "body" and "wheels 15" (***a frame having wheels***). TESLA-1004, [0038].



TESLA-1004, FIG. 2

1[b]: a motor connected to the frame;

63. From my analysis of the references, Joos renders obvious 1[b].

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

1012, [0127] (vehicle "frame structure 102 on which may be mounted the various functional systems, subsystems and components of the vehicle such as the motors, suspension, wheels, and passenger compartments, and the vehicle body 104 itself."); TESLA-1014, [0076] ("the motor 302 is coupled to the first end frame 204 and operatively coupled to the first and second wheels 208A, 208B.").

1[c]: a steering control connected to the wheels to establish a steering angle;

65. From my analysis of the references, Joos renders obvious 1[c].

66. Joos discloses that the motor vehicle has a "**steering wheel**" and a "**steering system**" that each individually or together provide a "***steering control***." TESLA-1004, [0014]-[0015], [0033].

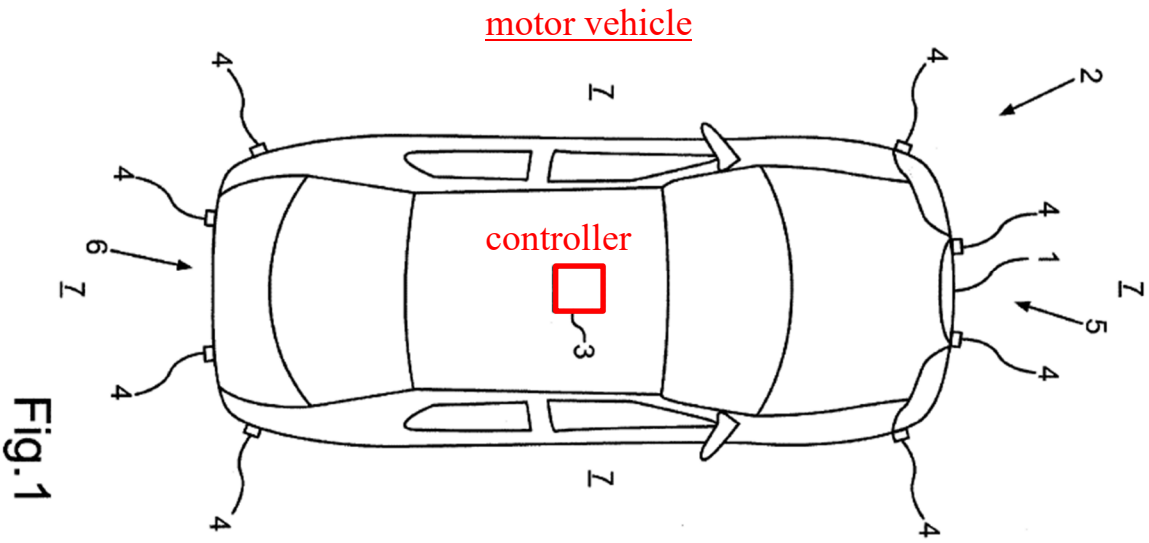
67. Joos explains that "the driver assistance system can intervene in the **steering** of the motor vehicle once again and can orient the **steerable wheels** of the motor vehicle in such a way that the steering has the predefined **steering angle**." TESLA-1004, [0016], [0033]. Additionally, "the driver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

1[d]: a controller operably connected to the steering control, to the motor, and to the wheels;

68. From my analysis of the references, Joos renders obvious 1[d].

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

the **controller 3 is designed to output corresponding control signals to the steering system** of the motor vehicle 1." TESLA-1004, [0033], [0037]-[0038].



TESLA-1004, FIG. 1 (rotated)

70. The controller of Joos's driver assistance system is ***operably connected to the*** steering system including the steering wheel (***steering control***) to detect steering inputs; indeed, Joos's controller receives data from a steering angle sensor of the steering system and issues control signals to the steering system that are operable to cause the wheels to adjust their angle in accordance with the steering input from the steering system including the steering wheel. TESLA-1004, [0016], [0021], [0031], [0033], [0037]-[0038]. 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").

71. A POSITA also would have recognized that Joos's drive system/controller monitors the steering control while autonomously or semi-autonomously driving in the reverse direction; indeed, the drive system/controller autonomously or semi autonomously guides the vehicle along the unparking trajectory to the calculated end position E. TESLA-1004, [0008]. It was known and obvious to use closed-loop steering feedback in this context to minimize a difference between the steering angles needed to follow the unparking trajectory and the measured steering angles obtained through monitoring of the steering control. TESLA-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.").

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

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

74. The '230 Patent's own description of the features recited in 1[d] underscores the obviousness of this limitation. For example, the '230 Patent discloses "a vehicle 10 having a frame or body 12 having wheels 14 that are driven

by a motor 16. Brakes 20 are associated with each wheel and a brake cylinder 22 operates the brakes. A steering system 24 steers the front wheels." TESLA-1001, 2:14-19. The '230 Patent further discloses that a "computer or controller 30 is connected to each of the above systems," and FIG. 1 depicts the controller 30 operably connected to the front wheels 14 via a motor 16, brake cylinder 22, and steering system 324. TESLA-1001, 2:20-24, FIG. 1. Joos's description thus substantially aligns with the description of this limitation in the '230 Patent.

1[e]: the controller operable to selectably drive the wheels in a forward direction in a drive mode and in a rearward direction in a reverse mode; and

75. From my analysis of the references, Joos renders obvious 1[e].

76. Joos discloses that a "driver assistance system can for example comprise **a controller or an electronic control unit**, with which during the unparking [maneuver] **control signals are output to** the steering system of the motor vehicle and possibly to the brake system and/or **the drive motor**. Thus, an autonomous unparking [maneuver] can be carried out using the driver assistance system." TESLA-1004, [0021], FIG. 2. Joos also discloses that "the driver assistance system itself can change from the **reverse gear** into the **forward gear**. A gear change can thus be carried out by the driver assistance system." TESLA-1004, [0017]. In Joos, if necessary, "a **forward movement** and a further **reversing movement** are carried out for [maneuvering] the motor vehicle along the unparking

trajectory." TESLA-1004, [0020], FIGs. 3-5. For example, "a **forward movement** and then a further **reversing movement** can be carried out. The performance of the forward movement and the subsequent reverse movement can also be carried out multiple times. It can thus be provided that the motor vehicle is moved back and forth until the end point can be reached." TESLA-1004, [0020], [0039]-[0040]. Accordingly, Joos provides a ***controller*** operable to shift between the reverse and forward gears ***to selectively drive the wheels in a forward direction in a drive mode and a rearward direction in a reverse mode***.

1[f]: the controller operable to select a direction for driving the wheels in response to a pattern of steering angle movements, without operator indication of a direction.

77. From my analysis of the references, Joos renders obvious 1[f].

78. In particular, the ***controller*** of Joos's driver assistance system is operable to ***select*** a (forward) ***direction*** for driving the wheels by auto-shifting from reverse to drive at the end position E of the autonomous or semi-autonomous unparking maneuver without "operator indication of direction," but rather ***in response to a pattern of steering angle movements*** made during the maneuver. As described further below, Joos's ***pattern of steering angle movements*** includes at least **(1)** steering in a first direction (*e.g.*, right) while reversing to reach the end position E of the unparking maneuver and **(2)** steering in the opposite direction (*e.g.*, left) at the end position E to set "a predetermined or adjusted steering angle," e.g.,

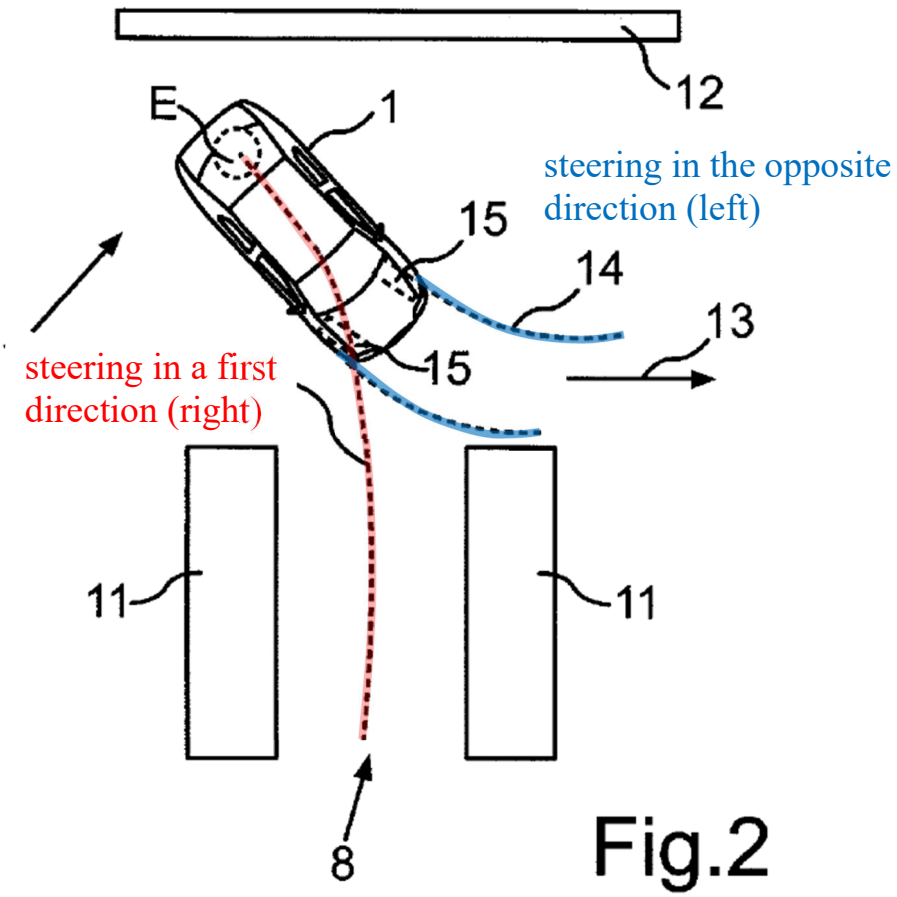
"a maximum steering angle," for the anticipated forward movement of the vehicle when manual control of the vehicle is returned to the driver at the end of the unparking maneuver.[3] TESLA-1004, [0010], [0014] ("on reaching the end position a steering angle is set that enables collision-free forward movement"), [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], FIG. 2.

