IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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ZF NORTH AMERICA, INC., ZF ACTIVE SAFETY US INC.,
Petitioners

v.

STONERIDGE CONTROL DEVICES, INC.,
Patent Owner

Patent No. 7,021,415

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*Inter Partes* Review No.: IPR2023-00273

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**DECLARATION OF DR. BRUNO LEQUESNE**
**IN SUPPORT OF PETITION FOR**
***INTER PARTES* REVIEW OF U.S. PAT. NO. 7,021,415**

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I, Bruno Lequesne, declare as follows:

## I. INTRODUCTION

1. I have been retained as an expert witness on behalf of the Petitioner for the above-referenced *inter partes* review proceeding.

2. I have been asked to render opinions regarding certain matters pertaining to U.S. Patent No. 7,021,415 ("the '415 Patent") and the unpatentability grounds set forth in the Petition for this proceeding.

3. I am being compensated at my usual consulting rate of $300 per hour for my work on this matter. My compensation is in no way dependent upon my opinions or testimony or the outcome of this proceeding.

### A. Education

4. I received my Certified Engineer Degree in 1978 from Ecole Supérieure d'Electricité (now CentraleSupélec) in Paris, France, with a major in electrical engineering. I received my Ph.D. in electrical engineering from Missouri University of Science and Technology in 1984.

5. My *Curriculum Vitae* is attached hereto as Exhibit 1003.

### B. Career History

6. I am the owner and president of E-Motors Consulting, LLC, a company that focuses on providing consulting services to clients in industrial fields such as automotive and transportation regarding analysis and design of electromechanical and electric drive systems (started in 2014).

7. My experience includes over 40 years in research and development regarding sensors, actuators, electrical machines and drives, and electromagnetic and electromechanical systems for automotive, transportation and industrial applications. My experience prior to opening my consulting practice includes work in the automotive and transportation industry, including: Principal Engineer for Eaton (Milwaukee, Wisconsin) where I was in charge of developing innovation programs for hybrid and off-road vehicles as well as industrial drives; Group Leader of Advanced Automotive Mechatronics for Delphi Powertrain (Auburn Hills, Michigan) where I was in charge of advanced electromechanical technology development for various Delphi Divisions; Senior Staff Research Engineer for Delphi Research Laboratories (Shelby Township, Michigan) where I focused on the key technical areas of automotive electric systems, sensors, electric machines and drives, and system design and control; and various research engineering positions with General Motors Research and Development Center (Warren, Michigan).

8. I am a member of the Institute of Electrical and Electronics Engineers (IEEE) and of the Society of Automotive Engineers (SAE). My responsibilities within IEEE have included president of the IEEE's Industry Applications Society (IAS) (2011-2012), and I am currently Chair of the IEEE Transportation Electrification Community (term 1/1/2019 to 12/31/2022).

9. I am the recipient of the IEEE's Nikola Tesla Award (2016), of the IEEE IAS Gerald Kliman Innovator Award (2007), and I am an IEEE Fellow (1997). My citation for the IEEE Nikola Tesla Award reads: "For contributions to the design and analysis of actuators, sensors, and motors for automotive applications".

10. I am a named inventor on 54 issued patents related to sensors, power steering and braking systems; electro-mechanical systems; and electric motor control and power electronics.

11. I have also authored or co-authored numerous publications, including 25 publications in refereed journals, and have been invited to speak and present at a number of conferences and seminars. Eleven of my publications received "Best Paper Awards" from various technical committees or conferences, 8 from the IEEE and 3 from the SAE.

12. The '415 Patent is entitled "Electro-Mechanical Actuator for an Electrically Actuated Parking Brake." Prior to reviewing the '415 Patent, I was familiar with the subject matter described therein. I am also familiar with design practices for electric brakes and more generally, electro-mechanical systems used in automobiles and other vehicles. Much of this work involves areas of technology that are related directly to the subject matter of the '415 Patent. During my tenure at Delphi, in the early 2000s, I was involved in the design and development of electric brake systems, for the Delphi Chassis Division, then a major supplier of

automotive brake systems. I wrote several papers on this work, specifically Papers 6, 7, 10, 12, 13, 31 and 32 in Exhibit 1003. Paper 31, SAE Paper 2006-01-0296, "The Potential of Switched Reluctance Motor Technology for Electro-Mechanical Brake Applications", received the 2006 SAE Vincent Bendix Automotive Electronics Engineering Award. Among my 54 patents, U.S. Patent No. 7,042,189 (filed April 30, 2002) applies to electric brake systems. A number of my other patents pertain to force sensors, which I was developing at the time for electric brakes, to provide feedback on the force the electromechanical system applies on the brake caliper. This work is contemporaneous to the time of the '415.

13. Additional details of my background are set forth in my current *Curriculum Vitae* attached as Exhibit 1003.

### C. Materials Considered

14. The analysis that I provide in this Declaration is based on my education and experience as an engineer, upon my knowledge of electric brakes and of their constituent technologies: Electric motors, gear systems, controls, design constraints, etc. My experience in other automotive systems is also relevant here: Electric power steering, electric engine-valve actuators, and traction drives, for instance, all involve a combination of electric motors, gears, and controls devised together to accomplish certain functions within the vehicle, in a manner similar to that of electric brakes. I

also relied on a number of documents I have considered, including the ’415 Patent (Ex. 1001).

15. I have reviewed various publications from the art at the time of the alleged invention of the ’415 Patent. Those publications, along with other materials I have reviewed, include those listed below:

| | |
|---|---|
| Ex. 1001: | U.S. Patent No. 7,021,415 to Farmer, et al. (“the ’415 Patent”) |
| Ex. 1004: | Certified File History of the ’415 Patent |
| Ex. 1005: | European Patent No. EP 1578633 |
| Ex. 1006: | European Patent No. EP 1578633 opposition proceedings |
| Ex. 1007: | Certified translation of German Patent No. DE 19732168 (“Poertzgen”) |
| Ex. 1008: | German Patent No. DE 19732168 |
| Ex. 1009: | U.S. Patent No. 6,179,097 (“Schumann”) |
| Ex. 1010: | U.S. Patent No. 6,098,948 (“Boucheret”) |
| Ex. 1011: | U.S. Patent No. 6,390,247 (“Drennen”) |
| Ex. 1012: | Certified translation of PCT Publication No. WO 00/61962 (“Weiler”) |
| Ex. 1013: | PCT Publication No. WO 00/61962 |
| Ex. 1014: | *An Introduction to Modern Vehicle Design*, Happian-Smith, Julian (2001) |
| Ex. 1015: | *Gear Types & Manufacturing*, Stock Drive Products/Sterling Instrument |
| Ex. 1016: | *Gears and Gear Drives*, Motion System Design, A145-A160 (2001) |

Ex. 1017: *Dudley's Gear Handbook*, Townsend, Dennis P., Editor-in-Chief (1991)

Ex. 1018: U.S. Patent No. 1,971,417 ("Kingston")

## II. LEGAL PRINCIPLES USED IN MY ANALYSIS

16. I understand that in writing this Declaration I am obliged to follow existing applicable law. I have therefore been asked to apply the following legal principles to my analysis, and I have done so.

### A. Person Having Ordinary Skill in the Art

17. I understand that my assessment of the claims of the '415 Patent must be undertaken from the perspective of what would have been known or understood by a person having ordinary skill in the art, reading the '415 Patent on its relevant filing date and in light of the specification and file history of that patent. I often refer to such a person as a "POSA" in this Declaration.

18. I understand that in identifying the appropriate level of one having ordinary skill in the art relevant to a patent, the following four factors may be considered: (a) the types of problems encountered by those working in the field and prior art solutions thereto; (b) the sophistication of the technology in question, and the rapidity with which innovations occur in the field; (c) the educational level of active workers in the field; and (d) the educational level of the inventor.

19. At the time of the alleged invention of the ’415 Patent, a POSA would have had a bachelor’s degree (or equivalent) in mechanical engineering, electrical engineering, automotive engineering, or a similar discipline, and at least two years of experience with electromechanical devices such as actuators.

20. My analysis and opinions regarding the claims of the ’415 Patent have been based on the perspective of a POSA as defined above as of November 13, 2002, the filing date of the U.S. provisional patent application to which the ’415 Patent claims priority. At that time, I had advanced degrees (beyond a bachelor’s) in electrical engineering. I had worked for 18 years at General Motors and Delphi, on various electromechanical systems being devised for vehicles. In particular, I had been involved with electric brake systems. My patent on the subject for instance, was filed in April of 2002, over 6 months before the ’415 patent was filed. As described above and as shown in my CV, I already had extensive experience in the relevant field in the relevant timeframe.

**B. The Prior Art**

21. I understand that applicable patent law provides categories of information that constitute prior art that may be used to anticipate patent claims or to render them obvious. I understand that for a reference to qualify as prior art to a particular patent claim under the relevant law, that reference must have been made, known, used, published, or patented, or must have been the subject of a patent

application by another person, before the priority date of the patent, and in this matter, must satisfy one of the standards of pre-AIA 35 U.S.C. § 102.

### C. Claim Construction Standard

22. In making this Declaration, I have been asked to review the terms in the ’415 Patent claims to determine what a POSA would have understood those terms to have meant at the time of the alleged invention. In addition, I understand that, in an *inter partes* review proceeding, the claim terms under consideration are to be construed using the same claim construction standard used in a civil action under 35 U.S.C. § 282(b), which is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc), and its progeny. I further understand that under the *Phillips* standard, the claim terms are given their ordinary and customary meaning, as would be understood by a POSA at the time of the invention, consistent with the specification and the prosecution history.

23. It is my opinion that none of the claim terms of the ’415 Patent require any specific constructions for the purposes of this proceeding. I do note that there is a lack of antecedent basis for certain claim limitations. However, it is also my opinion that the art teaches those limitations under any reasonable construction. As such, I give the claim terms their plain and ordinary meaning in light of their claim language in view of the specification and the prosecution history per the *Phillips* standard.

### D. Anticipation

24. I understand that to be valid, a patent claim must be "novel," and that a claim is invalid if it is "anticipated" by a single prior art reference. I further understand that a reference anticipates if it discloses each and every element of the claim and enables a POSA to make and use the claimed invention without undue experimentation.

### E. Obviousness

25. I also understand that even if a claim of a patent is not anticipated, that claim is still invalid if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious to a POSA at the time the invention was made.

26. I understand further that the condition "at the time the invention was made" is imposed to rule out impermissible hindsight. Accordingly, permissible reasoning takes into account only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made and does not include knowledge gleaned only from the applicant's disclosure. I also understand that an opining expert is required to analyze prior art from the perspective of a POSA and may not simply provide his or her own personal conclusions.

27. I also understand that an obviousness determination includes several factual inquiries, including: (1) determining the scope and content of the prior art; (2)

ascertaining the differences between the claimed invention and the prior art; (3) resolving the level of ordinary skill in the pertinent art; and (4) taking into consideration any secondary indicia (objective evidence) of non-obviousness.

28. I also understand that such objective evidence of non-obviousness may include: (1) a long felt but unsolved need that was satisfied by the claimed invention; (2) commercial success attributable to the claimed invention; (3) unexpected results achieved by the claimed invention; (4) praise by experts of the claimed invention with factual support; (5) taking of licenses under the patent by others for reasons related to the alleged non-obviousness of the claimed invention; (6) the failure of others; (7) the teaching away of others; (8) skepticism by experts; and (9) evidence that competitors in the marketplace have copied the invention instead of using the prior art. I also understand that, in order to establish non-obviousness, there must be a demonstrated relationship, or nexus, between any such secondary indicia and the claimed invention, *i.e.*, there must be objective evidence of non-obviousness attributable to the claimed invention.

29. I further understand that near simultaneous invention by two or more equally talented inventors working independently may or may not be an indication of obviousness when considered in light of all the circumstances.

30. I understand that a conclusion of obviousness can be based on a combination of multiple prior art references. I understand that rationales that may support a conclusion of obviousness include:

(A) Combining prior art elements according to known methods to yield predictable results;

(B) Simply substituting one known element for another to obtain predictable results;

(C) Using known techniques to improve similar devices (methods, or products) in the same way;

(D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;

(E) Using an "obvious to try" solution, *i.e.*, choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;

(F) Applying known work in one field of endeavor to yield variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;

(G) Applying some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or

to combine prior art reference disclosures to arrive at the claimed invention.

31. I further understand that an analysis of obviousness should recognize that market demand, rather than scientific literature, often drives design trends.

32. I also understand that if a technique has been used to improve one device, and if a POSA would recognize the technique would improve similar devices in the same way, then using that technique would be obvious to a POSA unless actual application of that technique is beyond his or her skill.

33. I also understand that practical and common-sense considerations should guide an analysis of obviousness, because familiar items may have obvious uses beyond their primary purposes. I further understand that applying common-sense does not require a "specific hint or suggestion in a particular reference." Rather, applying common-sense requires a reasoned explanation that avoids conclusory generalizations and false deductions.

34. I also understand that, when addressing a problem, a POSA will often be able to fit together the disclosures of multiple publications. In this regard, I understand that an analysis of obviousness may consider inferences and creative steps that a POSA would normally employ.

35. I also understand that a particular combination of prior art may be proven obvious merely by showing that it was obvious for a POSA to try that

combination. For example, when there is a design need or a market pressure to solve a problem, and/or there exists a finite number of identified, predictable solutions with a reasonable expectation of success, a POSA has good reason to pursue the known options within his or her technical grasp. I understand that if this leads to anticipated success, it is likely that the result is not of innovation but of ordinary skill and common-sense.

36. I also understand that a combination of familiar elements according to known methods is presumed to be obvious when that combination does no more than yield predictable results. Work known in one field of endeavor may prompt variations of that work for use in either the same field or a different field, based on design incentives and other market forces. If a technique has been used to improve some device, and a POSA can implement a predictable variation of that technique, then that variation is likely unpatentable.

37. I further understand that to be proper for use in an analysis of obviousness, a reference must teach art that is analogous to the claimed invention. I also understand that under a correct analysis, any need or problem known in the field of endeavor at the time of the invention and addressed by the claimed invention can provide a reason for combining the elements in the manner claimed.

38. I understand that a claim can be obvious in light of a single reference, without the need to combine references, if the elements of the claim that are not

found explicitly or inherently in that single reference can be supplied by the common-sense or technical knowledge of the POSA. For example, combining two embodiments disclosed adjacent to each other in a prior art patent likely does not require a leap of inventiveness.

39. I also understand that a claimed invention may be obvious if it merely involves simple substitution of one known element for another to obtain predictable results.

40. I understand further that, in an analysis of obviousness, two items of prior art need not be like two puzzle pieces that must fit together perfectly. For example, a claimed invention may be found obvious if a POSA would view rearrangement as an obvious matter of design choice.

41. I also understand that an analysis of obviousness requires a comparison between the properly construed claim language and the prior art on a limitation-by-limitation basis.

## III. THE ’415 PATENT

### A. Technical Background

42. As noted in the background section of the ’415 Patent, electric parking brake systems “typically include an electro-mechanical actuator connected to the brake caliper …. The actuator converts electrical power to rotational mechanical output power for moving the cable or drive screw and applying the brakes.” Ex.

1001, 1:25-33. Actuators generally contain an electric motor coupled to the mechanical output via a mechanical drive consisting of a series of gears, often including belt drives. The path of the energy to apply the brake, in a vehicle, consists of: First, power from the battery to the electric drive via cables. The electric drive consists of control electronics and/or relays (depending on the type of motors) in order to turn the motor on and off and adjust its torque and/or speed (motor control). Then, the motor converts the electrical energy to rotating mechanical energy. The motor shaft is usually connected to a mechanical system (drive), with two purposes: First, the drive adjusts the speed and torque of the motor to what is needed by the load. Usually, the drive lowers the speed and increases the torque. Second, in some instances such as brakes, the drive also commonly transforms the rotating motion to linear motion. The shaft out of the mechanism drives the load, which in the case of disc brakes is generally a mechanism that moves the caliper towards or away from the disc.

43. The motors are typically DC (direct current) motors, because the vehicle battery provides DC power. Some motors have brushes (brushtype motors) while others are brushless. The latter usually have magnets in the rotor and more complex electronics (called an inverter) to drive the currents to the motor coils.

44. Concerning the mechanical system, the below focuses on the first part of the mechanical system which transforms rotary motion to rotary motion, at

different speeds. For this purpose, mechanical drives (gears and/or belt drives) are often used with electric machines because for a given power level, electric motors are smaller (and cheaper) when operating at higher speeds and lower torque, but the resulting combination of torque and speed is often not ideally suited for the load, which often will operate more effectively at lower speeds and higher torques. A gear or belt drive increases torque and lowers speed (or vice-versa) in proportion of the so-called gear ratio (for gears) or pulley ratio (for belt drives), while preserving the overall power level, except for a small amount of losses due to friction mostly.

45. Long before the ’415 Patent, a variety of mechanical drive options were well known. The term “mechanical drive” refers generally to various mechanical systems which transmit mechanical power from one mechanism to another. For the purpose of this discussion, we will consider two types of well-known mechanical drives: Gears, where the mechanical drive includes toothed wheels or equivalent that transmit power by meshing into one another; and, belt drives, where a belt (often made of rubber) transmits power from one wheel (or gear) to another placed in the same plane but at some distance (the wheels or gears are often called pulleys). There are many variations within the categories of gears known in the art, including spur gears, planetary gears, and worm gears. See, *e.g.*, Ex. 1007, 2:31-3:8; Ex. 1009, 4:33-35. Also, Ex. 1015 provides a 1-page overview of gear types a POSA would have been aware of in 2001. Ex. 1016, a 2001 paper published in Motion System

Design, provides a longer, but still succinct view of the type of gears well known at the time. Ex. 1017 is a much more detailed technical book that was available at the time to a POSA.

46. Belt drives can accomplish the same function as gears, that is, again, transmitting power while usually modifying speed and torque and keeping overall power the same, except for losses in the drive. One difference between meshing gears and belt drives is that with gears that mesh, by their very definition, the driving and driven (input and output) gears are in direct contact with one another, whereas belt drives allow some distance between the driving and driven (input and output) pulleys. All of these drive options were known and understood by a skilled artisan, including their advantages and limitations, as well as the type of applications each would be most suited for. Where applicable, it was well known that various gears and pulleys could be included in a drive train having several stages, for instance, two sets of gears, two sets of belt drive systems, or one (or more) of each. The result of several stages provides an equivalent gear ratio equal to the product of each of the gear ratios within the drive train.