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

[3] The pattern of steering angle movements described in this example is the same pattern recited in claim 4. *Infra*, 0.

position E. *Id.*; TESLA-1004, FIG. 2.

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



TESLA-1004, FIG. 2 (annotated)

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

wheels of the motor vehicle.

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

83. Thus, by shifting gears from reverse to drive as a result of detecting a steering angle movement that steers the wheels first in a rightward direction to

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

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

be set *before* the forward gear is engaged because the pull-forward steering angle is set by the driver assistance system before the automatic or autonomous unparking maneuver is ended. *Id.*

85. A POSITA also would have found it obvious to condition Joos's auto-shift to drive (***select a direction for driving the wheels***) at the end position E of the unparking trajectory on completion of the pattern of steering angle movements, including detecting that the pull-forward steering angle has been set while the vehicle is parked at the end position. Indeed, this would have been obvious and beneficial to ensure full control of the vehicle could be handed back to the driver more quickly upon shifting to drive and to ensure the driver would not pull forward from the end position before the steering angle is set. TESLA-1004, [0017] ("driver … take[s] over directly and rapidly"); *Id.* Joos teaches that the steering angle is set to avoid collisions and to allow the vehicle to properly orient itself in the lane of travel when the driver pulls forward while maintaining the set steering angle. TESLA-1004, [0010], [0014]-[0016], [0036]-[0038]. Maintenance of the set steering angle also allows the vehicle to avoid collisions with other parked vehicles. *Id.* Allowing the driver to pull forward before the steering angle is set introduces risk of collisions with other vehicles and prevents the vehicle from being properly oriented such that it could move forward into the lane of travel, all of which may compromise safety. *Id.*; TESLA-1004, [0010], [0014]-[0016], [0036]-[0038].

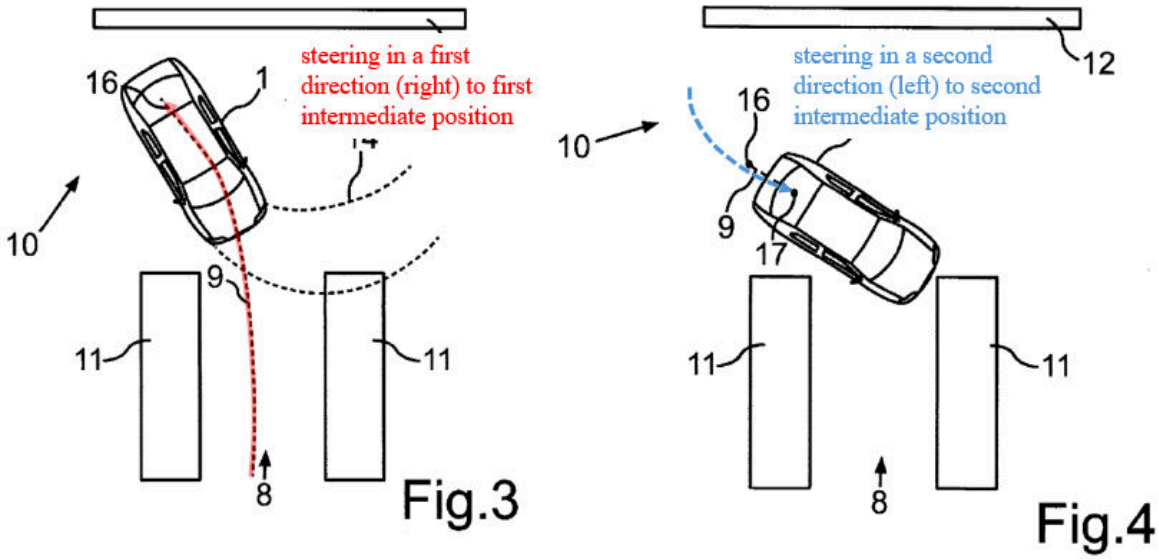
Accordingly, a POSITA would have been motivated to configure Joos's drive system/controller to auto-shift to drive based on the pull-forward steering angle first being set to enhance safety and provide a more intuitive driving experience that would allow the driver to immediately assume full control of the vehicle once the vehicle shifts to drive. Allowing the driver to more quickly assume control of the vehicle after the auto-shift to drive also furthers Joos's objective of "enabl[ing] the driver of the motor vehicle to take over directly and rapidly." TESLA-1004, [0017]. Further, it provides added convenience because the set steering angle allows the driver to simply pull forward into the direction of the lane of travel while avoiding collisions with nearby vehicles or objects (*e.g.*, vehicle in adjacent parking spaces). *Id.*, [0014]. Even basic driver's education instructional materials teach drivers to set the pull-forward steering angle before shifting to drive upon exiting a parking space. 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.").

86. Moreover, configuring the drive system/controller to auto-shift to drive only after setting the steering angle would have been obvious to try. Joos discloses both setting of the steering angle and shifting to drive as two actions that must occur at the end of the unparking procedure before control is handed back to the user. *Id.*;

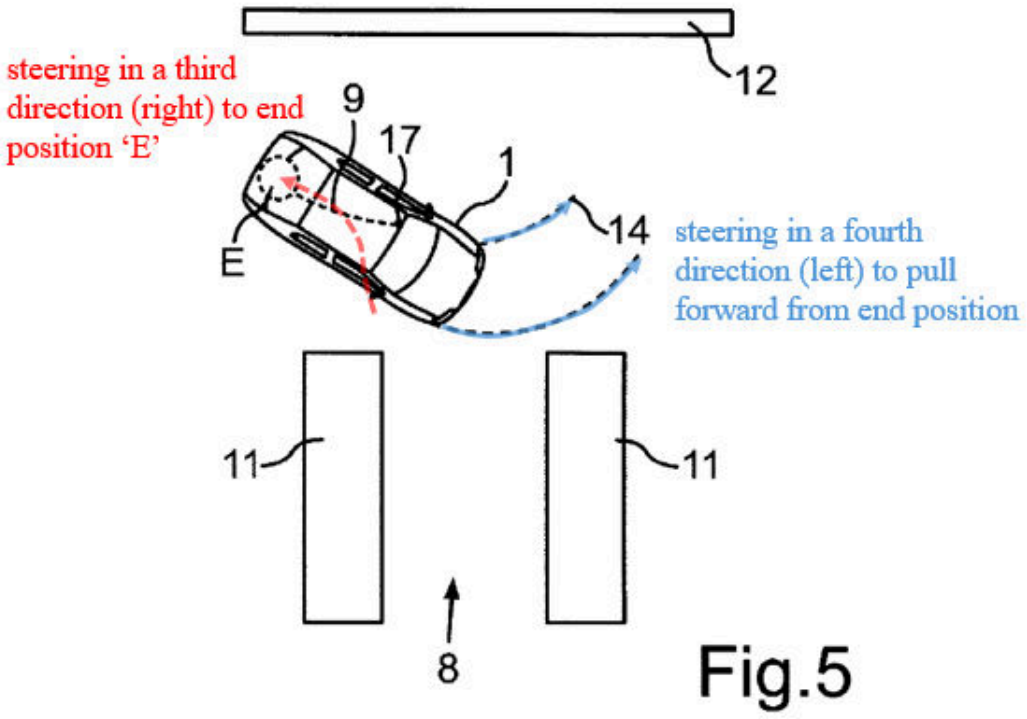
TESLA-1004, [0018]. A finite number of options exist for sequencing these actions. Namely, the steering angle could only be set before, during, or after the auto-shift to drive of the vehicle. Considering these limited options and the known benefits of setting the steering angle before auto-shifting 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 applying capabilities that the driver assistance system in Joos was already configured to perform (*e.g.*, setting the steering angle and auto-shifting to drive). *Id.* Joos's vehicle is also capable of adjusting the steering angle while in a reverse gear as evident from the curved trajectory taken by the vehicle when reversing from the parking space. *Id.*; TESLA-1004, FIG. 2; *see also id.*, [0039]-[0040] & FIGs. 3-5 (disclosing additional steering angle movements in the ***pattern of steering angle movements*** when the end position E cannot be reached in a single reversing motion).

87. Joos also discloses scenarios that require additional steering inputs to be provided in a sequence of alternating directions (additional steering angle movements in the ***pattern of steering angle movements***) to travel back and forth between intermediate positions until the end position E is reached. TESLA-1004, [0039]-[0040], FIGs. 3-5. Joos's motor 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 backing out of the parking space. *Id.*; TESLA-1004, FIGs. 2, 3-5. As illustrated below, the series of reversing and forward movements of the vehicle to reach the end position E while providing steering angle movements 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 angle movements***) further exemplifies how finally changing the drive direction in response ***a pattern of steering angle movements*** in opposite directions would have been obvious to a POSITA based on Joos.



TESLA-1004, FIGs. 3-4



TESLA-1004, FIG. 5

88. Further, in Joos, the driver assistance system's auto-shift to drive (***select a direction for driving the wheels***) is accomplished ***without operator indication of a direction***. This is evident, or at least obvious, because the driver never manipulates the vehicle's gear selector or any other control that specifies a particular direction at end position E when the driver assistance system determines to shift the vehicle from reverse to drive. TESLA-1004, [0017] ("gear change can thus be carried out by the driver assistance system"); *cf.*, TESLA-1001, 1:38-36, 3:36-41, 4:44-54 ('230 Patent disclosing similar inputs that do not involve operator indication of direction).

Claim 2: The motor vehicle of claim 1 wherein the controller is operable to change from reverse mode to drive mode without operation of a selector by a driver.

89. From my analysis of the references, Joos renders obvious Claim 2.

90. Joos teaches that the "gear change can [] be **carried out by the driver assistance system**" rather than the driver. TESLA-1004, [0017]; *supra*, 1[f] (explaining how Joos's auto-shift from reverse to drive is performed without operator selection of a direction consistent with examples disclosed in the specification of the '230 Patent). *Cf.* TESLA-1001, 1:27-36, 4:37-54. Joos's driver assistance system/controller auto-shifts from reverse to drive ***without operation of a selector by a driver***; indeed, the driver is not involved in shifting gears at the end position E of the unparking maneuver. *Id.*

91. A POSITA also would have found it obvious that Joos's driver would not operate a selector to change the drive direction when driver assistance system shifts gears because Joos explicitly 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], [0038].

Claim 3: The motor vehicle of claim 1 wherein the controller is operable while the vehicle is underway in one of the forward and reverse directions, and has stopped momentarily, to determine whether to remain in the same direction or to change direction.

92. From my analysis of the references, Joos renders obvious Claim 3.

93. Joos discloses that "the motor vehicle is stopped at the end position" and "[a]fter the end position is reached, the driver assistance system itself can change from the reverse gear into the forward gear" thereby ending the assisted unparking maneuver, returning manual control of the vehicle to the driver, and allowing the driver to drive in the forward direction. TESLA-1004, [0016]-[0017]. Because Joos's driver assistance system/controller only auto-shifts to drive to end the unparking maneuver if the vehicle has reached the target end position E, the driver assistance system/controller is operable while the vehicle is underway in the reverse direction, and has stopped momentarily at the end position E, to determine whether to remain in the same direction or to change direction based on whether vehicle is determined to have successfully reached the end position E. *Id.*, [0017]-[0018], [0038], FIG. 2. If the vehicle determines that it has reached the end position E such that manual control can be safely handed back to the driver, the driver assistance system/controller determines to change the direction from reverse to drive. *Id*. If the vehicle stops while reversing but determines that it has not reached the end position, then it would be obvious that the driver assistance system/controller determines whether to remain in the same direction or to change direction based on whether the surrounding environment would allow the vehicle to continue reversing to the end position or whether the vehicle needs to pull forward to an intermediate position before reversing again to reach the end position (as described in Joos with respect to

FIGs. 3-5). *Id.*, [0039]-[0040], FIGs. 3-5. For example, it would have been obvious to momentarily stop the vehicle while reversing toward the end position E to avoid a temporary obstacle such as a pedestrian that walks behind the vehicle, in which case the driver assistance system/controller would determine to continue reversing toward the end position. TESLA-1009, 1:31-32 ("emergency braking systems are used to avoid hitting an obstacle"), 1:16-47). However, if there is insufficient space to continue reversing toward the end position as taught in Joos, then the controller determines to change directions and pull forward to an intermediate position. TESLA-1004, [0039]-[0040], FIGs. 3-5.

Claim 4: The motor vehicle of claim 1 wherein the pattern of steering angle movements includes steering in a first direction, then steering in the opposite direction.

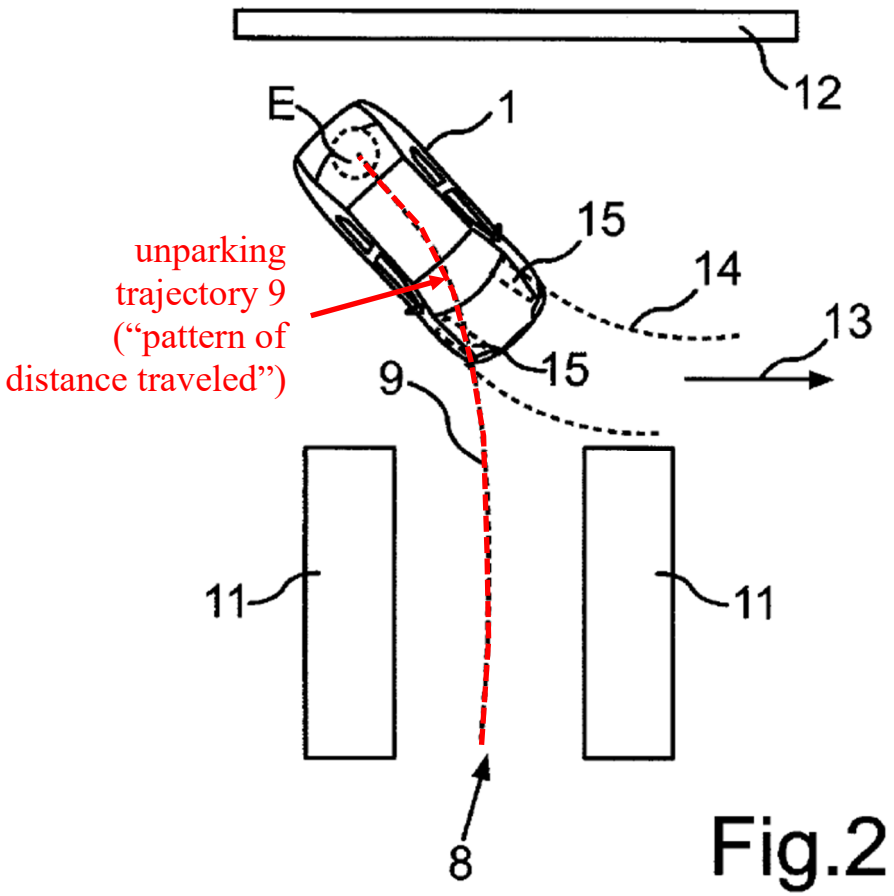
94. Joos renders obvious Claim 4 for the reasons discussed above with respect to Element 1[f]. *Supra*, 1[f].

Claim 13: The motor vehicle of claim 1 wherein the controller is operable to select a direction for wheel driving in response to a pattern of distance traveled.

95. From my analysis of the references, Joos renders obvious Claim 13.

96. Joos discloses that "after reaching the end position" of the assisted unparking maneuver "a forward gear is engaged" by the driver assistance system. TESLA-1004, [0017]; *see also id.*, [0018], [0034]-[0038], FIG. 2. Specifically, "the motor vehicle 1 is manoevred along an unparking trajectory 9" to the end position

E, where the vehicle stops before the driver assistance system shifts to the forward gear. *Id.*, [0034], [0006], [0016] ("motor vehicle is stopped at the end position"). "In principle, the unparking trajectory can be predetermined. The unparking trajectory can also be defined using objects bounding on the cross-parking space" and "the unparking trajectory is adjusted when unparking the motor vehicle using sensor data that are detected with sensors of the motor vehicle." *Id.*, [0008]. The unparking trajectory 9 defines a ***pattern of distance traveled***, such as a pattern comprising a first distance traveled while reversing substantially straight out of the cross-parking space and a second distance traveled while reversing with a sharper steering angle toward the end position E once the vehicle has sufficiently cleared the cross-parking space. Because the vehicle must follow the unparking trajectory 9 to reach the end position E, and because the driver assistance system requires that the vehicle stop at the end position E for the forward gear to be engaged (***select a direction for wheel driving***), Joos's controller of the driver assistance system is ***operable to select a direction for wheel driving in response to a pattern of distance traveled***.