47. Such a person of skill in the art (POSA) would know how to design and use these gears and pulleys, and expect them to readily achieve predictable results with respect to the desired location, torque, speed, direction, angle, etc. of the output, including whether the device is self-locking or not. In short, POSAs were well-

versed in selecting, arranging, and mixing and matching various types and sizes of mechanical drives, including gears and pulleys to achieve their desired output.

48. POSAs, particularly those dealing with automotive applications, were also well-versed in reducing noise, vibration, and harshness ("NVH") in automotive components. Automobiles, like most if not all machinery, produce noise while operating. In general, the less noise, the better. The main and obvious reason is that noise is not pleasant to the human ear, and the resulting discomfort affects both the individuals inside the vehicle as well as the general public nearby. Note however that there are exceptions to this general rule. Some degree of noise may be occasionally desirable. The main reason is that noise is used by humans and particularly the operators of machinery as a feedback mechanism, for instance to ascertain whether the piece of machinery is "on" or "off", moving or stationary, running smoothly (or not), etc. Some vehicles, for instance, make a specific, additional noise when backing up. Similarly, vibrations are generally undesirable, for several reasons. First, they may be uncomfortable to the human operator. Second, vibrations can result in wear in the mechanism. The more severe the vibrations are, the shorter typically the life of the system. Harshness is related to either or both noise and vibrations, but refers more to the subjective feel of the mechanism, as experienced by humans. Some noises and vibrations, for instance,

bring more discomfort to humans than others. The term "NVH" (noise, vibration, harshness) has come to denote these three phenomena together.

49. Several different, well known methods, are used to reduce the noise and vibrations emitted by a mechanism. Generally speaking, a first approach consists of reducing NVH emission in the first place. For instance, it is known that plastic or rubber components are generally less noisy than metal ones. Another example would consist of selecting or designing the apparatus to minimize NVH, or if NVH is generated, to minimize the discomfort it produces in those experiencing it, by modifying the frequency of the vibrations or the pitch of the noise for instance. A second approach consists in isolating the source of NVH from the outside, in other words, putting a barrier (literally or figuratively) between the NVH source and the outside.

50. Concerning the latter category, many approaches and systems have been developed and were well known in the art to isolate components so as to reduce the transmission of NVH. Some are designed for vibrations, others for noise, some for both. One of the most basic methods is to place a cushion (isolator) between two components that serves to dampen NVH from one of the components. See, *e.g.*, Ex. 1018, which is a patent dating back to 1934, describing placing cushioning rubber bearing assemblies at opposite ends of electric motors to reduce vibrations. Ex. 1018, 1:1-27, 2:5-11, 2:31-74, 2:89-98, claims 1-2. At the most elementary, physical

level, both noise and vibrations are forms of energy being dissipated as waves. For both vibrations and noise, these waves operate at a frequency, or in a range of frequencies. A damping mechanism can be used to either reduce the magnitude of these waves, or shift their frequencies, or both. It can absorb this energy, or dissipate it in a different form. A damping mechanism, such as rubber, can absorb this energy and dissipate it in form of heat in ways that humans will not perceive. A damping mechanism can also have some form of spring action which will modify the frequency of the incoming vibration, resulting in frequencies that are less problematic. Rubber is a well-known substance that possesses both spring and energy-absorbing qualities, which can be adjusted by varying the composition of the rubber material itself. In other systems, such as for instance suspensions in automobiles, POSAs have used a combination of a spring and of an oil-filled, energy absorbing damper to achieve a reduction in the transmission of NVH. In the case of a suspension, the point is to reduce the transmission of road vibrations to the body of the vehicles and its occupants. In dampening systems for NVH, a distinction can generally be made between springs, where the force is proportional to distance (*i.e.*, force is larger when elongation or compression is larger), and damping elements, where the force is proportional to velocity. The proportionality constants are often called “spring constant” and “damping constants”, respectively. The forces in such

systems (spring or damper) counter the force acting on the system, thus "dampening" (or weakening) the acting force.

51. For noise in particular, it can also be helpful or even sufficient to place the noisy mechanism inside of a housing. The air inside of the housing, and the housing itself, can absorb the noise waves. Where the housing is attached to the mechanism, isolators can be used to prevent transmission of vibration and/or noise to the housing, etc. The placement of the *e.g.*, isolators such as dampers or other vibration/noise reduction systems is a matter of design with which a POSA would be well-familiar. POSAs will determine, from experience or from experimentation, the source and path of the vibrations and noise, then design and place the damping system(s) where most effective, taking into consideration the frequencies of the noise and vibrations, their magnitude, the path(s) to the outside, the actual need (how much noise, for instance, can be tolerated, or even in some cases would be desirable), where humans susceptible to hear the noise or feel the vibrations are most likely to be, the cost of adding the damping system, etc.

52. Automobile design has come a long way in the more than a century of its existence. Buyers and operators of vehicles expect increased levels of comfort with each new purchase. Noise and vibration reduction is therefore a powerful marketing element, and manufacturers have been using many available tools to reduce noise and vibrations, from any source, in the vehicles they design. The

assessment and reduction of NVH has therefore been a key element of vehicular design for decades now. Ex. 1014, for instance, is an introductory book on "Modern Vehicle Design". It dedicates an entire chapter (chapter 8) to "Noise vibration and harshness".

53. With respect to manufacturing automotive components, it also was well known, and indeed expected, to first create subassemblies attached to structural supports, and then connect those subassemblies together and/or place them in housings to form larger modules or assemblies, which could then be attached to other assemblies, and so on. This basic technique allows larger parts to be efficiently created from smaller parts, and is one of the foundations of the assembly process that has been used throughout the automotive industry for over a century. Indeed, the industry is structured in supplier tiers, with so-called Tier 3 suppliers providing components to Tier 2 suppliers, who then supply subassemblies to Tier 1 suppliers, who incorporate those components into larger structures, and then supply those components to automobile manufacturers, who then further assemble those components into cars. The supply chain, of course, goes deeper than three tiers. Concerning actuators, it is not uncommon for a Tier 1 supplier to build the entire brake system for the vehicle manufacturer. This Tier 1 supplier may procure the motor from one Tier 2 supplier and the gears from another Tier 2 supplier. They may manufacture one or both themselves, of course, but possibly in different plants

or at least different parts of the same plant. Whoever manufactures the motor will procure, *e.g.*, wires from one source, sheet metal for the motor core from another supplier, magnets from yet another one, etc. These subassemblies must be designed to be self-supporting so they can be shipped from one supplier to another, or part of a plant to another. For instance, the electric motor can be made in one place, with a housing, a shaft, and bearings such that it can be readily shipped, then assembled with the gears. All this is known to POSAs, and in fact has been the backbone of the manufacturing industry at least since the beginning of the 20th century.

54. One aspect of using subassemblies and components is that in many instances, they will be attached to some form of frame or subframe that, in essence, brings them together. For instance, so-called engine cradles are essentially frames that support the engine, one of the axles, the suspension and other subassemblies, and connect them to the rest of the car. Or, considering the inside of an automobile, the dashboard (aside from its esthetic purposes) constitutes a frame upon which various indicators (speed, etc.), a radio, a glove box, ventilation vents, etc. are mounted.

### B. Overview

55. The ’415 Patent is directed to an electromechanical parking brake actuator that uses a motor and a gear train to generate a mechanical output to engage or release a parking brake. Ex. 1001, Abstract. The “gear train” may include two

stages, such as a drive/driven gear set and a planetary gears set. *Id.* It further describes a motor to turn a drive shaft that then turns a gear (the drive gear) that is also cooperatively attached to and turns other gears (driven gears) to ultimately generate the output. *Id.* The ’415 Patent further describes a number of well-known combinations of drive gears, including worm gears, planetary gears, and (by extension of the term “gear” to include belt drives,) pulley systems (i.e., pulleys attached to each other via a drive belt). *See*, *e.g.*, *id.*, 4:29-43. The ’415 Patent further discusses the well-known concept of subassembly, a process by which certain components are attached to a subframe or mounting plate to form a subassembly, which then can be placed in a housing for assembly of the actuator. *Id.*, 2:11-18, 4:44-54.

56. The ’415 Patent also describes some alleged benefits of having quiet automotive components, or, for that matter, loud systems “to alert an operator”. *Id.*, 1:34-44. When a quiet system is desirable, these components include means for the dampening of noise, vibration, and harshness (commonly known as NVH) through the use of an isolator (*e.g.*, a cushion or similar) between, *e.g.*, the motor (or the frame to which the motor is attached) and the actuator housing. *Id.*, 1:56-67. Isolators are well known components that can also be used between other components, to similarly reduce NVH. *Id.*, 2:1-10.

57. An actuator is shown in Figure 7 (reproduced and annotated below), in which the motor 300 (**red**) rotates pulley gears 302 and 304 (**green**), which rotate planetary gears 306 (**blue**). *Id.*, 4:23-44. The motor and gears are attached to a plate, sub-frame 312 (**orange**), and then placed in a housing 301 (**yellow**). *Id.*, 4:44-54. The described isolator has two portions 316, 318 (**purple**) that reduce transmission of NVH from the motor to other components. *Id.*, 5:46-56, 6:44-53. The isolator is further described as including a spring component and a damping component, with constants $K_1$ (906) and $B_1$ (908), which all isolators do feature. *Id.*, Figure 9, 5:50-56.

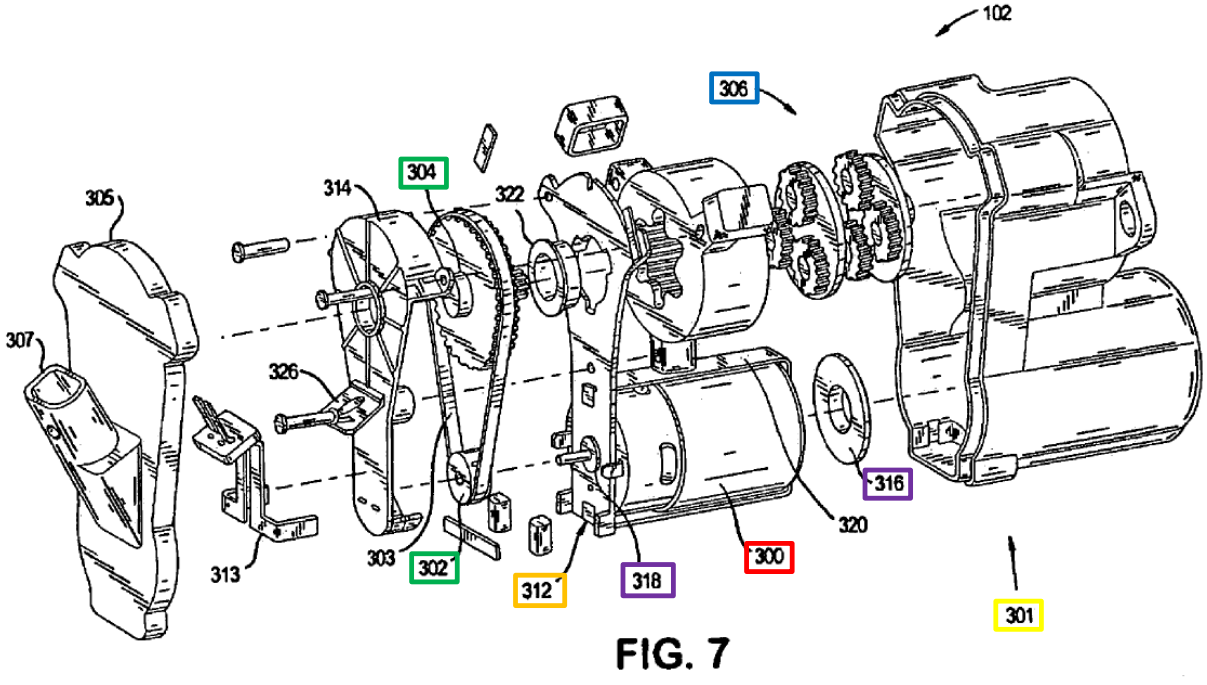



FIG. 7

Ex. 1001, Figure 7 (annotated)

### C. The Prosecution History of the ’415 Patent

58. The ’415 Patent was filed as Application No. 10/712,764 (“the ’764 Application”) on November 13, 2003, as a continuation-in-part of Application No. 10/061,940 (“the ’940 Application”), filed February 1, 2002, now U.S. Patent No. 6,736,233. The ’415 Patent claims the benefit of U.S. provisional patent application Nos. 60/467,993, filed May 5, 2003, and 60/426,044, filed November 13, 2002. The ’940 Application does not have any description of planetary gears, belted gears (pulley gears), or brake calipers. I understand that this lack of description means that at least the various claims that recite planetary gears, belted gears or brake calipers (claims 1-12, 17-19) are not entitled to claim priority to the ’940 Application and thus would have a priority date of November 13, 2003. It is my opinion that there would be no significant differences in the education, experience or knowledge of a POSA in the time frame between February 1, 2002 and November 13, 2003. Also, as discussed below, the prior art references relied on in my analysis are prior art to either of these dates.

59. During prosecution of the ’764 Application, the Examiner rejected then-pending claims 1, 6, and 13 as anticipated by U.S. Patent No. 6,412,610 to

Drennen[1] (see Ex. 1004 at 62-63) thus acknowledging his understanding that the substance of those claims was in the prior art:

> 1. An electrically actuated parking brake system comprising:
>
> a vehicle power source;
>
> an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear, and at least one planetary gear set coupled to said driven gear for driving an actuator output; and
>
> a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position.

60. The Examiner did suggest that various other claims would be allowable if rewritten into independent form. *Id.* at 63. The Patent Owner followed this suggestion to obtain allowance of these various other claims. *Id.* at 116-122, 126, 132. However, the only difference between certain of the issued claims and the rejected claims were the inclusion of well-known features found in the art such as a worm gear (issued claim 1), gears coupled by a drive belt (issued claim 2), an isolator between components (issued claims 3, 8, 16), mounting gears on a sub-frame (issued claims 6, 11), and having a housing with a separate cavity for the motor (issued claim 9). *Id.* The presence of these well-known features (described further herein) in the art was not identified to the Examiner.

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[1] This is a different Drennen reference from the Drennen reference (U.S. Patent No. 6,390,247) that I rely on below.

61. Some claims of what I understand to be the European counterpart to the ’415 Patent (EP 1578633) also recited certain of these features, such as European claim 2 (reciting gears mounted to a sub-frame), claims 3, 4, 9, and 10 (reciting a housing with a cavity for the gears or the motor), and claims 5-7 and 11-13 (reciting the isolators). Ex. 1005. However, these claims were invalidated in a European opposition proceeding. Ex. 1006 at 300-312, 400-407. I further understand that the Patent Owner did not argue that any of these additional features provided a basis for added patentability of these claims. Ex. 1006 at 342-347.

## IV. THE CLAIMS OF THE ’415 PATENT

62. The ’415 Patent includes twelve independent claims (claims 1, 2, 3, 5, 6, 8, 9, 11, 13, 16, 17 and 20) and thirteen dependent claims. Ex. 1001, 8:45-12:31. Independent claim 1 is below:

> *1. An electrically actuated parking brake system comprising:*
>
> *a vehicle power source;*
>
> *an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear, said drive gear and said driven gear comprising a worm gear and a worm wheel in meshing engagement, and at least one planetary gear set coupled to said driven gear for driving an actuator output; and*

*a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position.*

63. Independent claims 1, 2, 3, 5, 6, 8, 9, 11, 13, 16, and 17 of the ’415 Patent are system claims. The dependency of the dependent system claims is as follows: (1) claim 4 depends from claim 3; (2) claim 7 depends from claim 6; (3) claim 10 depends from claim 9; (4) claim 12 depends from claim 11; (5) claims 14 and 15 depend from claim 13; and, (6) claims 18 and 19 depend from claim 17. Independent claim 20 of the ’415 Patent is the only independent method claim, and claims 21-25 depend from it.

## V. SCOPE AND CONTENT OF THE PRIOR ART

### A. Poertzgen

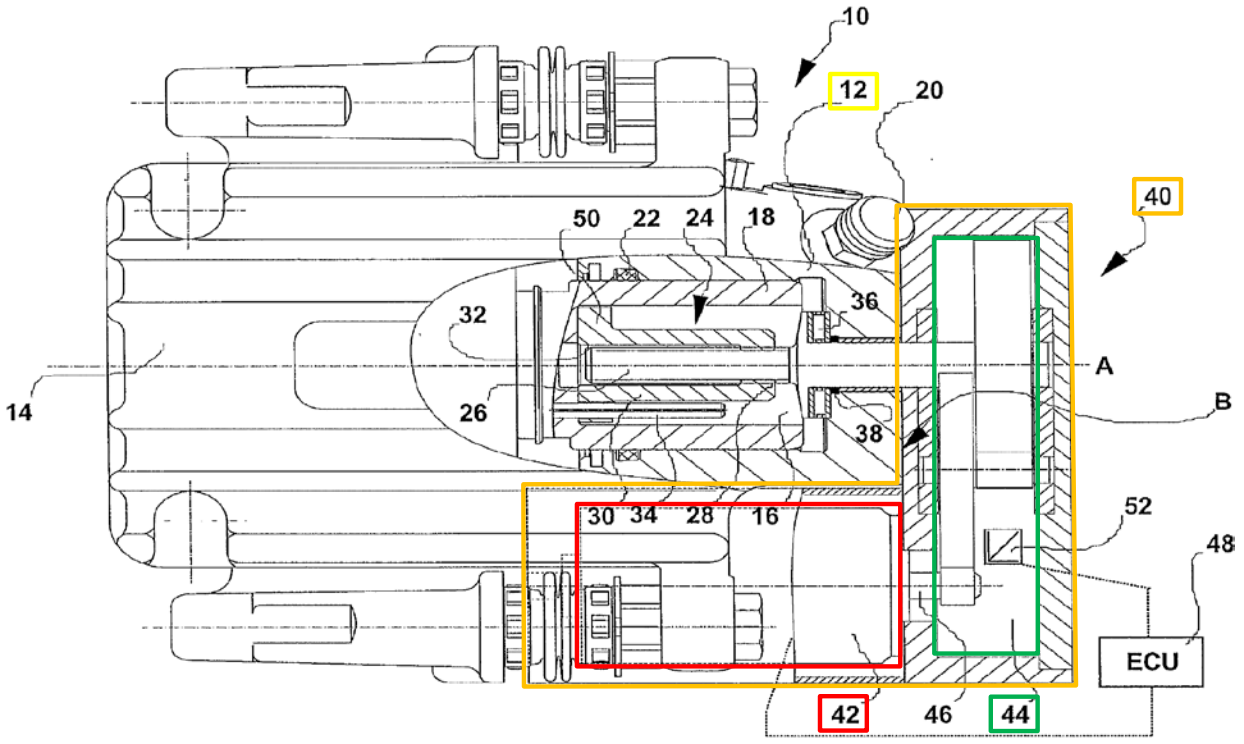
64. The Poertzgen reference (Ex. 1008, translation at Ex. 1007) is a German Patent published January 7, 1999. I understand that Poertzgen is prior art under § 102(b) even if the claims are entitled to their earliest priority date. The Patent Office did not consider Poertzgen during prosecution of the ’415 Patent. Ex. 1001, cover.