TESLA-1004, FIG. 2 (annotated)

Claim 15: The motor vehicle of claim 1 wherein the controller is operable to select a direction for wheel driving in response to a pattern of velocity.

97. From my analysis of the references, Joos renders obvious Claim 15.

98. Joos discloses that "after reaching the end position" of the assisted unparking maneuver "a forward gear is engaged" by the driver assistance system. TESLA-1004, [0017]; *see also id.*, [0018], [0034]-[0038], FIG. 2. Specifically, "the motor vehicle 1 is manoevred along an unparking trajectory 9" to the end position E, where the vehicle stops before the driver assistance system shifts to the forward

gear. *Id.*, [0034], [0006], [0016] ("motor vehicle is stopped at the end position"). Because the vehicle must follow the unparking trajectory 9 to reach the end position E by reversing with a negative velocity, and because the driver assistance system requires that the vehicle then stop at the end position E, thereby attaining a velocity of zero, for the forward gear to be engaged (***select a direction for wheel driving***), Joos's controller of the driver assistance system is ***operable to select a direction for wheel driving in response to a pattern of velocity*** (e.g., a negative velocity followed by a zero velocity).

Claim 17: The motor vehicle of claim 1 wherein the steering angle movements are determined by any of steering sensors on the vehicle and vision systems on the vehicle.

99. From my analysis of the references, Joos renders obvious Claim 17.

100. Joos first determines steering angle movements by ***steering sensors*** on the vehicle. For example, Joos discloses that the controller receives data from a "**steering angle sensor**," which the controller uses to "output corresponding control signals to the steering system of the motor vehicle 1." TESLA-1004, [0033]. Joos also determines steering angle movements by ***vision systems*** on the vehicle. For example, Joos discloses that "[u]sing sensors of the motor vehicle or the driver assistance system of the motor vehicle, objects can be detected that bound on the cross-parking space. The sensor can be for example an ultrasonic sensor**, a radar sensor, a laser sensor or a camera**. Furthermore, it can be provided that the sensor

data that is provided by the sensors are analysed by the controller of the motor vehicle. … [T]he motor vehicle is reversed along the unparking trajectory until it can be steered past the objects bounding on the cross-parking space without collisions." TESLA-1004, [0012], [0032], [0035]; *see also id.*, [0008] ("the unparking trajectory is adjusted when unparking the motor vehicle using sensor data that are detected with **sensors** of the motor vehicle"), [0009].

IX. ANALYSIS OF JOOS IN VIEW OF KISCHKAT

A. A POSITA Would Have Combined Joos and Kischkat

101. 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.

102. 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.

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

104. 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 options for shifting gears according to the techniques described in Kischkat.

105. First, a POSITA would have pursued the combination to provide drivers with another option for shifting from reverse to drive during the unparking procedure that would achieve distinct benefits from those attained by Joos's original solution. Considering these distinct benefits, a POSITA would have expected Kischkat's option to be preferred by a significant population 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].

106. 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.

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

108. 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], [0016], [0019].

109. 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.

110. Fifth, a 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].

111. 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 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].

112. 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].

113. 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.

114. 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 5, 9-12, and 18 are Rendered Obvious by Joos in view of Kischkat (Ground 1B)

Claim 5: The motor vehicle of claim 1 wherein the controller is operable to offer an auto-shift in response to a prior pattern of vehicle operation based on at least one of distance traveled, velocity profile, and steering angle profile.

115. From my analysis of the references, the Joos-Kischkat combination renders obvious Claim 5.

116. As discussed above, the controller of Joos's driver assistance system auto-shifts to drive (*e.g.*, engages the forward gear) at the end position E of the unparking trajectory 9 in response to a pattern of distance traveled (*see* Ground 1A at Claim 13), a pattern of velocity that constitutes a velocity profile (*see* Ground 1A at Claim 15), and a pattern of steering angles that constitutes a steering angle profile (*see* Ground 1A at 1[f]). *Supra*, §§VIII.A(g), VIII.A(k), VIII.A(l). Joos's pattern of distance traveled, pattern of velocity (velocity profile), and pattern of steering angle movements (steering angle profile) are all "prior" patterns that represent vehicle

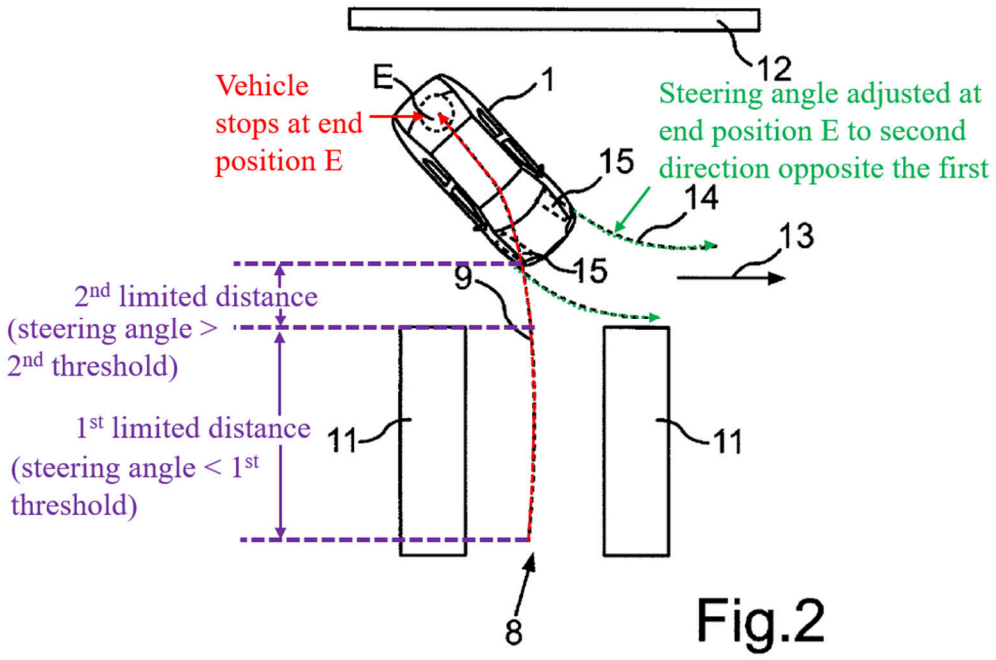
operation before the driver assistance system auto-shifts to drive and that represent prior defined conditions for the auto-shift to occur (*e.g.*, conditions for the vehicle to travel distances along the unparking trajectory to end position E, to stop at the end position E, and for the predefined steering angles to be set). TESLA-1004, [0016]-[0018], [0008]-[0009]; *supra*, §§VIII.A(g), VIII.A(k), VIII.A(l). Further, based on Kischkat, the Joos-Kischkat vehicle offers to auto-shift rather than directly proceeding to auto-shift without the driver's acceptance. *Supra*, §§VI.B, IX.A, IX.B(l). Therefore, in the Joos-Kichkat combination, the controller is operable to ***offer an auto-shift in response to a prior pattern of vehicle operation based on at least one of distance traveled, velocity profile, and steering angle profile***.

> ***Claim 9: The motor vehicle of claim 1 wherein the controller is operable to offer an auto-shift only if a first limited distance associated with vehicle length was covered with a steering angle less than a first threshold, and a second distance was traveled with a steering angle greater than a second selected threshold and in a first direction, and the vehicle subsequently stops, and the steering angle is adjusted to a second direction opposite the first direction.***

117. From my analysis of the references, the Joos-Kischkat combination renders obvious Claim 9.

118. As shown in FIG. 2 (below), Joos discloses that the vehicle 1 reverses from a cross-bounding parking space to an end position E along trajectory 9 during the assisted unparking maneuver. TESLA-1004, [0008]-[0010], [0036]-[0038], FIG. 2. During the reversing movement, the vehicle 1 travels a first distance with the

steering angle turned only a small amount to the right as the vehicle 1 moves clear of nearby vehicles on either side of the parking space (***a first limited distance associated with vehicle length*** (e.g., length of vehicles 11). *Id.* The steering angle during this portion of the movement is less than a first threshold selected to prevent vehicle 1 from turning too sharply and colliding with vehicle 11. *Id.*, [0014] ("exclude collisions"), [0037]. The controller of vehicle 1's driver assistance system then turns the wheel more sharply to the right while reversing ***a second limited distance*** to reach end position E, located back and to the side of vehicle 1's original parking space. *Id.* The steering angle during this portion of the movement is more than a second selected threshold as needed to swing the vehicle with the correct orientation to reach the predefined end position E. *Id.*, [0008]-[0009]. The vehicle 1 subsequently stops at end position E. *Id.*, [0016]. While stopped at end position E, the controller then adjusts the steering angle to the left (***a second direction opposite the first direction***) for the anticipated forward motion of the vehicle 1. *Id.*, [0014]-[0018], [0037]-[0038]. Because each of these actions must be performed for vehicle 1 to reach end position E where the controller offers the auto-shift to drive (*see supra*, §IX.A), the Joos-Kischkat controller is operable to offer an auto-shift only if the conditions recited in claim 9 are satisfied.