65. Poertzgen relates to an electromechanical parking brake actuator that uses a motor and a gear train to generate a mechanical output to engage and release a parking brake. Ex. 1007, Abstract, 2:2-11, 2:24-3:8, 4:30-33, 7:8-8:32, claims 1, 5, 9. The motor turns a drive shaft that rotates a series of gears to generate the output. *Id.*, Abstract, 2:18-3:8, 4:30-5:10, 8:5-32, claims 1, 4. Poertzgen teaches that these

gears can include planetary gears, preferably as part of a two-stage gearing system. *Id.*, 2:31-3:8. The two-stage gearing system of Poertzgen can also include a belt gear to provide greater advantages. *Id.*

66. Further, Poertzgen discloses that certain components, such as the motor and the gears, can be attached to a sub-frame or plate to form "a subassembly which can be handled separately and which can be combined not only with the illustrated disk brake 10 but also with other disk brakes." *Id.*, 8:9-11, Abstract, 2:24-30, claim 1, Figure 1.

67. Poertzgen's Figure 1 (reproduced and annotated below) shows an electro-mechanical actuator, in which the electric motor 42 (**red**) has a driveshaft 46 that rotates reduction gears 44 (**green**). Poertzgen further describes a two-stage reduction, preferably using planetary gears and a belt gear. *Id.*, 2:31-3:8. The motor and gears are included as a subassembly 40 (**orange**) which is then attached to housing 12 (**yellow**). *Id.*, Abstract, 2:24-30, 7:8-10, 8:9-14, claim 1.



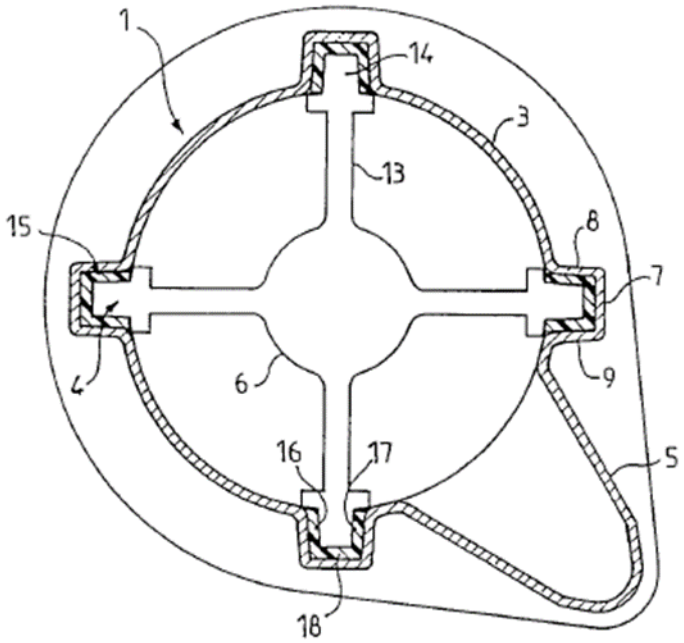

Ex. 1007, Figure 1 (annotated)

**B. Boucheret**

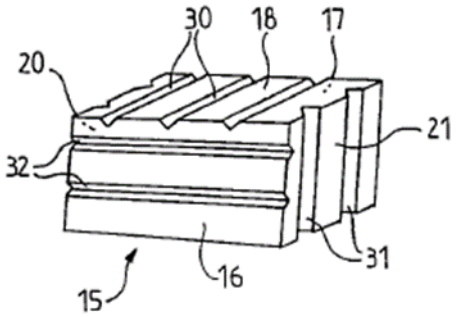
68. Boucheret (Ex. 1010) is a U.S. Patent issued on August 8, 2000. I understand that Boucheret is prior art under 35 U.S.C. § 102(b) even if the claims are entitled to their earliest priority date. Boucheret was not considered during prosecution of the ’415 Patent. Ex. 1001, cover.

69. Boucheret teaches the use of damping elements when attaching motors within housings to absorb and reduce NVH in automobiles. Ex. 1010, Abstract, 1:5-65, 2:30-34, 3:15-40, 4:27-56, claims 1, 9, Figures 1-4. Boucheret, like the ’415 Patent, is aimed at automotive applications. Ex. 1010, 1:6-9.

70. In Boucheret's Figure 3 and Figure 4 (both reproduced below), a housing 1 for a motor 6 is depicted, where damping members 15 are placed between the motor and the motor housing which provide elastic cushioning to reduce NVH. *Id.*, 3:15-22 ("Each end portion 14 of a fastening lug 13 is equipped with a removable damping element 15 of resilient material … These damping elements 15 are adapted to serve as vibration dampers, in particular between the electric motor 6 and the housing 1.").




Ex. 1010, Figure 3




Ex. 1010, Figure 4

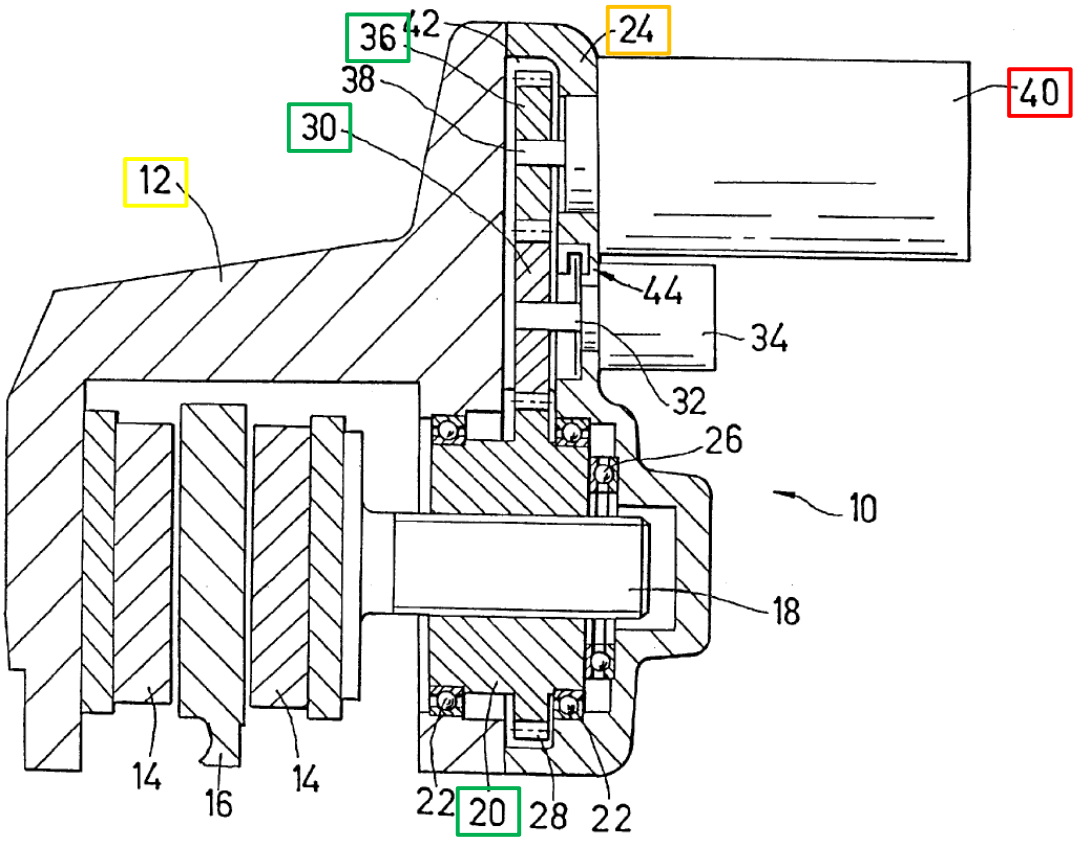
**C. Schumann**

71. Schumann (Ex. 1009) is a U.S. Patent issued January 30, 2001. I understand that Schumann is prior art under 35 U.S.C. § 102(b) even if the claims

are entitled to their earliest priority date. Schumann was not considered during prosecution of the ’415 Patent. Ex. 1001, cover.

72. Schumann discloses an electro-mechanical parking brake actuator that uses one or more motors in combination with a gear train to generate mechanical output and engage and release a brake caliper. Ex. 1009, Abstract, 1:4-9, 2:21-3:31, 3:53-64, 4:16-21, 4:29-50, Figure 1.

73. As shown in Schumann’s Figure 1 (reproduced and annotated below), the motor 40 (**red**) turns a drive shaft 38 that turns a series of gears 30, 36, 20 (**green**) to generate the output. *Id.*, Abstract, 2:50-61, 3:1-12, 3:53-64. Additionally, as shown in Figure 1 below, Schumann teaches that certain components, such as the motor(s) and the gears can be attached to a sub-frame (the cap 24 (**orange**) of the brake), which is attached to the brake caliper 12 (**yellow**). *Id.*, 3:1-12, Figure 1.




Ex. 1009, Figure 1 (annotated)

74. Schumann further teaches that the gears can include planetary gears and/or worm gears. Ex. 1009, 2:21-39, 4:29-50.

**D. Drennen**

75. Drennen (Ex. 1011) is a U.S. Patent filed October 11, 2000. I understand that Drennen is prior art under 35 U.S.C. § 102(e) even if the claims are entitled to their earliest priority date and was not considered during prosecution of the ’415 Patent. Ex. 1001, cover.

76. Drennen discloses an electro-mechanical brake actuator having a motor and a gear train to generate a mechanical output to engage and release a brake

caliper. Ex. 1011, Abstract, 1:13-29, 1:38-65, 3:27-65, 4:30-48, 5:4-15, 5:38-51, 6:66-7:9, 7:26-32, Figures 1, 2.

77. Drennen's Figure 2 (reproduced and annotated below) depicts a motor 12 (**red**) which turns a motor shaft 70 that in turn, turns a series of pulleys 64, 66, and belt 68 (**green**) that rotate a ball screw 14 (**blue**) to move a ball nut 16 (**blue**) to generate the output. *Id.*

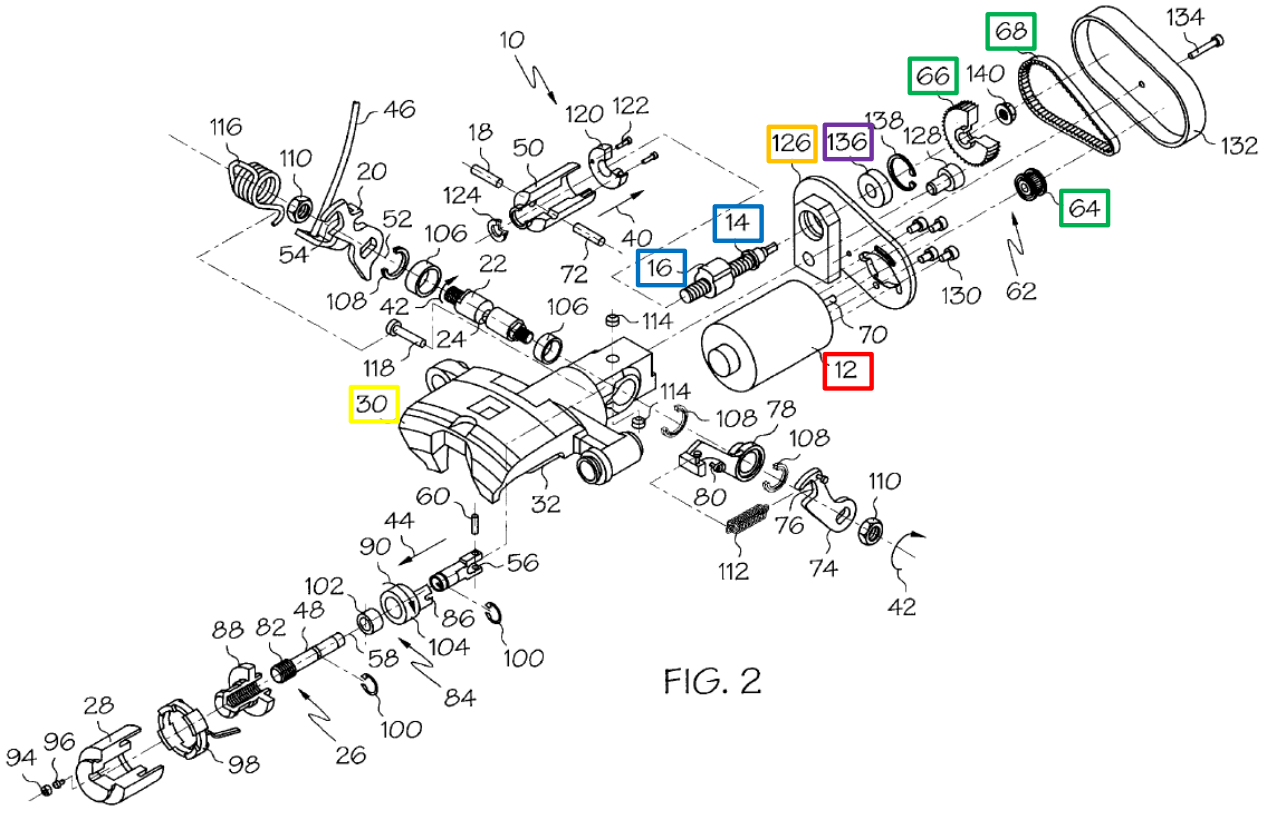



FIG. 2

Ex. 1011, Figure 2 (annotated)

78. Drennen teaches that the gears are preferably pulley gears in a pulley assembly 62. *Id.*, 3:49-65, 5:38-51, 7:26-32, Figure 2. Drennen further describes that certain components, as shown in annotated Figure 2 above, such as the motor,

the pulley gears, belt and belt cover, and the ball screw, can be attached to a sub-frame (mounting block 126 (**orange**)), which is then attached to the brake-caliper housing 30 (**yellow**). *Id.*, 3:49-51, 5:38-51, 7:26-32, Figure 2. Additionally, a bushing 136 (**purple**) is interposed between the ball screw 14 and the mounting block 126 (sub-frame). *Id.*, 7:29-32.

**E. Weiler**

79. Weiler (Ex. 1013, certified translation Ex. 1012) is a PCT Published Application published on October 19, 2000. I understand that Weiler is prior art under 35 U.S.C. § 102(b) even if the claims are entitled to their earliest priority date and was not considered during prosecution of the '415 Patent. Ex. 1001, cover.

80. Weiler is directed to an electro-mechanical parking brake actuator that uses an electric motor and a gear train to generate a mechanical output to engage and release a brake caliper. Ex. 1012, Abstract, 1:4-14, 2:12-3:8, 4:9-15, 5:13-25, 6:10-7:2, 8:9-11, 8:16-9:6, 12:4-7, 13:7-8, 13:28-14:29, Figures 1-4, claims 1, 7-8, 14, 18-19.

81. As can be seen in Weiler's Figure 2 (reproduced and annotated below), the motor 8 (**red**) turns a drive shaft 15 that turns a series of gears 16, 17, 18, 19 (**green**) to eventually actuate the parking brake caliper. *Id.* Weiler teaches that these gears preferably include planetary gears. *Id.*, 4:9-15, 8:27-9:4, Figures 2-4.

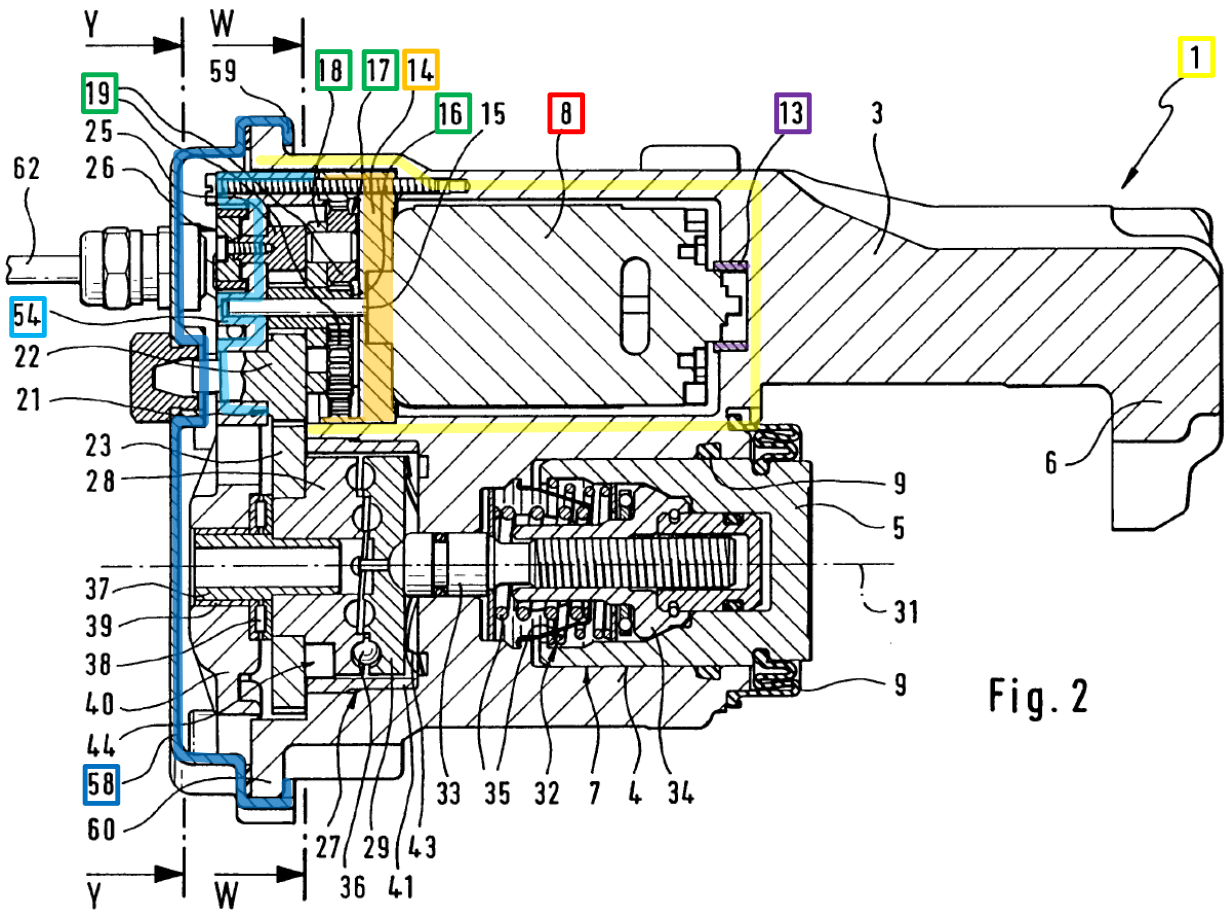



Fig. 2

Ex. 1012, Figure 2 (annotated)

82. As also can be seen in annotated Figure 2 above, Weiler further highlights some of the well-known benefits of modular design by teaching that a subassembly where the motor and planetary gears are attached to a sub-frame (bearing plate 14 (**orange**)) and covered with gear cover 54 (**light blue**), that is placed into a housing (**yellow**) recessed into the brake caliper 1 and then covered with housing cover 58 (**dark blue**). *Id.*, 2:17-28, 6:10-7:2, 8:16-25, 13:28-14:29, Figures 1-4. A bushing 13 (**purple**) is located between the motor and the housing.