TESLA-1004, FIG. 2 (annotated)

Claim 10: The motor vehicle of claim 1 including a driver input device operably connected to the controller, and wherein the controller is operable to offer an auto-shift and enact the auto-shift in response to a user acceptance action on the driver input device.

119. From my analysis of the references, the Joos-Kischkat combination renders obvious Claim 10.

120. 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]. For example, an "accelerator or brake pedal," a "voice control system," or "a steering wheel button or a scroll wheel or similar," can all be configured as an input device for receiving a driver's acceptance of an offer

to auto-shift between reverse and forward gears. *Id.*, [0010]-[0013], [0016]-[0018]; *supra*, §VI.B.

121. As described above (*supra*, §IX.A), it would have been obvious to apply Kischkat's techniques in combination with Joos such that the brake pedal or other elements in the vehicle would be configured as ***a driver input device operably connected to the controller, the controller operable to offer an auto-shift and to enact the auto-shift in response to a user acceptance action on the driver input device***. TESLA-1005, [0009], [0011] ("switching of the transmission is realized by a simple acknowledging action"), [0016] ("[I]f the … **assistance system asks 'Change direction?', the driver simply has to answer 'yes'**."), [0036]; *infra*, 18[f].

Claim 11: The motor vehicle of claim 10 wherein the driver input device is a brake pedal.

122. Joos-Kischkat renders obvious Claim 11 for the reasons discussed above with respect to Claim 10. TESLA-1005, [0009] ("the signal for shifting the automatic transmission … can be given via the … brake pedal").

Claim 12: The motor vehicle of claim 10 wherein the driver input device is a control selected from the group of controls including buttons, knobs, levers, and touch sensitive displays.

123. Joos-Kischkat renders obvious Caim 12 for the reasons discussed above with respect to Claim 10. TESLA-1005, [0013] ("it is sufficient to simply operate this control element, for example, a steering wheel button or a scroll wheel or similar"), [0017] ("switching signal is given via a control element on the steering

wheel or dashboard side, a button, a knob, scroll wheel, or touch field is expediently used"), [0018], [0027], [0036].

18[p]: A motor vehicle for operation by a driver, comprising:

124. *Supra*, Ground 1A at 1[p]; TESLA-1004, [0006] ("manual driving of the motor vehicle can be carried out by a vehicle driver"), [0009]-[0014].

18[a]: a frame having wheels;

125. *Supra*, Ground 1A at 1[a].

18[b]: a motor connected to the frame;

126. *Supra*, Ground 1A at 1[b].

18[c]: a steering control connected to the wheels to establish a steering angle;

127. *Supra*, Ground 1A at 1[c].

18[d]: a controller operably connected to the steering control, to the motor, and to the wheels;

128. *Supra*, Ground 1A at 1[d].

18[e]: the controller operable to selectably drive the wheels in a forward direction in a drive mode and in a rearward direction in a reverse mode; and

129. *Supra*, Ground 1A at 1[e].

18[f]: the controller operable when the vehicle has been operated in reverse to offer the driver an auto-shift to drive; and

130. From my analysis of the references, the Joos-Kischkat combination renders obvious 18[f].

131. Joos discloses that, during the assisted unparking maneuver, the vehicle

is operated in reverse until "reaching the end position" where "a forward gear is engaged" by the driver assistance system. TESLA-1004, [0017]; *see also id.*, [0018], [0034]-[0038], FIG. 2. Specifically, "the motor vehicle 1 is manoevred along an unparking trajectory 9" to the end position E, where the vehicle stops before the driver assistance system shifts to the forward gear. *Id.*, [0034], [0006], [0016] ("motor vehicle is stopped at the end position").

132. To the extent Joos does not explicitly disclose the claimed "***offer***," 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]. 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], [0036]. The driver

assistance system asking the driver whether the assistance system should change direction and/or informing the driver that a shift signal must be given constitutes an ***offer [to] the driver [of] an auto-shift to drive***. It would have been obvious to apply Kischkat's techniques in combination with Joos as described above in Section IX.A such that the driver assistance system would first offer to auto-shift to drive at the end position E of Joos's unparking trajectory 9 and would wait for the driver's confirmation response before carrying out the auto-shift. *Supra*, IX.A. Therefore, in the Joos-Kischkat combination, the ***controller is operable when the vehicle has been operated in reverse to offer the driver an auto-shift to drive***.

18[g]: the offer of an auto-shift being based on at least one of time traveled from a parked position, distance traveled from a parked position, velocity of travel since parked, steering angle, and vehicle location.

133. From my analysis of the references, the Joos-Kischkat combination renders obvious 18[g].

134. As discussed above, Joos's auto-shift to drive at the end position E of the unparking trajectory 9 is based on at least distance traveled from a parked position (*see* Ground 1A at Claim 13), velocity of travel since parked (*see* Ground 1A at Claim 15), and steering angle (*see* Ground 1A at 1[f]). *Supra*, §§VIII.A(g), VIII.A(k), VIII.A(l). Further, based on Kischkat, the Joos-Kischkat vehicle offers to auto-shift rather than directly proceeding to auto-shift without the driver's acceptance. *Supra*, §§VI.B, IX.A, IX.B(l). Therefore, in the Joos-Kichkat

combination, ***the offer of an auto-shift is based on at least one of distance traveled from a parked position, velocity of travel since parked, and steering angle***.

X. ANALYSIS OF JOOS IN VIEW OF KISCHKAT AND ALLEXI

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

135. A POSITA would have found it obvious to further modify the Joos-Kischkat vehicle from Ground 1B based on Allexi to implement "a velocity or speed limiter" that would limit the speed of the vehicle during an autonomous or semi-autonomous unparking procedure to a speed less than an upper speed limit threshold. *Supra,* §VI.C; TESLA-1009, 3:18-29, 1:51-2:49, FIG. 2. In the resulting Joos-Kischkat-Allexi combination, the assisted unparking procedure is "cancelled" if the vehicle speed exceeds a defined speed limit. TESLA-1009, 1:34-36, 2:50-3:8, 4:61-67, 5:35-39. Thus, the assisted unparking procedure is maintained, and the Joos-Kischkat-Allexi vehicle would only successfully reach the target (end) position E of the unparking trajectory where an auto-shift to drive is made, if the vehicle's velocity does not exceed the speed limit. *Supra,* §VI.C; 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.

136. 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].

137. Applying Allexi's techniques in combination with Joos and Kischkat also would have been obvious as a matter of law; indeed, the combination merely

involves combining prior art elements according to known methods to yield predictable results. A POSITA would have reasonably expected success implementing the combination. Indeed, Joos, Kischkat, and Allexi each describe autonomous or semi-autonomous parking/unparking systems and adding a velocity limiter to a similar system would have been well within the skill of a POSITA. *Id.*

B. Claims 5, 7, and 15-16 are Rendered Obvious by Joos in view of Kischkat and Allexi (Ground 1C)

Claim 5: The motor vehicle of claim 1 wherein the controller is operable to offer an auto-shift in response to a prior pattern of vehicle operation based on at least one of distance traveled, velocity profile, and steering angle profile.

138. From my analysis of the references, the Joos-Kischkat-Allexi combination renders obvious Claim 5.

139. As discussed in further detail below (*infra*, Ground 1C at claim 15), the controller of the Joos-Kischkat-Allexi's driver assistance system offers an auto-shift to drive (*e.g.*, offers to engage the forward gear) at the end position E of the unparking trajectory 9 in response to a prior pattern of velocity that represents a velocity profile. *Supra*, §X.B(c). This prior pattern of vehicle operations is based on a velocity profile because the offer to auto-shift to drive only occurs if the vehicle has achieved the requisite velocity profile including reversing to the end position E in accordance with Allexi's speed-limited operation and ultimately stopping at the end position E (zero velocity). TESLA-1004, [0015]-[0018], FIG. 2; TESLA-1009,

2:14-18, 3:18-29, 5:59-61, 6:22-28, FIGs. 2, 6.; *supra*, §§VI.C-X.A.

Claim 7: The motor vehicle of claim 1 wherein the controller is operable to offer an auto-shift only if velocities are less than a selected threshold.

140. From my analysis of the references, the Joos-Kischkat-Allexi combination renders obvious Claim 7.

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

Claim 15: The motor vehicle of claim 1 wherein the controller is operable to select a direction for wheel driving in response to a pattern of velocity.