*Id.*, 8:16-25, Figure 2. Figure 1 of Weiler, below, provides an isometric view of the actuator.

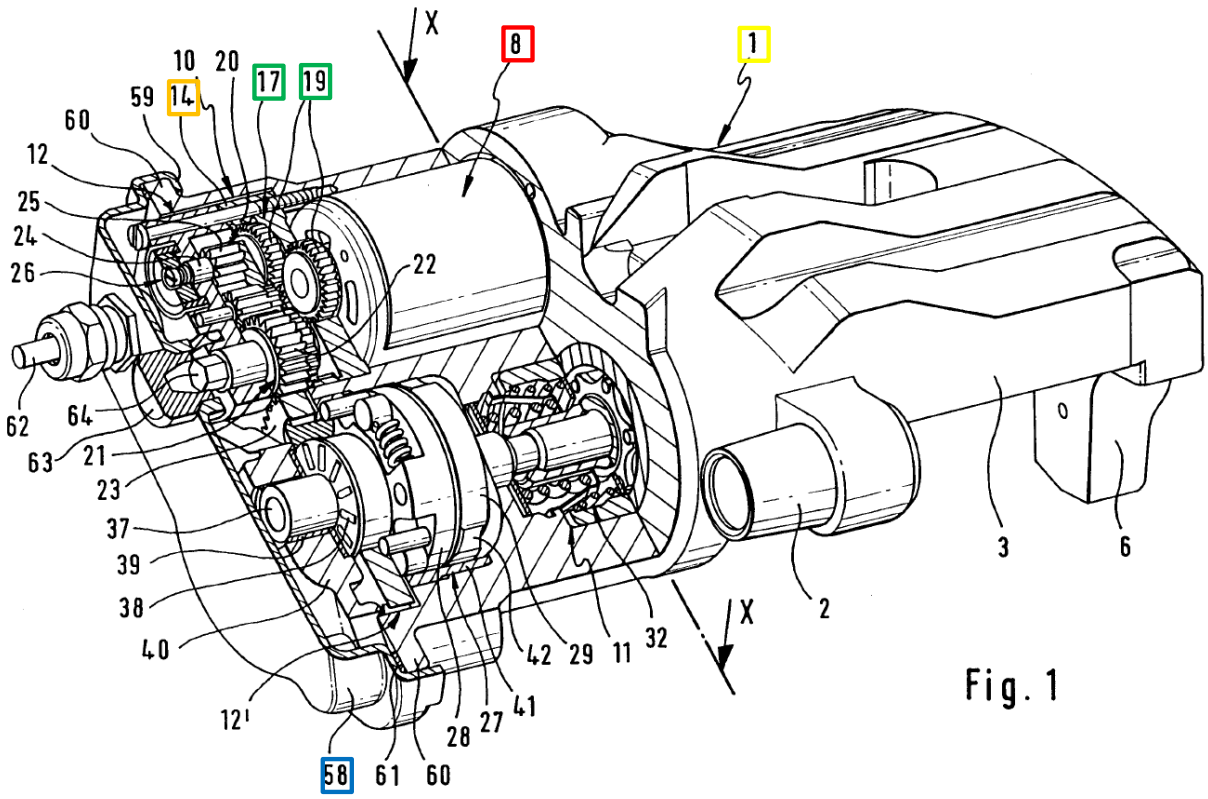



Fig. 1

Ex. 1012, Figure 1 (annotated)

## VI. ANALYSIS OF THE INVALIDITY OF THE '415 CLAIMS

### A. Summary of Analysis

83. Based on my study of the references listed in the table below, as well as on my education and years of experience in the relevant art, it is my opinion that those references collectively render obvious all of the elements of all of the claims of the '415 Patent. In the table below, I have associated each of the '415 Patent claims with a specific reference or combination of references, following the legal

principles I explained in Section II above, and using the *Phillips* standard discussed above in Section II.C that I believe forms a basis for rendering the challenged claims obvious. Furthermore, in accordance with the legal principles I explained in Section II above, there is an appropriate basis to combine each of the specific combinations of references, as I further explain below.

| Ground | Prior Art | Claims Challenged |
|---|---|---|
| A | Poertzgen | 2, 6, 9-13 |
| B | Poertzgen in view of Boucheret | 3-5, 7-8, 14-19 |
| C | Poertzgen in view of Schumann | 1 |
| D | Poertzgen in view of Drennen | 6, 10-13 |
| E | Poertzgen in view of Boucheret and Drennen | 5, 7-8, 14-19 |
| F | Poertzgen in view of Weiler | 6, 10-13 |
| G | Poertzgen in view of Boucheret and Weiler | 5, 7-8, 14-19 |
| H | Weiler | 20-25 |
| I | Weiler in view of Boucheret | 23-25 |

### B. Claim Construction

84. As I have stated above, no construction is necessary for any of the terms of the claims of the ’415 Patent.

85. I note the lack of antecedent basis for certain claim terms and limitations, but it is my opinion that the art herein teaches those limitations under

any reasonable construction. Although I understand that there are other statutory requirements related to the validity of a patent claim, I have not currently been asked to provide my opinions on any additional issue related to validity other than those I describe in this declaration. Nothing in my declaration should be construed as an opinion on whether the claims or claim terms are definite or indefinite.

### C. Ground A: Claims 2, 6, 9-13 Are Invalid as Obvious Over Poertzgen

#### 1. Independent Claim 2

86. As I have noted above during prosecution of the ’415 Patent, the sole basis articulated by the Patent Office for allowing claim 2 was limitation [2D]. During prosecution of the ’415 Patent, Poertzgen was not reviewed by the Patent Office and the patentee did not dispute that the Patent Office’s determination that the other claim limitations of claim 2 were known in the prior art. *See* Section III.C, above. In the following paragraphs, I explain how Poertzgen renders all of the elements of claim 2 obvious.

##### i. Claim Limitation [2A]: “An electronically actuated parking brake system comprising:”

87. Poertzgen teaches or suggests “[a]*n electrically actuated parking brake system.*” Ex. 1007, Abstract (describing use of brake 10 as a parking brake actuated by electric motor 42), 2:2-30, 4:30-5:10, 6:7-13, 7:26-8:32, Figure 1. Specifically, Poertzgen states: “[a]n advantageous method that enables the use of a generic vehicle

brake as a hand brake, in which the spindle is driven by means of an electric motor, will be described below." Ex. 1007, 4:30-31. As such, Poertzgen teaches or suggests claim limitation [2A].

**ii. Claim Limitation [2B]: "a vehicle power source;"**

88. Poertzgen teaches or suggests "*a vehicle power source.*" Ex. 1007, Abstract (describing electric motor 42 actuating vehicle brake), 2:2-30, 4:30-5:10, 6:7-13, 7:26-8:32, claim 1, Figure 1.

89. Poertzgen discloses an electric motor actuating a vehicle brake. "For locking, the electric motor 42 is first driven by an electronic control unit 48 so that its output shaft 46 rotates in a first direction." Ex. 1007, 8:17-19. Poertzgen further describes that, "[f]or releasing the parking brake, the electric motor 42 is driven by the control unit 48 so that its output shaft 46 rotates in the opposite direction." *Id.*, 8:28-29.

90. As discussed above, it was well-known that a power source is required for both electric motors and their electric control units, and that such motors and controllers in a vehicle would beneficially use a vehicle power source. A POSA would understand that Poertzgen's reference to an electric motor and an electric control unit causing the motor to activate and controlling its direction means that there is a power source for the motor and its control unit. A POSA would have

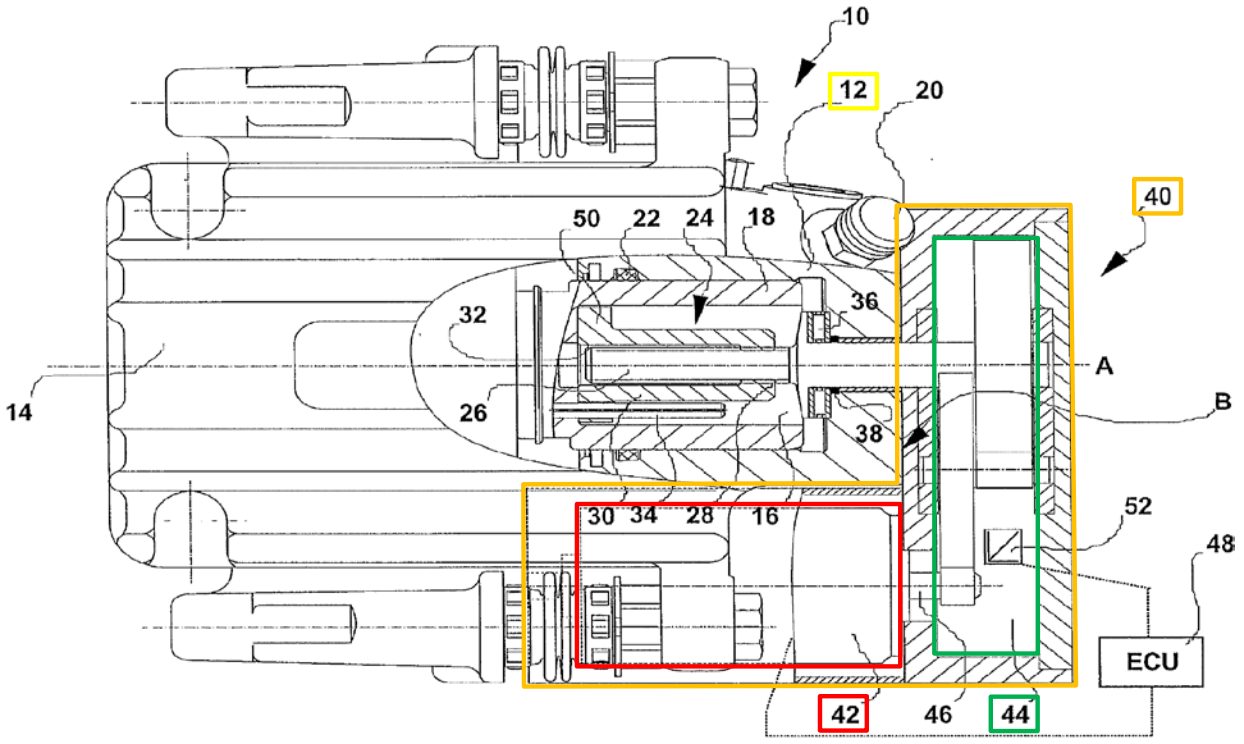
further understood that the power source of Poertzgen was a vehicle power source since Poertzgen's electric motor actuates a parking brake for a vehicle.

91. As such, Poertzgen teaches or suggests "*a vehicle power source*" as claimed by claim 2 of the '415 Patent.

**iii. Claim Limitation [2C]: "an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear,"**

92. Poertzgen teaches or suggests "*an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear.*" Ex. 1007, Abstract, 2:2-30, 4:30-5:10, 6:7-13, 7:26-8:32, Figure 1, claim 1.

93. Poertzgen discloses a braking system actuated by an electric motor 42. *Id*. As can be seen in Figure 1 of Poertzgen (reproduced and annotated below), the electric motor 42 (**red**) has an output shaft 46 (the "*motor having a drive shaft*") that rotates a reduction gear 44 (**green**). Ex. 1007, Abstract, 2:18-20, 2:24-3:8, 8:5-8:32, Figure 1.




Ex. 1007, Figure 1 (annotated)

94. Poertzgen describes the reduction gear 44 as preferably having two stages. *Id.*, 2:31-3:8 ("A two-stage gear is particularly advantageous with respect to saving installation space."). One stage is preferably "a planetary gear, a harmonic drive gear, an eccentric disk gear, or a swash plate gear," and is either upstage or downstage from a second stage that is preferably formed by a belt gear, a toothed-belt gear, or a simple spur gear. *Id.* A POSA would have understood that both the preferred belt gear or toothed-belt gear include a drive gear and a driven gear coupled via a drive belt. Thus, the reduction gear 44 of Poertzgen is the claimed "*drive gear coupled to said drive shaft, a driven gear coupled to said drive gear.*"

95. Further, a POSA would have appreciated that Poertzgen teaches that the motor output shaft 46 rotates the drive gear of the belt gear (the "*drive gear coupled to said drive shaft*") that in turn rotates the driven gear of the belt gear (the "*driven gear coupled to said drive gear*"). For example, Poertzgen describes a preferred embodiment where the first gear stage uses a "belt gear or a toothed-belt gear" (Ex. 1007, 3:6-7) the drive gear is coupled to and drives the driven gear via a belt, much like the pedals of a bicycle drive a gear that is coupled to another gear near the back wheel of the bicycle via the bicycle chain. In this example of a "simple spur gear" (Ex. 1007, 3:5-6), the drive gear has teeth that physically contact corresponding teeth of the driven gear to rotate it. *Id.* Because the brake of Poertzgen is actuated using the electric motor 42 which drives various gears of the reduction gear 44, Poertzgen discloses the recited "*electromechanical actuator*" of claim 2 of the '415 Patent.

96. As such, Poertzgen teaches or suggests "*an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear*" as claimed by claim 2 of the '415 Patent.

**iv. Claim Limitation [2D]: "said drive gear and said driven gear coupled via a drive belt, and"**

97. Poertzgen teaches or suggests "*said drive gear and said driven gear coupled via a drive belt*" as recited in claim 2 of the '415 Patent. Ex. 1007, Abstract, 2:2-30, 4:30-5:10, 6:7-13, 7:26-8:32, Figure 1, claim 1.

98. As explained above with respect to limitation [2C], an exemplary preferred embodiment of Poertzgen uses a "belt gear" or a "toothed-belt gear." Ex. 1007, 2:31-3:8, claim 6 ("the reduction gear (44) is designed multistage, especially two-stage and that a gear stage is formed as a belt drive, especially a toothed-belt gear"). As also discussed above, with respect to either a belt gear or toothed-belt gear (also called pulley gears), a POSA would be familiar with and further understand the well-known practice of utilizing a drive belt to couple the drive gear and the driven gear.

99. As such, Poertzgen teaches or suggests "*said drive gear and said driven gear coupled via a drive belt, and*" as claimed by claim 2 of the '415 Patent.

**v. Claim Limitation [2E]: "at least one planetary gear set coupled to said driven gear for driving an actuator output; and"**

100. Poertzgen teaches or suggests "*at least one planetary gear set coupled to said driven gear for driving an actuator output.*" Ex. 1007, Abstract, 2:18-3:20, 8:5-8:32, claims 1, 5, Figure 1.

101. As explained above for claim limitations [2C] and [2D], Poertzgen discloses a preferred two stage reduction gear 44 driven by the electric motor 42, with one of those stages being a belt gear and the other stage advantageously being a planetary gear set where the planetary gear stage is either "upstream or downstream" of the other stage and the other stage is "advantageously … a belt gear

or a toothed-belt gear." Ex. 1007, 2:31-3:8 ("The reduction gear is advantageously designed as a planetary gear, … because these gear types are compact and, at a small weight, have good efficiency."), claims 1, 5. Thus, Poertzgen's exemplary preferred embodiment describes a configuration in which the electric motor 42 drives a belt gear as a first stage of reduction gear 44, the belt gear itself comprising (a) a drive gear and (b) a driven gear coupled together via a belt. That driven belt gear in turn drives a second stage of the reduction gear 44, which Poertzgen further discloses as a planetary gear set. Thus, reduction gear 44 of Poertzgen is the recited "*at least one planetary gear set coupled to said driven gear*."

102. Poertzgen further explains that the electric motor 42 and reduction gear 44 together comprise a subassembly. Ex. 1007, Abstract, 2:24-30, 8:5-16. This subassembly provides an output that rotates spindle 26, which is what causes nut 30 to move, thus closing or opening the brake caliper. *Id.*, 7:26-8:32.

103. Poertzgen states:

> The rotational drive of the spindle 26 is provided by a unit generally identified by 40 which consists of an electric motor 42 and a reduction gear 44 coupled thereto, which in turn is functionally coupled to the end section of the spindle 26 protruding from the housing 12.

Ex. 1007, 8:5-7.

104. Unit 40 of Poertzgen provides the recited "*actuator output*" of claim 2 of the '415 Patent. In the exemplary embodiment using the planetary gear set

downstream from the belt gear set (Ex. 1007, 2:31-3:8), the planetary gear set drives the rotation of spindle 26. Additionally, the translational movement of nut 30 is driven by the planetary gear set coupled to the spindle 26.