142. From my analysis of the references, the Joos-Kischkat-Allexi combination renders obvious Claim 15.

143. Allexi teaches that "[p]arking maneuvers with good parking results"—which include maneuvers for "leaving" a parking space—"follow a typical pattern." TESLA-1009, 2:14-18; *supra*, VI.C. In particular, the "application of the rate/speed versus the distance or time results in a typical curve." *Id.* In this context, Allexi proposes, and the combination includes, a vehicle velocity or speed limiter that applies a "dynamic speed limitation." *Id.*, 6:21-28. The "dynamic speed limitation" varies the vehicle speed limit as a function of "the distance or time" that the vehicle travels along the unparking trajectory consistent with the "typical pattern" of velocities of the vehicle during an unparking maneuver. *Id.*. Because the Joos-Kischkat-Allexi vehicle must abide by a pattern of velocities allowed by the dynamic speed limitation to successfully traverse the unparking trajectory 9 and reach the target (end) position E where offer to auto-shift to drive occurs (otherwise the maneuver is cancelled), the vehicle controller is operable to select to auto-shift to drive and thus ***select a direction for wheel driving in response to the pattern of velocity***. *Id.*

Claim 16: The motor vehicle of claim 15 wherein the controller is operable to offer an auto-shift only if the velocity is less than a selected threshold.

144. *Supra*, Ground 1C at Claims 7 and 15.

XI. ANALYSIS OF JOOS IN VIEW OF KISCHKAT AND MATTERS

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

145. A POSITA would have found it obvious to further modify the Joos-Kischkat vehicle from Ground 1B (*supra*, §IX.A) based on Matters such that the vehicle would monitor the distance traveled during each reverse and forward movement of the vehicle in an unparking procedure, and would prevent further movement if the distance traveled exceeded a maximum allowable distance. *Supra,* §VI.D; TESLA-1010, [0054], [0069], [0076], . In the resulting Joos-Kischkat-Matters combination, the determination that the vehicle has arrived at the end position E (as taught in Joos) where the offer to auto-shift from reverse to drive is made (as taught in Kischkat) would be further based on the distance traveled during the unparking process not exceeding the maximum allowable distance for the unparking procedure (as taught in Matters). TESLA-1010, [0069]; *supra,* §VI.D.

146. A POSITA would have been motivated to apply Matters's techniques in combination with Joos and Kischkat "in order to minimize [] potential risk," e.g., risk that the vehicle collides with an object or moves into an unsafe location such as a cross-bound traffic lane. TESLA-1010, [0076]. Matters's techniques would have benefitted Joos's vehicle by better ensuring the unparking procedure ends and the

auto-shift or offer to auto-shift occurs in a safe, predictable environment. *Id.* For example, it is well known that parking lots and garages are often tight and crowded, and unparking a vehicle often involves short, precise movements. Limiting the distance of forward/reverse movements during an assisted unparking maneuver ensures the vehicle does not travel too far into potentially hazardous zones (e.g., pedestrian walkways, traffic lanes) before the driver takes control or the system reassesses. *Id.* The longer the vehicle travels autonomously, the higher the chance of encountering unexpected obstacles like moving vehicles, pedestrians, or debris. *Id.*

147. Applying Matters's techniques in combination with Joos and Kischkat also would have been obvious as a matter of law because the combination merely involves combining prior art elements according to known methods to yield predictable results. A POSITA likewise would have reasonably expected success implementing the combination. Indeed, Joos, Kischkat, and Matters each describe autonomous or semi-autonomous parking/unparking systems and applying Matters's techniques to limit the distance traveled during an unparking maneuver in a similar system would have been well within the capabilities of a POSITA. *Id.*

B. Claims 5, 8, and 13-14 are Rendered Obvious by Joos in view of Kischkat and Matters (Ground 1D)

Claim 5: The motor vehicle of claim 1 wherein the controller is operable to offer an auto-shift in response to a prior pattern of vehicle operation based on at least one of distance traveled, velocity profile, and steering angle profile.

148. Joos-Kischkat-Matters renders obvious Claim 5. As discussed in further detail below (*infra*, Ground 1D at claim 13), the controller of the Joos-Kischkat-Allexi's driver assistance system offers an auto-shift to drive (*e.g.*, offers to engage the forward gear) at the end position E of the unparking trajectory 9 based on distance traveled. *Supra*, §XI.B(c); TESLA-1004, [0015]-[0018], FIG. 2; TESLA-1010, [0041], [0069], [0076], [0054]-[0056].

Claim 8: The motor vehicle of claim 1 wherein the controller is operable to offer an auto-shift only if distance traveled is less than a selected threshold.

149. From my analysis of the references, the Joos-Kischkat-Matters combination renders obvious Claim 8.

150. The Joos-Kischkat-Matters vehicle implements Matters's technique for monitoring the distance traveled during an assisted unparking maneuver and imposes a maximum allowable distance for reversing during the maneuver. *Supra,* §VI.D, XI.A; TESLA-1010, [0041], [0054]-[0056], [0069], [0076], . In the combination, the determination that the vehicle has arrived at the end position where the ***offer to auto-shift*** from reverse to drive occurs is therefore responsive to the distance traveled during the unparking process not exceeding the maximum allowable travel distance (***selected threshold***) for the unparking procedure. TESLA-1004, [0016]-[0018];

TESLA-1010, [0076]. For example, the distance traveled by the vehicle in the combination must be less than a maximum allowable distance (***selected threshold***) by the time it reaches the target (end) position E, otherwise the vehicle would be stopped for exceeding the maximum allowable distance before reaching the end position E, and consequently, the vehicle would not offer an auto-shift to drive for the driver to pull forward because the offer to auto shift to drive only occurs at the end position E of the trajectory. TESLA-1004, [0016]-[0018]; TESLA-1010, [0076]; TESLA-1003, ¶__.

151. Accordingly, the controller of the Joos-Kischkat-Matters vehicle is ***operable to offer an auto-shift only if distance traveled is less than a selected threshold***. *Id.*

Claim 13: The motor vehicle of claim 1 wherein the controller is operable to select a direction for wheel driving in response to a pattern of distance traveled.

152. From my analysis of the references, the Joos-Kischkat-Matters combination renders obvious Claim 13.

153. As described above, the distance traveled by the Joos-Kischkat-Matters vehicle must follow a pattern of distance traveled defined by the unparking trajectory 9 (as taught in Joos) and that is limited by Matter's maximum allowable travel distance (selected threshold) to reach the target (end) position E where the offer to auto-shift to drive is made. TESLA-1004, [0008]-[0009], [0016]-[0018], FIG. 2;

TESLA-1010, [0076]; *supra*, §§VIII.A(k), XI.B(b). If these aspects of the pattern are not satisfied, the unparking maneuver is cancelled or the vehicle does not reach the end position E and the controller would not select a direction for wheel driving by offering the auto-shift to drive as taught in Joos. *Id.* Accordingly, the controller of the Joos-Kischkat-Matters vehicle is ***operable to select a direction for wheel driving in response to a pattern of distance traveled***. *Id.*

Claim 14: The motor vehicle of claim 13 wherein the controller is operable to offer an auto-shift only if the distance traveled is less than a selected threshold.

154. *Supra*, Ground 1C at Claims 7 and 15.

XII. ANALYSIS OF JOOS IN VIEW OF BETTGER

A. A POSITA Would Have Combined Joos and Bettger

155. It would have been obvious to modify Joos in view of Bettger's suggestion for the driver to confirm initiation of an assisted reverse-turning maneuver based on the driver's steering input to the vehicle.

156. In the combination, the Joos-Bettger vehicle would initiate Joos's autonomous or semi-autonomous unparking maneuver—*i.e.*, a type of reverse-turning maneuver like those taught in Bettger—only following confirmation by the driver. TESLA-1006, [0021], [0043]-[0047], FIGs. 1-2. More specifically, the driver would provide confirmation by "carrying out a certain steering movement, for example, a steering movement of an angle which lies above a certain threshold value and which corresponds to the steering movement that is necessary for carrying out

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

157. Once the vehicle arrives and stops at the end position of Joos's unparking trajectory, and the pull-forward steering angle is set as taught in Joos, the controller of the driver assistance system in the Joos-Bettger vehicle changes from the reverse mode to drive mode by auto-shifting from a reverse gear to a drive gear as taught in each of Joos and Bettger. TESLA-1004, [0017], [0038]; TESLA-1006, [0045], [0047]. Because the driver's steering input that sets a steering angle greater than a threshold as taught in Bettger triggers initiation of the assisted unparking

maneuver that culminates in auto-shifting from reverse to drive at the end position E as taught in Joos, the controller/driver assistance system in the Joos-Bettger vehicle initiates the assisted unparking maneuver and shifts from reverse to drive at the end position E in response to the initiating steering input. Multiple reasons would have prompted a POSITA to implement Joos in accordance with Bettger's teachings in this manner.