105. As such, Poertzgen teaches or suggests "*at least one planetary gear set coupled to said driven gear for driving an actuator output*" as claimed by claim 2 of the '415 Patent.

**vi. Claim Limitation [2F]: "a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position."**

106. Claim Limitation [2F] spells out one of the functions of the "*parking brake system*" in Claim Limitation [2A]. The "*actuator*" drives the "*brake caliper*" between two positions, "*a released position*", or rest position or off status, and "*an engaged position*", with the brake fully on. Poertzgen teaches or suggests "*a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position.*" Ex. 1007, Abstract, 2:2-3:16, 4:30-5:14, 6:7-13, 7:8-8:32, Figure 1, claim 1. More specifically, Poertzgen discloses a "brake locking function", Ex. 1007, 8:17-32, which fully anticipates Claim Limitation [2F].

107. In exemplary Figure 1, Poertzgen discloses that the brake, is "a floating caliper disk brake, which in a known manner comprises a housing 12 on which a

floating caliper 14 is integrally formed, which straddles a brake disk ….” Ex. 1007, 7:8-10. Turning to Poertzgen’s “brake locking function”, “motor 42 is first driven”, that is, the brake starts from a non-driven, or off or rest, position. It then moves the “reduction gear” and the “spindle/nut arrangement” such that the friction pad is forced against the brake, that is, engages the brake. The motor is then turned off, and because the system is self locking, “the achieved position … is maintained”. The “locking function”, therefore, not only brings the pad and disc into contact with one another, but maintains the brake in a specific position with disc and pad forced towards one another (the recited “*engaged position*” of the brake caliper).

108. Poertzgen then describes the “releasing [of] the parking brake.” Ex. 1007, 8:28-32. Driving the motor “rotates [the shaft] in the opposite direction”. Brake pressure is released and “the friction pads **disengage** from brake disk” (my emphasis) (the recited “*released position*” of the brake caliper). Ex. 1007, 8:28-32, 5:8-10.

109. As such, Poertzgen teaches or suggests “*a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position*” as claimed by claim 2 of the ’415 Patent.

110. Because Poertzgen teaches or suggests every claim limitation of claim 2 of the ’415 Patent, Poertzgen renders claim 2 obvious.

### 2. Independent Claim 6

111. As explained in the following sections, Poertzgen teaches or suggests all claim limitations of claim 6 of the ’415 Patent and renders it obvious.

#### i. Claim Limitations [6A]-[6D]

112. Limitations [6A]-[6C] of claim 6 of the ’415 Patent are identical to the limitations [2A]-[2C] of claim 2 of the ’415 Patent. Poertzgen teaches the claim elements recited in [6A]-[6C] for the same reasons set forth above for [2A]-[2C].

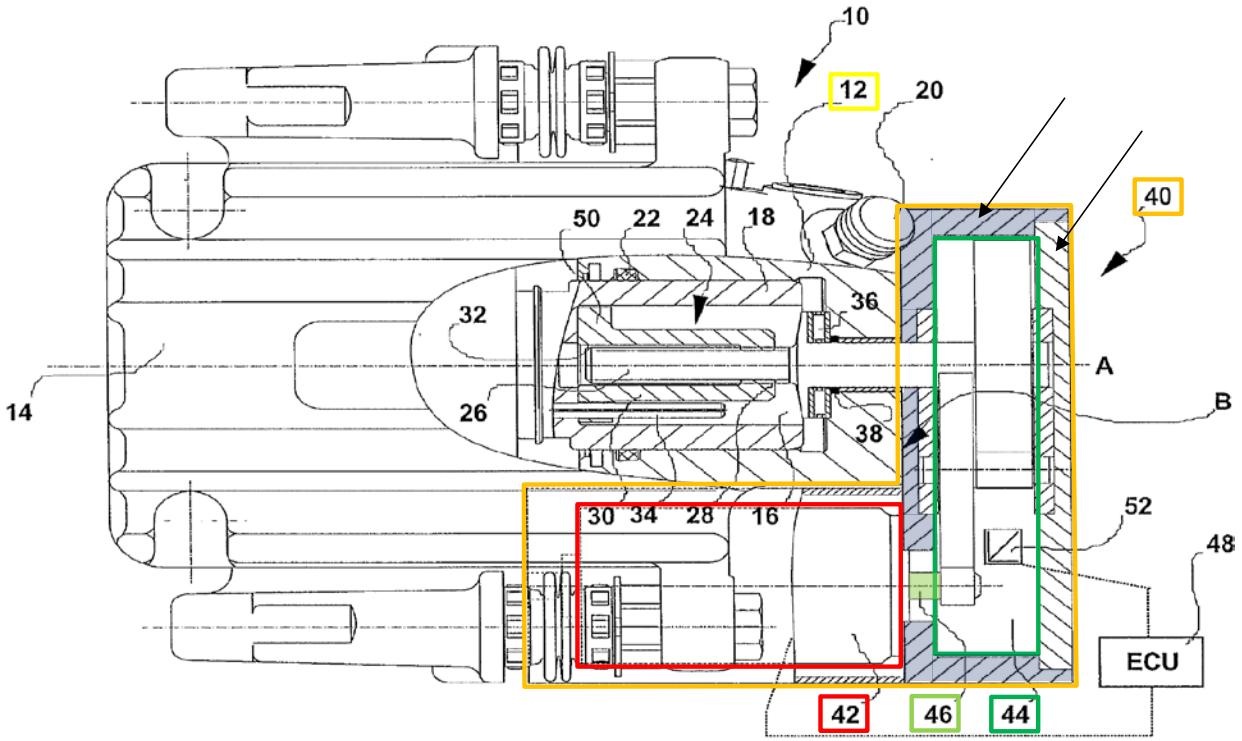
113. Limitation [6D] is identical to limitation [2E] and is likewise taught by Poertzgen for the reasons set forth above.

#### ii. Claim Limitation [6E]: “a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame;”

114. Poertzgen teaches or suggests “*a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame*” as recited in claim 6 of the ’415 Patent. Ex. 1007, Abstract, 2:24-30, 8:5-16, claim 1, Figure 1.

115. As I have explained above with respect to limitation [2E], the electric motor 42 and reduction gears 44 of Poertzgen together comprise a subassembly 40. Ex. 1007, Abstract, 2:24-30, 8:5-16. This subassembly “can be manipulated independently and combined with various vehicle brakes of one type” (*Id.*, 2:24-25, 8:9-11) and provides manufacturing benefits, and greater flexibility with respect to

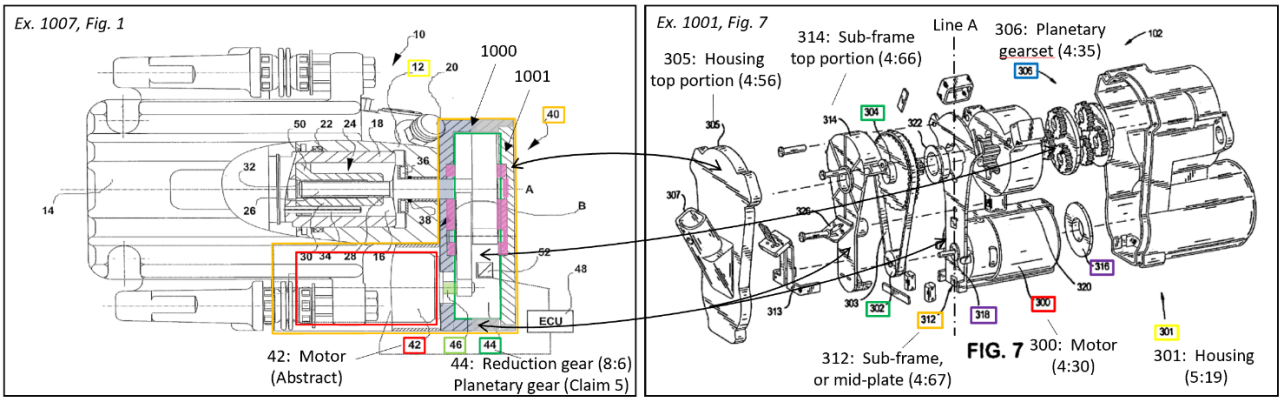
the attachment of the subassembly to the various brakes it would actuate. *Id.*, 2:24-30. A POSA would understand that Poertzgen describes an electric motor 42 and reduction gears 44 that are mounted on a sub-frame that allows them to be separately handled, apart from the remainder of the braking system shown in Figure 1 (reproduced and annotated below).




Ex. 1007, Figure 1 (annotated)

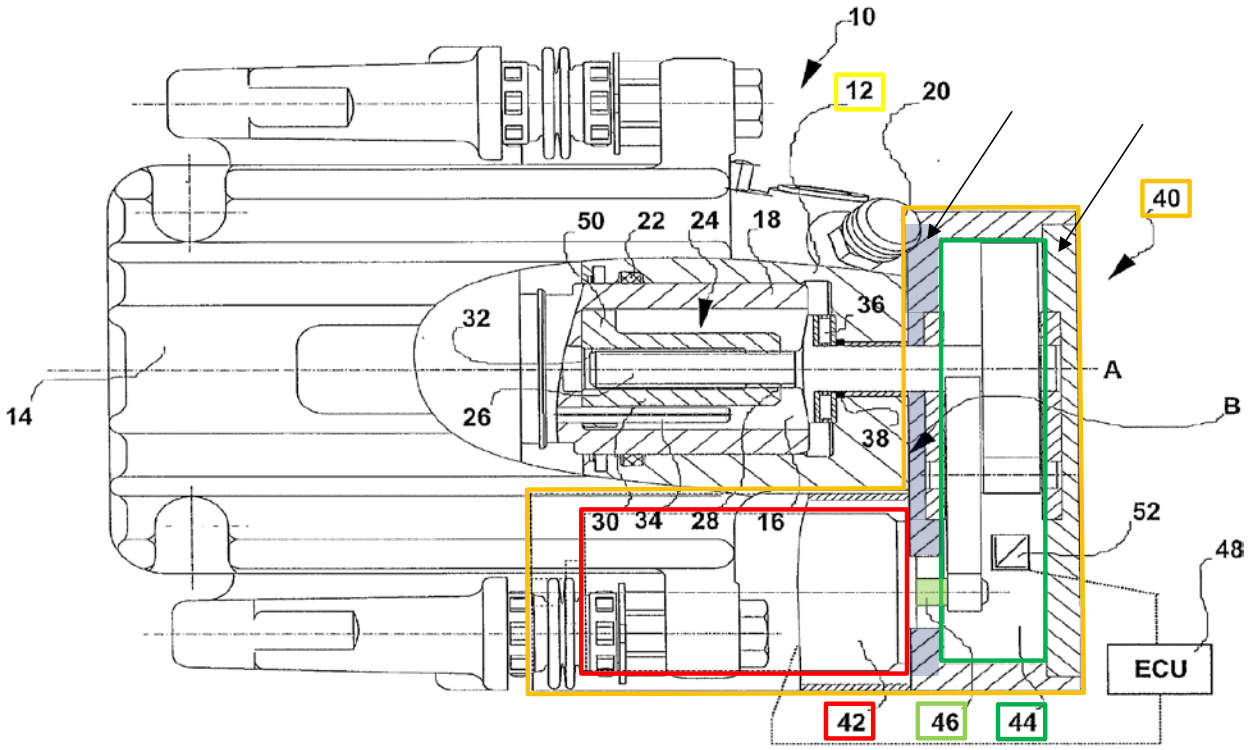
116. Figure 1 above shows a hatched component surrounding reduction gear 44, serving as a housing for the gear. Looking at the hatched component in more detail, it is composed of two primary parts, one in gray (I added the number 1000 for convenience) and another one, not in gray (number 1001 added). As can be seen in annotated Figure 1 above, part of the unit 40 (**orange**) has a plate (1000, **gray**)

(all or part of which may be the recited "*sub-frame*") between the electric motor 42 and the reduction gears 44 through which the output shaft 46 (**light green**) passes, to which the electric motor 42 and reduction gears 44 are mounted.




117. The figure above shows Figure 1 in Ex. 1007 (left) along with Figure 7 in '415 (right). This juxtaposition shows that Poertzgen is similar to the actuator disclosed in the '415 patent, with curved arrows between Figure 1 (Ex. 1007) and Figure 7 ('415) linking like elements.

118. A POSA would also understand that it would be obvious for the sub-frame on the left side of the gear housing to have different shapes, such as a flat piece (as shown below in **gray**), in which case the right side of the gear housing would be "C" shaped and include the top and bottom sides.




Ex. 1007, Figure 1 (annotated)

119. A POSA would understand from the depiction of motor 42 and reduction gear 44 to subframe 1000 that they are both mated or mounted to the subframe. Various mounting techniques were known and obvious to a POSA. Press fit, screws, bolts, rivets, straps, and epoxy were some of the well known methods a POSA would have been aware of for mounting motor 42 to subframe 1000. The non colored area between shaft 46 and subframe 1000 will be recognized by a POSA as a bearing, which allows the shaft to rotate within stationary subframe 1000. Similarly, a POSA will understand that the reduction gear is mounted to subframe 1000 via bearings inserted in both the subframe 1000 and its mating cover 1001 (number added to Figure 1, Ex. 1007 for convenience).

120. As such, Poertzgen teaches or suggests "*a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame*" as claimed by claim 6 of the '415 Patent.

**iii. Claim Limitation [6F]**

121. Limitation [6F] is identical to limitation [2F] and is, likewise, taught or suggested by Poertzgen for the reasons set forth above. As such, Poertzgen teaches or suggests all elements of claim 6 of the '415 Patent and, thus, renders claim 6 obvious.

**3. Independent Claim 9**

122. As explained in the following sections, Poertzgen teaches or suggests all claim limitations of claim 9 of the '415 Patent and renders it obvious.

**i. Claim Limitations [9A]-[9D]**

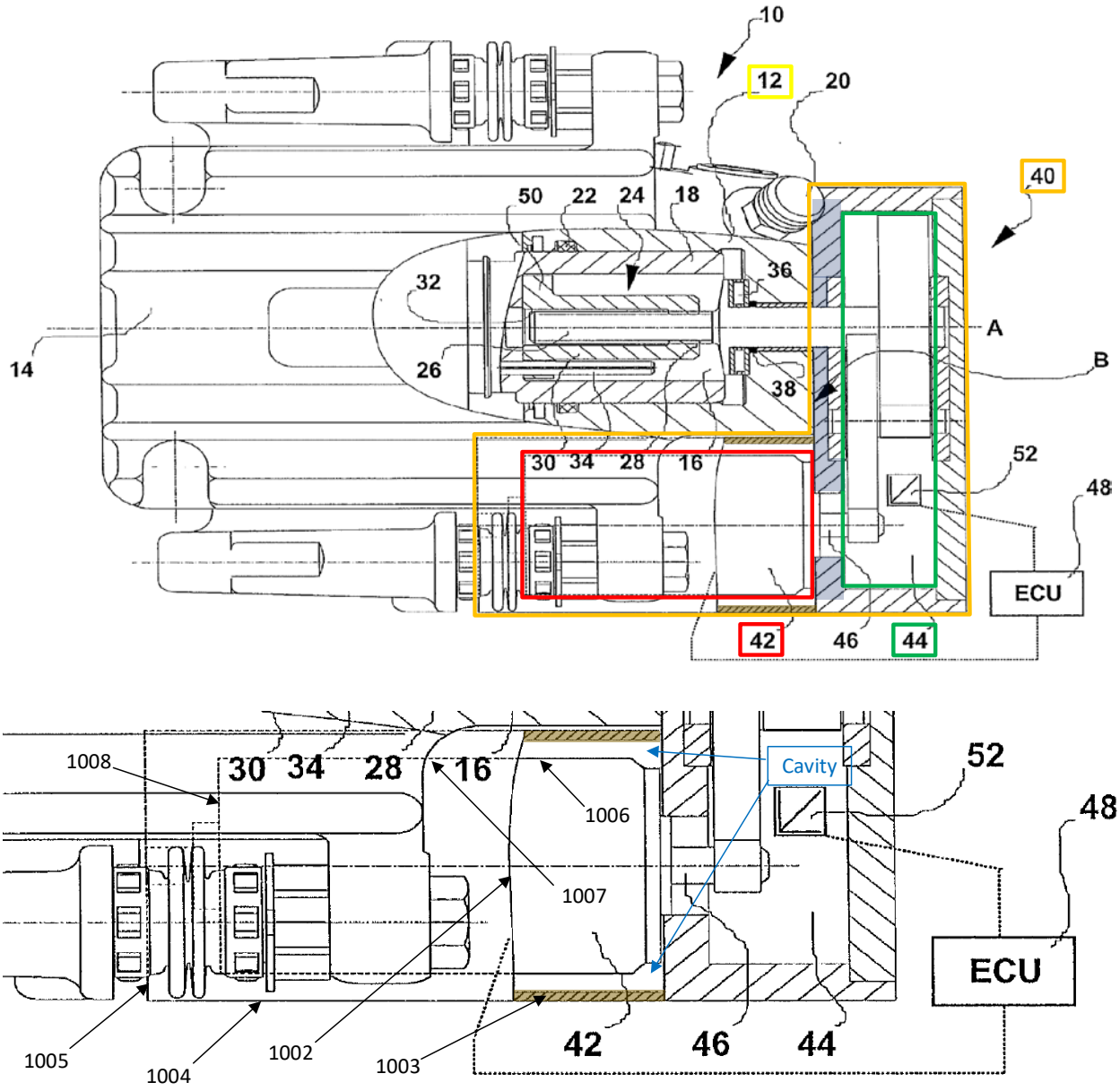
123. Limitations [9A]-[9C] are identical to limitations [2A]-[2C] and [6A]-[6C], and are taught or suggested by Poertzgen for the reasons set forth above. Limitation [9D] is identical to limitation [2E] and is taught by Poertzgen for the reasons set forth above.

**ii. Claim Limitation [9E]: "and further comprising an actuator housing defining a motor cavity receiving at least a portion of said motor and a covering member disposed adjacent said motor cavity, thereby separating said motor from a remainder of said actuator"**

124. Poertzgen teaches or suggests "*and further comprising an actuator housing defining a motor cavity receiving at least a portion of said motor and a covering member disposed adjacent said motor cavity, thereby separating said motor from a remainder of said actuator*." Ex. 1007 at Abstract, 2:24-30, 8:5-16, claim 1, Figure 1.

125. As I have explained previously regarding claim limitation [2E], Poertzgen teaches or suggests that electric motor 42 and reduction gears 44 together comprise a subassembly 40. Ex. 1007, Abstract, 2:24-30, 8:5-16. This subassembly "can be manipulated independently and combined with various vehicle brakes of one type." *Id.*, 2:24-25, 8:9-11. This provides manufacturing benefits, and greater flexibility with respect to the attachment of the subassembly to the various brakes it would actuate. *Id.*, 2:24-30.

126. As can be seen in Figure 1 (reproduced and annotated below), part of the housing for subassembly 40 (**orange**)—the recited "*actuator housing*"—encloses electric motor 42 (**red**). *Id.*, 8:9-13, Figure 1.




Ex. 1007, Figure 1 (annotated), top, with details of the motor, and the cavity surrounding it, bottom

127. A further look at Figure 1, above, as seen the way a POSA would read it, shows the housing and the cavity around the motor. The motor proper is delineated by a generally rectangular box, shown in red on the top figure. The motor area is repeated and enlarged below, without the red box. Outside of the motor, one

can distinguish, on the right-hand side, two hatched areas (one above the motor, one underneath). These two hatched areas were colored in light brown, and marked "1003". These two hatched areas 1003 extend, from right to left, from the subframe (gray area) to a somewhat curved cut-out line which I denoted 1002. Going further to the left, the hatched areas are discontinued and replaced by a solid line 1004, until they reach a perpendicular line 1005. A POSA, based on known drawing conventions, would identify the hatched areas as being cross-sections, and the curved line as demarcating a view of the outside (left of the curve) from a cut-out (right of the curve). Similarly, the rectangle corresponding to the motor has solid lines 1006 to the right of line 1002, and broken lines 1007 and 1008 to the left of line 1002. Broken lines, in drawing convention, indicate something that is inside of something else. A POSA would understand, therefore, that areas 1003 and lines 1004, 1005 constitute an envelope, or housing, for the motor, shaped as a cylindrical cup, of a thickness indicated by the widths of the brown hatched areas 1003. The space between the housing (1003, 1004, 1005) and the motor (1006, 1007, 1008) is a cavity surrounding the motor.

128. The space between the motor and its housing is the recited "*motor cavity receiving at least a portion of said motor*." The subframe covering the motor and completing the envelope (1003, 1004, 1005) around the motor (1006, 1007, 1008) is the recited "*covering member disposed adjacent said motor cavity*". The

subframe shown in gray to the right of the motor and housing, in the Poertzgen description and as shown in the figure, achieves the recited goal of "*separate*[ing] *said motor from a remainder of said actuator*" because the remainder of the actuator is on the opposite side of the subframe from the motor. (Ex. 1007, Figure 1).

129. As such, Poertzgen teaches or suggests "*and further comprising an actuator housing defining a motor cavity receiving at least a portion of said motor and a covering member disposed adjacent said motor cavity, thereby separating said motor from a remainder of said actuator*" as recited in claim 9 of the '415 Patent.

130. Because Poertzgen teaches or suggests all claim limitations of claim 9 of the '415 Patent, Poertzgen renders claim 9 obvious.

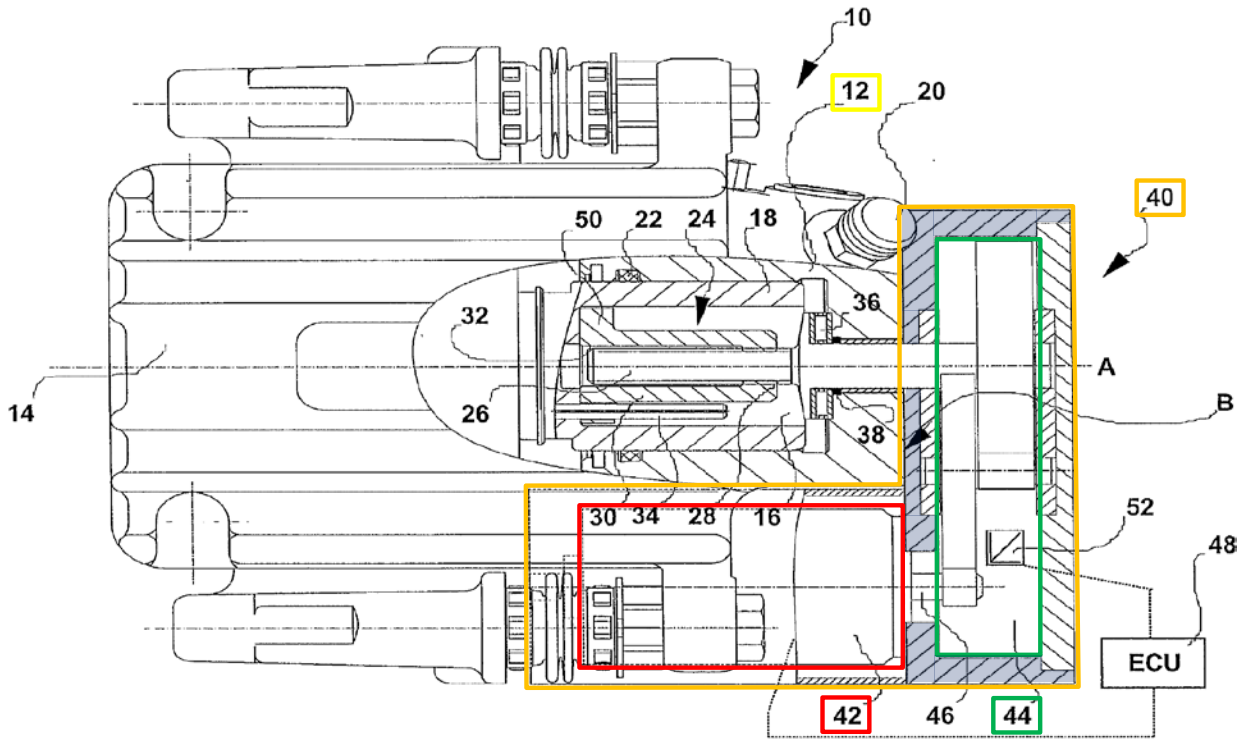
**4. Dependent Claim 10**

131. As shown in the following analysis, Poertzgen teaches or suggests all of the limitations of claim 10 of the '415 Patent. Claim 10 of the '415 Patent is dependent from claim 9 and further requires "*wherein said covering member comprises a sub-frame.*" Ex. 1001, claim 10.

132. As discussed above, Poertzgen teaches or suggests all elements of claim 9. Poertzgen also teaches or suggests that the covering member comprises a sub-frame. Ex. 1007, Abstract, 2:24-30, 8:5-16, claim 1, Figure 1. More particularly, and as explained with respect to limitation [6E], Poertzgen describes that

subassembly 40 is a separate unit having electric motor 42 and reduction gears 44 mounted within it.

133. As can be seen in Figure 1 (reproduced and annotated below), electric motor 42 is mounted on the plate (**gray**) to the right of the motor cavity.




Ex. 1007, Figure 1 (annotated)

134. This is the same plate identified as the "covering member" with respect to claim 9. This plate, to which the motor is mounted, is the recited "*sub-frame*." It is a sub-frame at least because the motor is mounted to it, and it is not the entirety of the actuator, *i.e.*, the plate is a sub-component.

135. As such, Poertzgen teaches or suggests "*wherein said covering member comprises a sub-frame*" as recited by claim 10. Thus, Poertzgen renders claim 10 of the '415 Patent obvious.

### 5. Independent Claim 11

136. As explained in the following sections, Poertzgen teaches or suggests all claim limitations of claim 11 of the '415 Patent and, thus, renders claim 11 obvious.

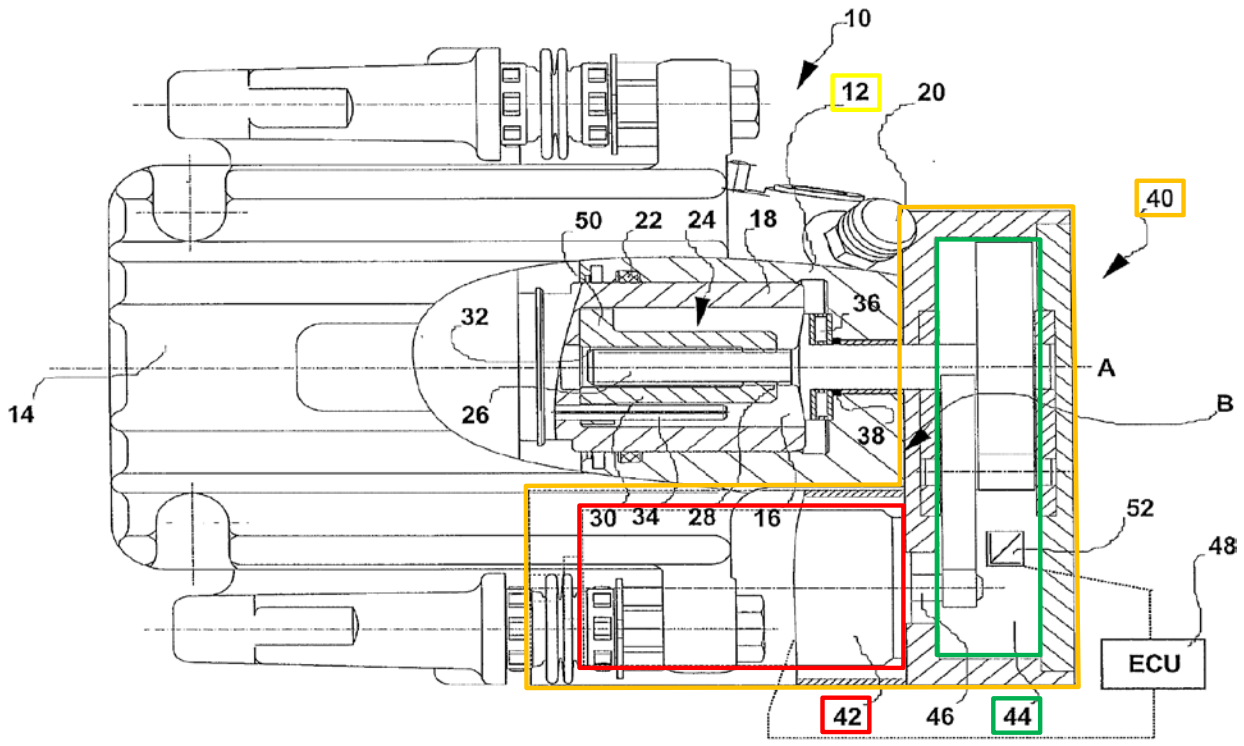
#### i. Claim Limitations [11A]-[11C]

137. Limitations [11A]-[11C] are virtually identical to, and encompassed within, limitations [2C] and [2E]. Thus, for the at least the reasons that I have set forth above, Poertzgen teaches or suggests the limitations [11A]-[11C].

#### ii. Claim Limitation [11D]: "a sub-frame, said motor and at least one of said driven gear and said planetary gear set being mounted on said sub-frame."

138. Poertzgen teaches or suggests "*a sub-frame, said motor and at least one of said driven gear and said planetary gear set being mounted on said sub-frame*" as recited by claim 11 of the '415 Patent. This claim limitation ([11D]) is virtually identical to, and encompassed within limitation [6E], and is taught by Poertzgen for at least the reasons set forth above. *See also* Ex. 1007, Abstract, 2:24-30, 8:5-16, claim 1, Figure 1.

139. As I have explained above regarding limitation [6E], a POSA would understand that Poertzgen describes (as reproduced and annotated below) an electric motor 42 and reduction gear 44 that are mounted on a sub-frame, allowing them to be handled separately (apart from the remainder of Poertzgen Figure 1's braking system). Unit 40 (**orange**) has within it a plate between the electric motor 42 (**red**) and reduction gears 44 (**green**). The driveshaft 46 passes through the plate—where the entirety or a portion of this plate is the claimed "sub-frame" to which the electric motor 42 and reduction gears 44 are mounted. The reduction gears are mounted to the "sub-frame", *e.g.*, via bearings inserted into the sub-frame. As such, Poertzgen teaches or suggests the claimed "sub-frame."




Ex. 1007, Figure 1 (annotated)

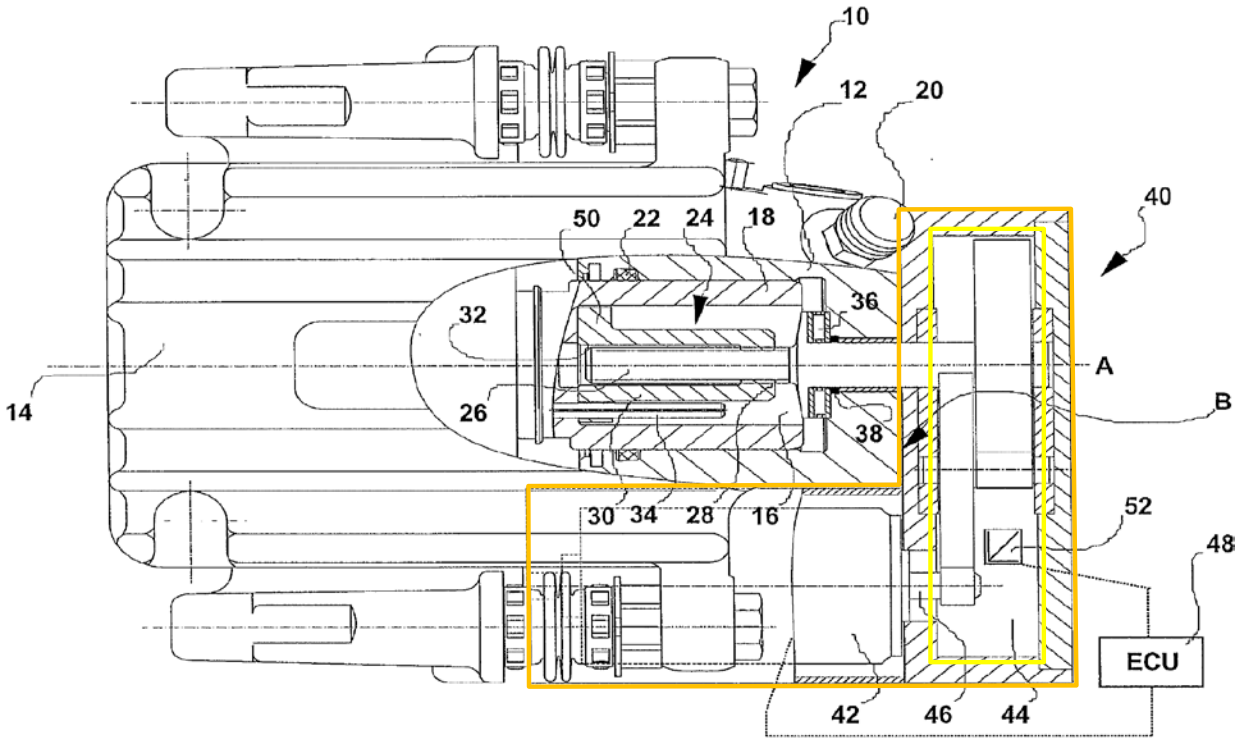
140. As I have explained above, Poertzgen also describes that the reduction gears 44 include at least a planetary gear and a driven gear. Thus, Poertzgen teaches or suggests "*said motor and at least one of said driven gear and said planetary gear set being mounted on said sub-frame*" as claimed in claim 11 of the '415 Patent.

141. As such, Poertzgen teaches or suggests limitation [11E]. Because Poertzgen teaches or suggests all claim elements of claim 11, Poertzgen renders claim 11 of the '415 Patent obvious.

### 6. Dependent Claim 12

142. As explained in the following analysis, Poertzgen discloses all of the limitations of claim 12 of the '415 Patent. Claim 12 of the '415 Patent is dependent from claim 11 and also requires "*further comprising an actuator housing defining a planetary gear set cavity receiving at least a portion of said planetary gear set, wherein cooperation between said housing and said sub-frame separate said planetary gear set from a remainder of said actuator*." Ex. 1001, claim 12. As I have discussed above, Poertzgen teaches or suggests all the elements of claim 11.

143. Poertzgen's Figure 1 (reproduced and annotated below), shows the reduction gears 44, which includes the planetary gear set, located in a cavity (**yellow**) in subassembly 40. This cavity is defined by the housing of the subassembly 40 (**orange**) and is the claimed "*actuator housing defining a planetary gear set cavity receiving at least a portion of said planetary gear set*" of claim 12 of the '415 Patent.




Ex. 1007, Figure 1 (annotated)

144. The housing in annotated Figure 1 above cooperates with the plate on the left side of the gear set cavity (the claimed sub-frame) to form an enclosure for the planetary gear set and separate it from a remainder of the actuator, as part of the actuator (for example, the electric motor 42), is outside the cavity and mounted on the opposite side of the plate (sub-frame), within its own, separate cavity. Poertzgen further describes that this arrangement where the motor and gear set are on opposite sides of this sub-frame provides space-saving benefits. Ex. 1007, 2:18-23.

145. As such, Poertzgen teaches or suggests "*further comprising an actuator housing defining a planetary gear set cavity receiving at least a portion of said planetary gear set, wherein cooperation between said housing and said sub-frame*

*separate said planetary gear set from a remainder of said actuator*" as claimed by claim 12 of the '415 Patent. Thus, Poertzgen teaches or suggests all limitations of claim 12 and renders claim 12 obvious.

### 7. Independent Claim 13

146. As explained in the following sections, Poertzgen teaches or suggest all claim limitations of claim 13 of the '415 Patent, and, thus, renders claim 13 obvious.

#### i. Claim Limitations [13A]-[13C]

147. Limitations [13A]-[13C] are virtually identical to, and encompassed within limitations [11A]-[11C]. Thus, for at least the reasons that I have set forth above, Poertzgen teaches or suggests the limitations [11A]-[11C].