158. First, Bettger's approach would promote safety and improve the user experience by allowing the driver to confirm that an assisted reverse-turning unparking maneuver should be initiated by adjusting the steering angle by at least a threshold value. 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 the maneuver (or intervenes to assist in the maneuver), rather than leaving the determination entirely up to the vehicle. TESLA-1006, [0043]-[0044]. Indeed, a POSITA would have expected Bettger's solution to enhance drivers' overall satisfaction with the driver assistance system since the system would be restricted from initiating the assisted unparking maneuver without the driver's awareness and confirmation. *Id.*

159. Second, a POSITA would have applied Bettger's suggestion to require

driver confirmation for initiating an assisted 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.

160. 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 ordinarily used when reversing the vehicle.

161. 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'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. 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, 13, 15, and 17 are Rendered Obvious by Joos in view of Bettger (Ground 2A)

162. Ground 2A incorporates the analysis of Ground 1A. Where Ground 1A relies on the teachings of Joos, Ground 2A relies on the combined teachings of Joos and Bettger. Integration of Bettger in Joos does not disturb the mapping of Joos's teachings to each of the claim elements in claims 1-4, 6, 13, 15, and 17 addressed in Ground 1A but not addressed below because the Joos-Bettger combination maintains the aspects of Joos's teachings mapped to these claim elements in Ground 1A. For brevity, only claim elements whose mappings are materially affected by the integration of Bettger in the combination are addressed below.

1[f]: the controller operable to select a direction for driving the wheels in response to a pattern of steering angle movements, without operator indication of a direction.

163. From my analysis of the references, the Joos-Bettger combination renders obvious 1[f].

164. As discussed above (*supra*, §XII.A), the controller of the driver assistance system of the Joos-Bettger vehicle initiates Joos's assisted unparking maneuver—*i.e.*, a type of reverse-turning maneuver like those taught in Bettger—only following confirmation by the driver. TESLA-1006, [0021], [0043]-[0047],

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

indication of a direction for the reasons previously discussed. *Supra*, Ground 1A at 1[f].

Claim 4: The motor vehicle of claim 1 wherein the pattern of steering angle movements includes steering in a first direction, then steering in the opposite direction.

165. *Supra*, Ground 2A at 1[f].

XIII. ANALYSIS OF JOOS IN VIEW OF BETTGER AND KISCHKAT

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

166. It would have been obvious to combine Joos (as modified by Bettger (*supra*, §XII.A)) with Kischkat for each of the reasons described above in Ground 1B. *Supra*, §IX.A. The resulting Joos-Bettger-Kischkat combination maintains the functionality of the Joos-Bettger combination from Ground 2A but further adds Kischkat's techniques as described above in Ground 1B. *Id.* The Joos-Bettger-Kischkat combination provides the additional features recited in claims 5, 9-12 and 18[4] for each of the reasons described for the same claims in Ground 1B. *Supra*, §IX.B (Claims 5, 9-12, 18). The Joos-Bettger-Kischkat combination also provides

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[4] The "***steering angle***" recited in 18[g] is met in the Joos-Bettger-Kischkat combination by the driver's confirmation steering input as taught in Bettger. TESLA-1006, [0044]; *supra*, VIII.A. The offer to auto-shift is conditioned on this steering angle for the reasons discussed above in Ground 2A at 1[f] and in V.B.

§IX.B (Claims 5, 9-12, 18). The Joos-Bettger-Kischkat combination also provides claim 6 for the reasons discussed below. *Id.*

B. Claims 5-6, 9-12, and 18 are Rendered Obvious by Joos in view of Bettger and Kischkat (Ground 2B)

Claim 6: The motor vehicle of claim 1 wherein the controller is operable to offer an auto-shift only if steering angles in a limited prior period were greater than a selected threshold.

167. From my analysis of the references, the Joos-Bettger-Kischkat combination renders obvious Claim 6.

168. Bettger teaches that the driver provides confirmation by "carrying out a certain steering movement, for example, a steering movement of an **angle which lies above a certain threshold value**." TESLA-1006, [0044]; *supra*, §VI.E. Because this steering movement must be made in the Joos-Bettger-Kischkat-combination for the assisted unparking procedure to be initiated and for the offer to auto-shift to be made (the offer is part of the assisted unparking procedure), ***the controller is operable to offer an auto-shift only if steering angles in a limited prior period were greater than a selected threshold***. Supra, §§VI.E, XII.A, IX.A. Joos also teaches that the steering angle set at the end position E is a "maximum" angle that is greater than a selected threshold below the maximum. TESLA-1004, [0015], [0037]-[0039].

XIV. ANALYSIS OF JOOS IN VIEW OF BETTGER, KISCHKAT, AND ALLEXI

A. Claims 5, 7, and 15-16 are Rendered Obvious by Joos in view of

Bettger, Kischkat, and Allexi (Ground 2C)

169. It would have been obvious to combine Joos (as modified by Bettger (*supra*, §XII.A) and Kischkat (*supra*, §IX.A)) with Allexi for each of the reasons described above in Ground 1C. *Supra*, §X.A. The resulting Joos-Bettger-Kischkat-Allexi combination maintains the functionality of the Joos-Bettger-Kischkat combination from Ground 2B but further adds Allexi's techniques as described above in Ground 1C. *Id.* The Joos-Bettger-Kischkat-Allexi combination provides the additional features recited in claims 5, 7, and 15-16 for each of the reasons described for the same claims in Ground 1C. *Supra*, §X.B (Claims 5, 7, and 15-16).

XV. ANALYSIS OF JOOS IN VIEW OF BETTGER, KISCHKAT, AND MATTERS

A. Claims 5, 8, and 13-14 are Rendered Obvious by Joos in view of Bettger, Kischkat, and Matters (Ground 2D)

170. It would have been obvious to combine Joos (as modified by Bettger (*supra*, §XII.A) and Kischkat (*supra*, IX.A)) with Matters for each of the reasons described above in Ground 1D. *Supra*, §XI.A. The resulting Joos-Bettger-Kischkat-Matters combination maintains the functionality of the Joos-Bettger-Kischkat combination from Ground 2B but further adds Matters's techniques as described above in Ground 1D. *Id.* The Joos-Bettger-Kischkat-Matters combination provides the additional features recited in claims 5, 8 and 13-14 for each of the reasons described for the same claims in Ground 1D. *Supra*, §XI.B (Claims 5, 8 and 13-14).

XVI. ANALYSIS OF JOOS IN VIEW OF BAYER

A. A POSITA Would Have Combined Joos and Bayer

171. A POSITA would have found it obvious to integrate Bayer's "driving steering assistance" techniques in Joos's semi-autonomous vehicle and unparking system. Supra, §VI.F. 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. Consistent with Bayer's teachings, the steering assistance would be indicated 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.

172. The Joos-Bayer vehicle would further include a "driver recognition module" and related capabilities as taught in Bayer "to determine whether the driver is properly monitoring" the unparking procedure and to check whether the driver is providing either not enough or too much force to the steering wheel. TESLA-1005, [0045]; *see also id.*, [0046], [0057]-[0058], [0065]. Bayer's techniques would thus

allow Joos's vehicle to attain the benefit of semi-autonomous steering interventions—*i.e.*, a type of intervention that Joos explicitly acknowledged was a suitable solution. TESLA-1004, [0008] ("the driver assistance system interven[ing] in the steering").

173. Multiple reasons would have motivated a POSITA to pursue the combination before the alleged invention of the '230 Patent.

174. First, a POSITA would have applied Bayer's steering assistance in Joos to assist drivers in properly following Joos's unparking trajectory, thereby improving the driver's ability to consistently, reliably, and efficiently reach the target end position of the trajectory. Joos explains that "[d]uring the unparking, the motor vehicle is [maneuvered] from a parked position in the cross-parking space onto the road bounding on the cross-parking space" by following a "predetermined" unparking trajectory. TESLA-1004, [0008]. "The motor vehicle is moved along the unparking trajectory until it has reached an end position," which is "defined at least as a position such that in the event of further movement from the end position …, manual driving of the motor vehicle can be carried out by a vehicle driver in a driving direction determined by the road without [maneuvering] the motor vehicle in a forward movement." *Id.*, [0006], [0008]-[0009]. Joos requires the motor vehicle to reach the targeted end position for the unparking maneuver to be completed, meaning that it is important for the vehicle to reliably reach the end position if Joos's

unparking procedure is to be successfully completed on a consistent basis. Bayer's steering assistance techniques would predictably aid the driver in operating the vehicle to follow a trajectory to the end position, especially since Bayer's techniques are specifically designed for this purpose. TESLA-1007, [0065], [0049], [0054], [0064], [0075].

175. Second, a POSITA would have applied Bayer's steering assistance to Joos to increase safety by ensuring the driver remains engaged during the unparking maneuver and ready to assume control of the vehicle at a moment's notice. 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].