#### ii. Claim Limitation [13D]: "a sub-frame, said motor and at least a portion of said drive train being mounted on said sub-frame; and"

148. Poertzgen teaches or suggests "*a sub-frame, said motor and at least a portion of said drive train being mounted on said sub-frame*" as recited by claim 13 of the '415 Patent. As I have explained above regarding claims 11 and 12, Poertzgen teaches or suggests the claimed "sub-frame," and the electric motor 42 and the various reduction gears 44 mounted onto this sub-frame. Ex. 1007, Abstract, 2:24-30, 8:5-16, claim 1, Figure 1.

149. The recitation of "*said drive train*" in this limitation is the first appearance of "*drive train*" in claim 13 and it could refer to the previously mentioned

"drive shaft" of the motor, or the "gear train", or both. Regardless of which of these the "*said drive train*" refers to, Poertzgen, as explained above, describes that the electric motor 42 (including its drive shaft) and the reduction gears 44 (the recited "*gear train*") are mounted on the plate ("*sub-frame*"). Accordingly, Poertzgen teaches that "*at least a portion of*" the drive train is mounted on the sub-frame regardless of whether "*said drive train*" refers to the "drive shaft" of the motor, the "gear train", or both.

150. As such, Poertzgen teaches or suggests "*a sub-frame, said motor and at least a portion of said drive train being mounted on said sub-frame*" as claimed by claim 13 of the '415 Patent.

**iii. Claim Limitation [13E]: "an actuator housing, said housing defining a motor cavity receiving at least a portion of said motor, wherein cooperation between said housing and said sub-frame separate said motor from a remainder of said actuator"**

151. Poertzgen teaches or suggests "*an actuator housing, said housing defining a motor cavity receiving at least a portion of said motor, wherein cooperation between said housing and said sub-frame separate said motor from a remainder of said actuator*" as recited by claim 13 of the '415 Patent. This limitation is virtually identical to limitation [9E] and claim 10. As such, Poertzgen teaches or suggests this limitation for the same reasons set forth above regarding those limitations. *See also* Ex. 1007, Abstract, 2:24-30, 8:5-16, claim 1, Figure 1.

152. As explained above utilizing the annotated and reproduced Poertzgen Figure 1, the housing of the subassembly 40 includes the rectangular motor housing (1003, 1004, 1005) which contains the motor cavity, in which the electric motor 42 resides. To the right of that cavity is the sub-frame to which the electric motor 42 is mounted. The housing and the sub-frame cooperate to separate the electric motor 42 from the remainder of the actuator, including at least the reduction gears 44, which are mounted on the opposite side of the sub-frame and reside in their own cavity. *Id.*

153. As such, Poertzgen teaches or suggests "*an actuator housing, said housing defining a motor cavity receiving at least a portion of said motor, wherein cooperation between said housing and said sub-frame separate said motor from a remainder of said actuator*" as recited in claim 13 of the '415 Patent.

154. Because Poertzgen teaches or suggests all elements of claim 13, Poertzgen renders claim 13 of the '415 Patent obvious.

### D. Ground B: Claims 3-5, 7-8, and 14-19 Are Invalid as Obvious Over Poertzgen in view of Boucheret

155. As I will explain in the following subsections, claims 3-5, 7-8, and 14-19 are rendered obvious by Poertzgen in view of Boucheret.

### 1. Independent Claim 3

156. As explained below, Poertzgen in view of Boucheret teaches or suggests all claim limitations of claim 3 of the ’415 Patent and, thus, renders this claim obvious.

#### i. Claim Limitations [3A]-[3D]

157. Limitations [3A]-[3D] are identical to limitations [2A]-[2C] and 2[E], and are taught by Poertzgen for the reasons set forth above.

#### ii. Claim Limitation [3E]: “said actuator further comprising a component isolator having a spring constant and a damping constant, said isolator coupled between said motor and a remainder of said; and”

158. Poertzgen in view of Boucheret teaches or suggests “*said actuator further comprising a component isolator having a spring constant and a damping constant, said isolator coupled between said motor and a remainder of said [actuator or parking brake system]*” as recited by claim 3 of the ’415 Patent.[2] Ex. 1010, Abstract, 1:5-64, 2:30-34, 3:15-40, 4:27-56, claims 1, 9, Figures 1-4.

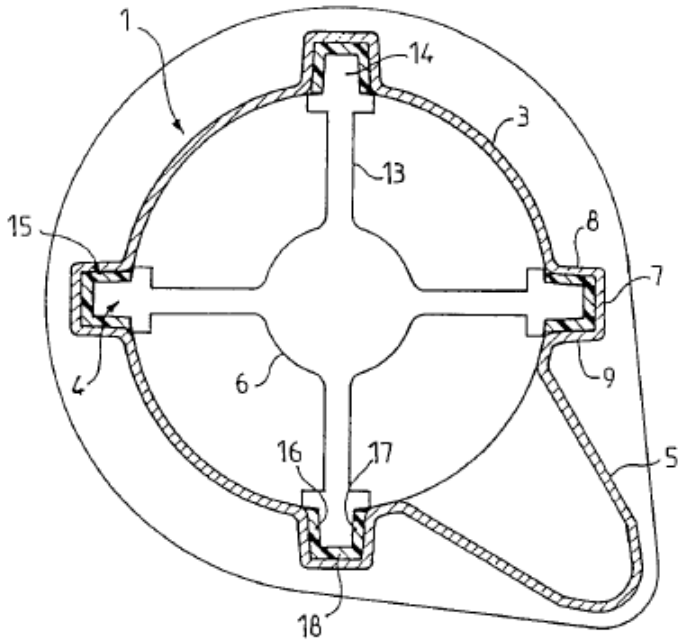
[2] It appears that the ’415 Patent has an error in Claim 3 as there is a word / words missing after “remainder of said.” Ex. 1001 at 9:15. For purposes of my opinion, I have assumed that the omitted word / words were “actuator” or “parking brake system” as those make the most sense in the context of Claim 3. For either of those assumptions, limitation [3E] is taught or suggested by Poertzgen in view of Boucheret.

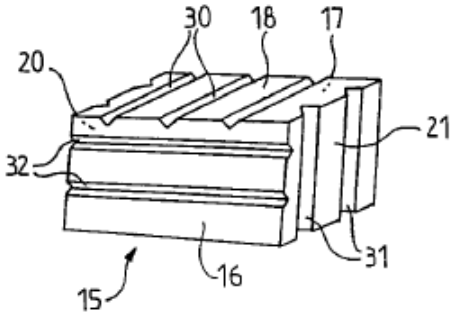
159. Poertzgen describes an electric motor 42 as part of an actuator. Ex. 1007, Abstract, 8:9-32, Figure 1. Poertzgen's Figure 1 shows a narrow rectangle between the electric motor 42 and the plate to which the motor is attached. For a POSA using conventional drawing rules, this rectangle indicates a separate component. Poertzgen however does not provide an explicit description of this rectangle, its nature, purpose, material it is made of, etc, whether it is an isolator or anything else. This said, it was well within the general knowledge in the art that the transmission of NVH can be reduced by placing an isolator or damping element between automotive components including between a motor and a plate attached to the motor.

160. One of the simplest and most well-known isolators is a passive elastic member(s) placed between automotive components and thus acting as a cushion to dampen NVH. Ex. 1014, 198 and Figure 8.6 therein ("Vibration isolation. This is a way of localizing vibration to the vicinity of the source, thereby preventing its transmission to other parts of a (vehicle body) structure where it may result in the generation of noise. It can be achieved by the use of either passive or controllable vibration isolators. Passive isolators range from simple rubber in shear …. The simpler forms of isolator are a cost-effective solution for sources with a limited range of operating conditions."). Further, isolators were well known at the time of the '415 patent to be composed of "a spring constant and a damping constant". Referring

again to Ex. 1014, page 210, where the author gives an example on how to design engine mounts, that is, isolators which prevent engine vibrations from reaching the chassis. The author says: "(b) Mount requirements and types / The requirements for engine mounts are: (i) a low spring rate and high damping during idling and (ii) a high spring rate and low damping for high speeds, manoeuvring and when traversing rough terrains." This sentence shows that, first, isolators have a spring rate (or constant) and damping (constant), second that selecting the magnitude of these two constants is a matter of course for a POSA, matching these constants to the application at hand.

161. Boucheret describes the utilization of passive damping elements when mounting electric motors (such as the electric motor 42 of Poertzgen) within housings, to reduce NVH in a motor vehicle. Ex. 1010, Abstract, 1:5-64, 3:15-40, 4:27-56, claims 1, 9, Figures 1-4. In particular, as shown in Boucheret Figures 3 and 4 (reproduced below), Boucheret describes a housing 1 for an electric motor 6, wherein damping members 15 are coupled between the motor and the motor housing. *Id.*




Ex. 1010, Fig. 3 Ex. 1010, Fig. 4

162. As can be seen in Boucheret Figure 4 (reproduced above), the damping members / elements 15 are essentially elastic cushions acting as vibration dampers between the housing 1 and the electric motor 6 to reduce NVH. *See also* Ex. 1010, 3:15-22 ("These damping elements are adapted to serve as vibration dampers, in particular between the electric motor 6 and the housing 1."). Boucheret further describes that "the cooperation between the retaining member and the damping elements enables the axial vibrations to be absorbed" (*Id.*, 1:60-64) and acknowledges that passive damping elements and their operation were well known to the POSA. *Id.*, 1:30-31 ("the damping elements are generally made in compact elastic materials"), 2:41-44 ("As the man in the art knows, each outer face of a

damping element works in a preferential direction."). Boucheret's damping members / elements 15, like all such damping members / elements, have basic inherent material properties (*e.g.*, spring and damping constants).

163. It is noteworthy that Boucheret addresses vibrations in all three directions of space: For a cylinder (and electric motors are typically cylindrically shaped), the three directions are tangential, radial and axial. Ex. 1010, 3:30-34, 4:26-39. This is in contrast with some prior art (prior to Boucheret) which bears only in one direction (radial). *Id.*, 1:19-29. What Boucheret does, namely effectively dampen vibrations in all three dimensions, can also be used by a POSA for simpler applications, *e.g.*, where only one dimension (axial) is of concern.

164. In those applications where noise suppression is desirable[3], a POSA would have been motivated to combine a resilient isolator as taught in Boucheret (the damping members / elements 15) with the motor mount of Poertzgen so that the isolator is coupled between Poertzgen's electric motor 42 and the remainder of the actuator or parking brake system—*e.g.* the rest of Poertzgen's actuator/subassembly 40—so as to dampen NVH coming from the electric motor 42. Placing a resilient isolator, as taught by Boucheret, between any component (including an electric

[3] As the '415 Patent notes, reducing noise from a brake system is desirable in some applications, but also acknowledges that, "[i]n some applications, a loud system is desirable to alert an operator…". Ex. 1001, 1:34-39. Thus, only in some situations will a parking brake system require NVH suppression.

motor) that may generate NVH and the components to which it is mounted or abuts is nothing more than the use of a known technique to make known improvements in the same way to similar components in the same technology area.

165. A POSA would have appreciated the benefit of reduced NVH transmission achieved by placing an isolator between those components as described in Boucheret and known this same application to get the same benefit would also apply to Poertzgen as both Poertzgen and Boucheret relate to actuators in motor vehicles that use electric motors, and both recognize the benefits of reducing NVH in certain applications. Ex. 1007, 2:12-3:8; Ex. 1010, 1:5-64, 3:20-22, 4:27-56. Moreover, the use of isolators between automotive components to reduce NVH was well within the general knowledge of the POSA and inserting isolators between components is a simple mechanical modification that a POSA could easily accomplish. Thus, a POSA would have had a reasonable expectation of success in inserting an isolator in between the components expressly taught in Poertzgen. Adding an isolator as described in Boucheret between Poertzgen's automotive components, the motor and its mount, is nothing more than a combination of known prior art elements in the same technology area according to known methods to obtain the well-known and predictable resulting benefit.

166. As I have explained above, the benefits of reducing noise were already well known to a POSA and expressly described in Poertzgen and Boucheret. Ex.

1007, 3:4-8 (discussing having "good noise decoupling between the driving electric motor and the remaining parts of the vehicle brake"), Figure 1 (spacer between the motor and the rest of the actuator); Ex. 1010, 1:5-64, 3:20-22, 4:27-56 (reduction of NVH transmission from an electric motor). These exemplary descriptions provide an explicit motivation to incorporate Boucheret's concept of an isolator between Poertzgen's electric motor and actuator.

167. As such, Poertzgen in view of Boucheret teaches or suggests "*said actuator further comprising a component isolator having a spring constant and a damping constant, said isolator coupled between said motor and a remainder of said*" as claimed by claim 3 of the '415 Patent.

**iii. Claim Limitation [3F]: "a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position"**

168. Limitation [3F] is identical to limitation [2F] and is, therefore, taught by Poertzgen for at least the same reasons that I have described above. Because Poertzgen in view of Boucheret teaches or suggests every claim limitation of claim 3 of the '415 Patent, Poertzgen in view of Boucheret renders claim 3 obvious.

**2. Dependent Claim 4**

169. Claim 4 of the '415 Patent depends from claim 3 and adds: "*wherein said component isolator comprises a first portion and a second portion, and said first portion is coupled to a first end of said motor and said second portion is coupled*

*to a second end of said motor*." Poertzgen in view of Boucheret renders claim 3 obvious for the reasons I discussed above. It is also obvious to simply duplicate, in an additional location, a known element (the isolator) performing its well-known, and intended purpose (dampening NVH).

170. Moreover, Boucheret expressly describes isolators placed at different ends of a motor. Ex. 1010, Abstract, 1:5-64, 2:30-34, 3:15-40, 4:27-56, claim 1 ("*a plurality of damping elements*"), claim 9, Figures 1-4. Figure 3 of Boucheret (reproduced below) shows four damping elements 15 (isolators) in four positions 90 degrees apart, shown in the figure at the top, bottom, left, and right of the motor 6.

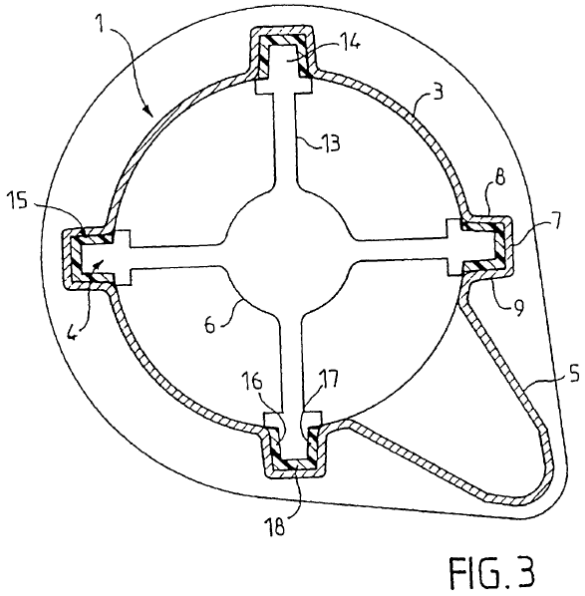


FIG. 3

Ex. 1010, Figure 3.

171. Boucheret also provides that "it is clear that it will be possible to provide housings having a smaller or greater number of cavities" for isolators. Ex.

1010, 4:52-56. Each one of these multiple isolators, of which there can be a greater or smaller number, allows "elastic decoupling to be obtained in all directions between the motor and the housing." *Id.*, Abstract.

172. The motivation to have multiple isolators between a motor and its surrounding components and/or housing is essentially the same as I described above with respect to claim 3 as the use of multiple, essentially duplicative, isolators simply provides greater reduction of NVH in one direction, or provides additional NVH reduction in one or multiple directions. Thus, in applications desiring reduced NVH, a POSA, especially in view of Poertzgen's teaching that its actuator could be attached to brakes in various ways (Ex. 1007, 2:24-30) would have been motivated to place an isolator in multiple locations, such as both to the left and right, or to the left, right, top, and bottom, of the electric motor 42, to further isolate the motor.

173. As such, Poertzgen in view of Boucheret teaches or suggests "*wherein said component isolator comprises a first portion and a second portion, and said first portion is coupled to a first end of said motor and said second portion is coupled to a second end of said motor*." Accordingly, Poertzgen in view of Boucheret renders claim 4 obvious.

### 3. Independent Claim 5

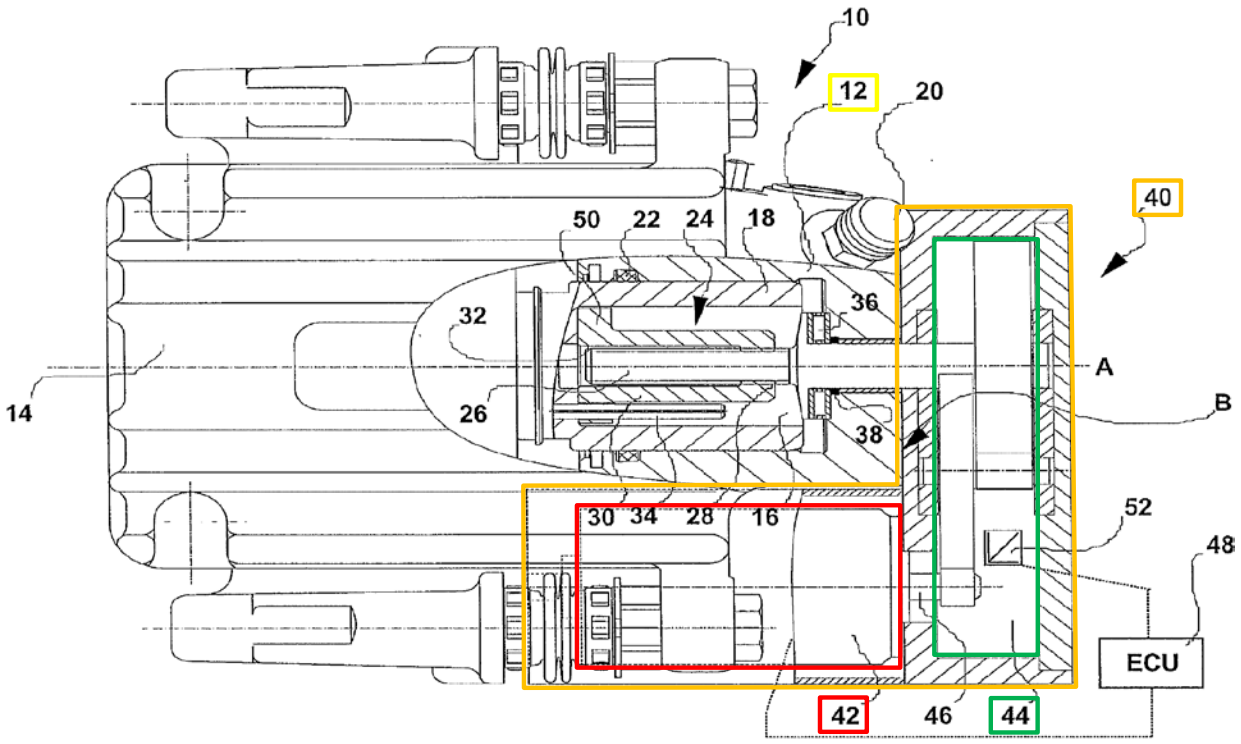
#### i. Claim Limitations [5A]-[5E], [5G]

174. Limitations [5A]-[5C] are identical to limitations [2A]-[2C], limitation [5D] is identical to limitation [2E], limitation [5E] is identical to the beginning of limitation [6E], and limitation [5G] is identical to limitation [2F]. Poertzgen teaches or suggests each of the limitations [5A]-[5E] and [5G] for at least the reasons explained above.