176. Third, a POSITA would have applied Bayer's steering assistance to Joos to increase safety through a driver recognition module that would monitor the driver's compliance with the steering instructions and allow the driver to quickly abort a trajectory (*e.g.*, to avoid collisions or for any other reason). 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].

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

178. Fifth, a POSITA would have pursued the Joos-Bayer combination because it merely involves the application of known techniques (*e.g.*, Bayer's steering assistance techniques) to improve a known system (*e.g.*, Joos's semi-autonomous parking system) to achieve predictable results. Here, there were known problems associated with driver assistance systems available as of the Critical Date that fully relieved the driver of responsibility for steering during an autonomous or semi-autonomous parking/unparking maneuver like that described in Joos. TESLA-1007, [0008]-[0009]; TESLA-1004, [0008]. Bayer's techniques helped address that problem (and provided the other benefits discussed above).

179. A POSITA would have reasonably expected success implementing the Joos-Bayer combination, because it merely involves the application of known techniques (*e.g.*, Bayer's steering assistance techniques) to improve a known system

(*e.g.*, Joos's semi-autonomous parking system) to achieve predictable results. Here, there were known problems associated with driver assistance systems available as of the Critical Date that fully relieved the driver of responsibility for steering during an autonomous or semi-autonomous parking/unparking maneuver like that described in Joos. TESLA-1007, [0008]-[0009]; TESLA-1004, [0008]. Bayer's techniques helped address that problem (and provided the other benefits discussed above).

180. Furthermore, Joos and Bayer both describe driver steering assistance systems designed for use in similar contexts (*e.g.*, parking/unparking maneuvers). Bayer also confirms that its techniques can be applied broadly to a range of different motor vehicles including "compact vehicles having electric servo steering with an electronic brake system" and in "vehicles having hydraulic servo steering." TESLA-1007, [0071]-[0072]. Because Joos's motor vehicle already includes a driver assistance system and associated steering and braking controls, it would be well suited to implement Bayer's techniques. 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, 13, 15, and 17 are Rendered Obvious by Joos in view of Bayer (Ground 3A)

181. Ground 3A incorporates the analysis of Ground 1A. Where Ground 1A relies on the teachings of Joos, Ground 3A relies on the combined teachings of Joos

and Bayer. Integration of Bayer in Joos does not disturb the mapping of Joos's teachings to each of the claim elements in claims 1-4, 6, 13, 15, and 17 addressed in Ground 1A but not addressed below because the Joos-Bayer combination maintains the aspects of Joos's teachings mapped to these claim elements in Ground 1A. For brevity, only claim elements whose mappings are materially affected by the integration of Bayer in the combination are addressed below.

1[f]: the controller operable to select a direction for driving the wheels in response to a pattern of steering angle movements, without operator indication of a direction.

182. From my analysis of the references, the Joos-Bayer combination renders obvious 1[f].

183. As described above (*supra*, §VIII.A(g) (Ground 1A at 1[f])), Joos's controller ***selects a direction for driving the wheels in response to a pattern of steering angle movements, without operator indication of a direction***, where the pattern includes includes **(1)** steering in a first direction (*e.g.*, right) while reversing to reach the end position E of the unparking maneuver and **(2)** steering in the opposite direction (*e.g.*, left) at the end position E to set "a predetermined or adjusted steering angle," e.g., "a maximum steering angle," for the anticipated forward movement of the vehicle when manual control of the vehicle is returned to the driver at the end of the unparking maneuver. TESLA-1004, [0010], [0014]-[0015], [0037]-[0038], FIG. 2; *supra*, §VIII.A(g). In the combination, Bayer further teaches a

parking/unparking procedure in which a steering assistance system guides the driver in steering the vehicle to follow a prescribed trajectory like Joos's unparking trajectory 9. TESLA-1007, [0001]-[0003], [0006], [0012], [0016]-[0018], [0020]-[0021], [0024], [0065]; *supra*, VI.F.

184. The Joos-Bayer vehicle provides these same steering angle movements as Joos, except that the driver steers the vehicle during the unparking maneuver guided by Bayer's steering assistance. *Supra*, XVI.A. The ***pattern of steering angle movements*** in the Joos-Bayer combination corresponds to the sequence of steering angle movements provided by the driver in compliance with the prescribed pattern of steering torque adjustments and steering stops indicated by Bayer's steering assistance necessary to follow Joos's unparking trajectory and set the pull-forward steering angle at the end position E. *Id.* The Joos-Bayer controller is operable to select a drive direction by auto-shifting to drive at the end position E in response to this pattern of steering angle movements for each of the reasons discussed above (*supra*, §VIII.A(g) (Ground 1A at 1[f])), and further because Bayer's technique enforces compliance with the steering assistance; otherwise, the maneuver is aborted or the vehicle is stopped such that the vehicle would not successfully reach the end position E where the auto-shift would occur if the driver did not comply with the prescribed pattern of steering angle movements. TESLA-1007, [0020]-[0021], [0043], [0056]-[0057], [0065].

Claim 4: The motor vehicle of claim 1 wherein the pattern of steering angle movements includes steering in a first direction, then steering in the opposite direction.

185. *Supra*, Ground 3A at 1[f].

XVII. ANALYSIS OF JOOS IN VIEW OF BAYER AND KISCHKAT

A. Claims 5 and 9-12 are Rendered Obvious by Joos in view of Bayer and Kischkat (Ground 3B)

186. It would have been obvious to combine Joos (as modified by Bayer (*supra*, §XVI.A)) with Kischkat for each of the reasons described above in Ground 1B. *Supra*, §IX.A. The resulting Joos-Bayer-Kischkat combination maintains the functionality of the Joos-Bayer combination from Ground 3A but further adds Kischkat's techniques as described above in Ground 1B. *Id.* The Joos-Bayer-Kischkat combination provides the additional features recited in claims 5 and 9-12 for each of the reasons described for the same claims in Ground 1B. *Supra*, §IX.B (Claims 5 and 9-12).

XVIII. ANALYSIS OF JOOS IN VIEW OF BAYER, KISCHKAT, AND ALLEXI

A. Claims 5, 7, and 15-16 are Rendered Obvious by Joos in view of Bayer, Kischkat, and Allexi (Ground 3C)

187. It would have been obvious to combine Joos (as modified by Bayer (*supra*, §XVI.A) and Kischkat (*supra*, IX.A)) with Allexi for each of the reasons described above in Ground 1C. *Supra*, §X.A. The resulting Joos-Bayer-Kischkat-Allexi combination maintains the functionality of the Joos-Bayer-Kischkat

combination from Ground 3B but further adds Allexi's techniques as described above in Ground 1C. *Id.* The Joos-Bayer-Kischkat-Allexi combination provides the additional features recited in claims 5, 7, and 15-16 for each of the reasons described for the same claims in Ground 1C. *Supra*, §X.B (Claims 5, 7, and 15-16).

XIX. ANALYSIS OF JOOS IN VIEW OF BAYER, KISCHKAT, AND MATTERS

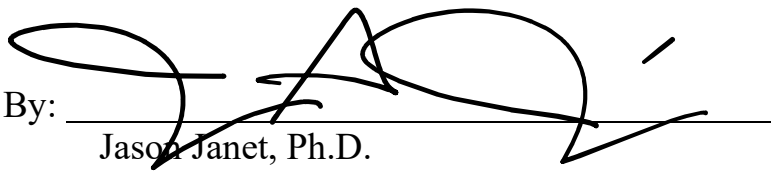
A. Claims 5, 8, and 13-14 are Rendered Obvious by Joos in view of Bayer, Kischkat, and Matters (Ground 3D)

188. It would have been obvious to combine Joos (as modified by Bayer (*supra*, §XVI.A) and Kischkat (*supra*, IX.A)) with Matters for each of the reasons described above in Ground 1D. *Supra*, §XI.A. The resulting Joos-Bayer-Kischkat-Matters combination maintains the functionality of the Joos-Bayer-Kischkat combination from Ground 3B but further adds Matters's techniques as described above in Ground 1D. *Id.* The Joos-Bayer-Kischkat-Matters combination provides the additional features recited in claims 5, 8 and 13-14 for each of the reasons described for the same claims in Ground 1D. *Supra*, §XI.B (Claims 5, 8 and 13-14).

XX. ADDITIONAL REMARKS

189. I currently hold the opinions 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.

190. 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: 01/23/2026 By: 

Jason Janet, Ph.D.

APPENDIX A

Jason A. Janét, Ph.D.

1420 Lillington Drive, Suite 205
Raleigh, NC 27607
Mobile: (919) 225-1724
E-mail: jasonajanet@gmail.com

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).

ShelfWorks Technologies: 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

Nekton Research (iRobot [IRBT]): 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.

Parata Systems: 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

Duke University, Pratt School of Engineering: 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.

North Carolina State University, School of Engineering: 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.

TMI Robotics: 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