#### ii. Claim Limitation [5F]: "said actuator further comprising a component isolator having a spring constant and a damping constant, said isolator coupled between said motor and said sub-frame; and"

175. Poertzgen in view of Boucheret teaches "said actuator further comprising a component isolator having a spring constant and a damping constant, said isolator coupled between said motor and said sub-frame" as recited by claim 5 of the '415 Patent. This limitation [5F] is virtually identical to limitation [3E], except the location of the isolator, particularly, limitation [3E] recites that "said motor and a remainder of said [actuator]" and limitation [5F] recites that the isolator be coupled between "said motor and said sub-frame." As explained above, it would have been obvious for and a POSA would have been motivated to include Boucheret's teachings with respect to isolators and couple an isolator between Poertzgen's electric motor 42 and the rest of the subassembly 40 to which the motor is attached. Application of this teaching to Poertzgen's Figure 1 (reproduced and

annotated below), would necessarily couple the isolator between the electric motor 42 and the sub-frame. As I further described above, the Poertzgen Figure 1 sub-frame includes the structure to the right of the electric motor 42 (**red**) to which the motor is mounted.




Ex. 1007, Figure 1 (annotated)

176. The motivations to include such an isolator between the electric motor 42 of Poertzgen and the remainder of the subassembly 40, including the reduction gears 44, or Poertzgen, are set forth above with respect to limitation [3E].

177. Furthermore, it would have been a routine matter of design choice for a POSA when applications desire reduced NVH, to analyze the design and select isolators. As I said earlier, a POSA aiming at reducing NVH will determine, from

experience or from experimentation, the source and path of the vibrations and noise (NVH) through the mechanism, and place isolators either at the source, or in the path, of the vibration and noise (or both). An example of a typical POSA approach in this regard can be found Ex. 1014, pages 206-211. This section is discussed simply to give a sense of the types of information and approach that would be within the background knowledge and skill of a POSA, who would be well versed in selecting and locating isolators between various automotive components to reduce NVH. This section of the book comes after a general treatise of vibrations and remedies therefor, and addresses two examples, "isolation of the engine from the vehicle structure and … control of torsional oscillation amplitudes in engine crankshafts" (*Id.*, page 206). The first of these two examples (isolation of the engine from the vehicle structure) is similar to (although more complex than) the problem addressed by '415 patent. The engine (Ex. 1014) and the electric motor or gears ('415 patent) are the sources of vibrations, and in both cases, the goal is to minimize the vibrations reaching or exciting the frame on which the engine (Ex. 1014) and the motor ('415 patent) are mounted. In Ex. 1014, the engine must be isolated from the "Vehicle structure", namely the vehicle chassis. In the '415 patent, the motor must be isolated from the "remainder of the actuator" (claim 3) or from "the mass of the subframe" (Ex. 1010, 6:24-25) or other components.

178. The first step taken by a POSA is to understand the source and nature of the vibrations, that is, concerning the latter, the frequencies and magnitudes of each component of the vibrations. In Ex. 1014, this is done in the paragraph called "Engine isolation", page 207. The author identifies the source as: "The primary components of engine vibration at idling are integer multiples of engine speed and the dominant component in four cylinder engines occurs at twice the engine speed" (page 207). The same sentence also identifies the frequency (*e.g.*, integer multiple of engine speed) and, indirectly, their magnitude, calling these frequencies "primary". Specific numbers follow, *e.g.*, "Idle speeds for four cylinder engines are typically in the range from 8–20 Hz producing dominant frequency components in the range from 16–40 Hz."

179. The next step, for a POSA, is to identify the vibration path. In Ex. 1014, this is done at the bottom of page 207 to the top of page 208: "In order to uncouple these motions the isolators should lie in planes aligned with the principal inertial axes passing through the centre of gravity of the unit. The problem facing the chassis mounting engineer is to select a set of appropriate mounts and position them in such a way as to isolate the chassis from the above excitations." The author speaks first in generic, theoretical fashion: "isolators should lie in planes aligned with the principal inertial axes passing through the centre of gravity." Then, the next step consists of: "select[ing] a set of appropriate mounts and position them in such a way

as to isolate the chassis from the above excitations". That is, select the nature ("appropriate"), number ("a set of") and location ("position") of the isolators between the engine and the chassis.

180. Concerning the nature of the isolators, the author frames the problem in identifying the proper spring and damping rate of the isolators: "(b) Mount requirements and types / The requirements for engine mounts are: (i) a low spring rate and high damping during idling and (ii) a high spring rate and low damping for high speeds, manoeuvring and when traversing rough terrains." Ex. 1014, p. 210. Note here the "spring rate" and "damping", which is the "… isolator having a spring constant and a damping constant" referenced in Claim 5, limitation 5F. Exhibit 1014 also provides a list of four types of isolators a POSA may consider, each with advantages and limitations that a POSA will match to his/her application. The author of Ex. 1014 ends this section of the book with an example, illustrated with a figure (Figure 8.15, page 209) reproduced below for convenience. The figure shows that the author (addressing POSAs) opted for four isolators, two "rubber bushes", one hydrabush and one hydramount. These isolators are placed in various locations around the engine, one of them (the hydrabush) to the rear of the engine, as seen in the picture and the other three in front. The description of the figure at page 210-211 (incorrectly referenced as Figure 8.16), shows that the isolators can be placed at

the "power unit end" (*i.e.*, engine or electric motor) or "at the body end" (*i.e.*, chassis or subframe).

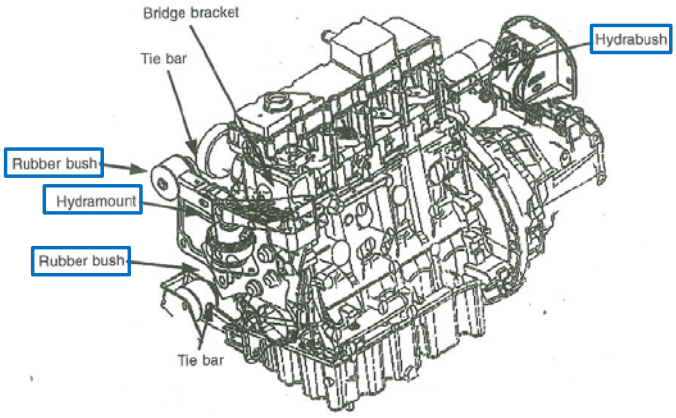



**Figure 8.15** A torque axis engine mounting system (courtesy of Rover Group Ltd)

Ex. 1014, Figure 8.15 (annotated)

181. Ex. 1014 is a basic textbook of automotive engineering. It is meant to help POSAs designing automobiles, or to be used by POSAs as a reference, for the same purpose of designing vehicles. It was available at the time of '415 patent to help a POSA interested in reducing vibrations in any automotive system, including a brake system: Replacing engine with motor, and chassis with subframe or "remainder of the actuator", such a POSA could follow the process outlined in Ex 1014 to identify the source of vibration, select the isolators (nature and number) and their locations.

182. Poertzgen in view of Boucheret teaches or suggests "*said actuator further comprising a component isolator having a spring constant and a damping constant, said isolator coupled between said motor and said sub-frame*" as recited

by claim 5 of the ’415 Patent. Because Poertzgen in view of Boucheret teaches or suggests every claim limitation of claim 5 of the ’415 Patent, claim 5 is rendered obvious.

#### 4. Dependent Claim 7

183. Claim 7 depends from claim 6, additionally requires “*a component isolator having a spring constant and a damping constant, said isolator coupled between said at least one planetary gear set and said sub-frame*” and is essentially the same as claim 5, except that the location of the placement of the isolator is now between the planetary gears and the sub-frame (claim 7), as opposed to between the motor and the sub-frame (claim 5). Poertzgen in view of Boucheret renders claim 7 obvious.

184. As detailed above, Poertzgen teaches all limitations of claim 6 of the ’415 Patent and Boucheret teaches a component isolator having a spring constant and a damping constant placed between automotive components to dampen NVH. It would have been within the general knowledge of and a matter of routine design choice for a POSA to place isolators judiciously within one or more possible NVH transmission paths, including placing an isolator between a motor and sub-frame. This knowledge is also applicable to the placement of an isolator between a sub-frame and a planetary gear set to reduce NVH. As I explained earlier, the first step for a POSA is to identify the source of vibrations. Applying this knowledge to a

brake system, a POSA would look for the source or sources of vibrations and noise (NVH), and consider, as a matter of course, the motor and the gears as potential NVH sources. It is well-known to a POSA that gear sets, like other components such as motors, are capable of generating and being subject to NVH that a POSA may choose to reduce using one of many well-known methods as a routine matter of design choice. *See* for instance "Gear noise" in the section on "Transmission noise" in Ex. 1014 at page 224. Boucheret's explicit teachings of placing an isolator between a motor and a sub-frame as described above with respect to claim 3-5 also render obvious, for the same reasons and motivations, the placement of an isolator between other components that generate or are subject to NVH such as the sub-frame and a planetary gear set.

185. As described above, isolators and their benefits, such as reducing the transmission of NVH, were well known in the art. Notably, the placement of an isolator between any two given components can beneficially dampen the transmission of NVH between those components. Placing an appropriate isolator between gears and a frame to which the gears are mounted is conceptually no different than having an isolator between any other component, such as a motor and the frame. In each case, moving parts are isolated from adjacent parts to minimize transmission of NVH. As such, a POSA's motivation to apply either their general knowledge, the express teachings of Boucheret to couple an isolator between a motor

and sub-frame (as described previously regarding claims 3-5), or a combination of both are the same motivations that make it equally obvious to couple an isolator between other automotive components such as a planetary gear set and the frame to which that planetary gear set is mounted.

186. Placing a resilient isolator between a component that may generate or be subject to NVH (whether that component be gears or a motor) and the components to which it is mounted is nothing more than a routine design choice for a POSA using a known technique of to reduce NVH and improve a similar device (*e.g.*, Poertzgen's actuator, which has a motor and gears mounted to other actuator parts) in the same way *(e.g.*, damping NVH generated by the moving parts such as the motor or gears) so that less NVH is transmitted to other components. Claim 7 of the '415 Patent is also a combination of known prior art elements from the same technical field (Boucheret's isolator and the gears and sub-frame of Poertzgen) created according to well-known methods (placing an isolator between automotive components) to obtain the expected, predictable results of damping NVH. In either case, a POSA would have reasonably expected success from this combination.

187. As such, Poertzgen in view of Boucheret renders claim 7 of the '415 Patent obvious.

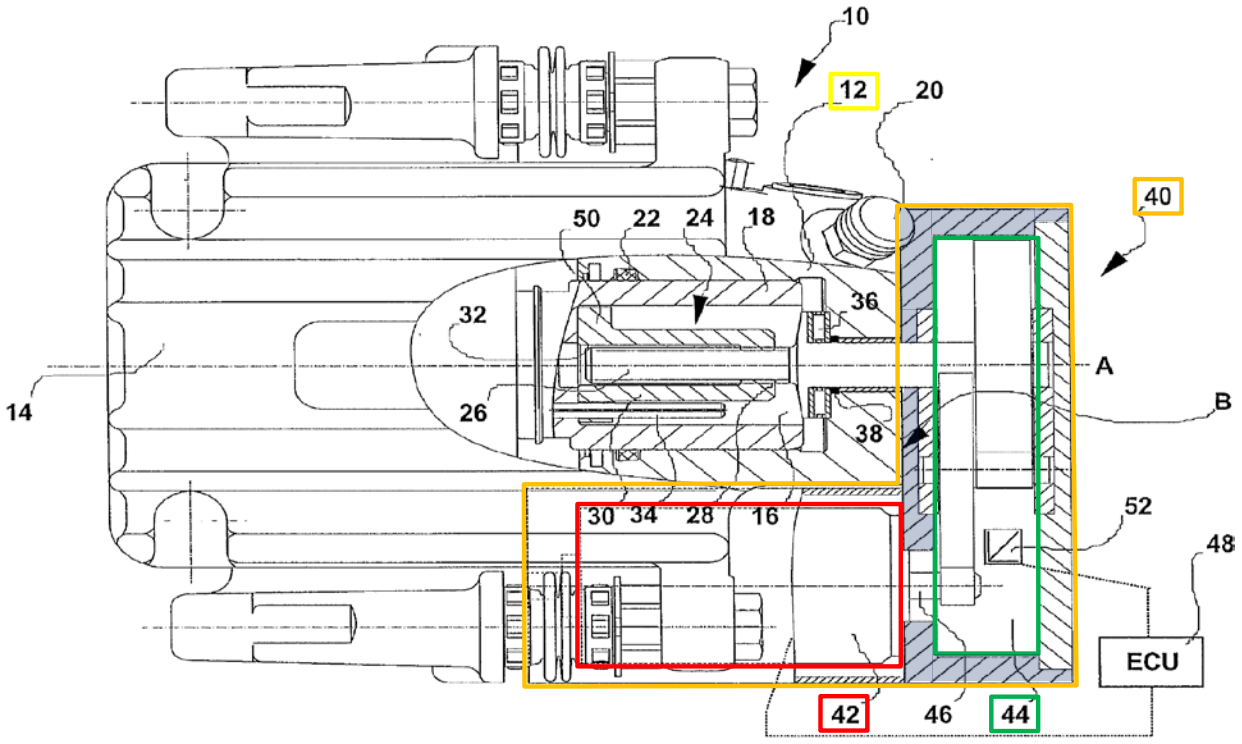
### 5. Independent Claim 8

#### i. Claim Limitations [8A]-[8E], [8G]

188. Limitations [8A]-[8C] are identical to limitations [2A]-[2C], limitation [8D] is identical to limitation [2E], limitation [8E] is identical to the beginning of limitation [6E], and limitation [8G] is identical to limitation [2F]. As such, for at least the reasons that I have set forth previously, Poertzgen teaches or suggests limitations [8A]-[8E] and [8G] as recited by claim 8 of the '415 Patent.

#### ii. Claim Limitation [8F]: "said actuator further comprising a sub-frame isolator having a spring constant and a damping constant, said isolator coupled between said sub-frame and a remainder of said actuator; and"

189. Limitation [8F] is virtually identical to limitation [3E], except for the specific location of the isolator. Particularly, limitation [3E] requires an isolator between "*said motor and a remainder of said [actuator]*" and limitation [8F] requires the isolator be coupled between "*said sub-frame and a remainder of said actuator*." For the same reasons as explained above with respect to claim 3 and element [5F] and as shown in annotated and reproduced Poertzgen's Figure 1 below, it would have been obvious, in view of Boucheret's description, for a POSA to place an isolator (or multiple isolators) so that it is / they are coupled between the sub-frame and the remainder of the actuator, as required by limitation [8F], to reduce transmission of NVH from the motor.




Ex. 1007, Figure 1 (annotated)

190. The motor (**red**), which is mounted to the sub-frame (as explained above with respect to limitation [6E]), transmits less NVH to the remainder of the actuator when isolators are coupled between the sub-frame and the remainder of the actuator. The same motivations and expectations of success to include such an isolator are set forth above, for example with respect to limitation [3E].

191. As such, Poertzgen in view of Boucheret teaches or suggest "*said actuator further comprising a sub-frame isolator having a spring constant and a damping constant, said isolator coupled between said sub-frame and a remainder of said actuator*" as recited by claim 8 of the '415 Patent.

192. Because Poertzgen in view of Boucheret teaches or suggests all claim limitations of claim 8, claim 8 of the ’415 is rendered obvious.

**6. Dependent Claim 14**

193. Claim 14 depends from claim 13 adding that “*a first motor isolator having a spring constant and a damping constant, said isolator disposed between said sub-frame and said motor*.” Poertzgen teaches claim 13 for at least the reasons set forth above. The additional limitation of claim 14 is identical to that of the limitation [5F], which is rendered obvious by Poertzgen in view of Boucheret for at least the same reasons set forth above.

194. As such, Poertzgen in view of Boucheret renders claim 14 of the ’415 Patent obvious.

**7. Dependent Claim 15**

195. Claim 15 depends from claim 14 adding that “*a second motor isolator having a spring constant and a damping constant, said isolator disposed between said motor and said housing.*” Poertzgen in view of Boucheret teaches claim 14 for at least the reasons set forth above. Further, the additional limitation of claim 15 is rendered obvious by Poertzgen in view of Boucheret for at least the reasons described above with respect to claim 4.

196. As explained previously, Boucheret teaches having multiple isolators disposed between the motor and its housing. Ex. 1010, Abstract, 1:5-64, 2:30-34,

3:15-40, 4:27-56, claims 1, 9, Figures 1-4. In addition to the above reasoning and the express description in Boucheret, it would be obvious to a POSA to repeat the placement of well-known isolators in multiple locations to diminish NVH. I have previously described a POSA's motivation to place these multiple isolators between a motor and its surrounding components and/or housing (see above discussion of claim 3) as using multiple isolators provides greater reduction of NVH in one direction, or provides such reduction in multiple directions. I also provided earlier a design example, from Ex. 1014, where multiple isolators are placed in various locations between a source of NVH (*e.g.*, an engine) and the rest of the structure (be it a chassis, a subframe, a housing, a remainder of the actuator, etc.).

197. As such, Poertzgen in view of Boucheret renders claim 15 of the '415 Patent obvious.

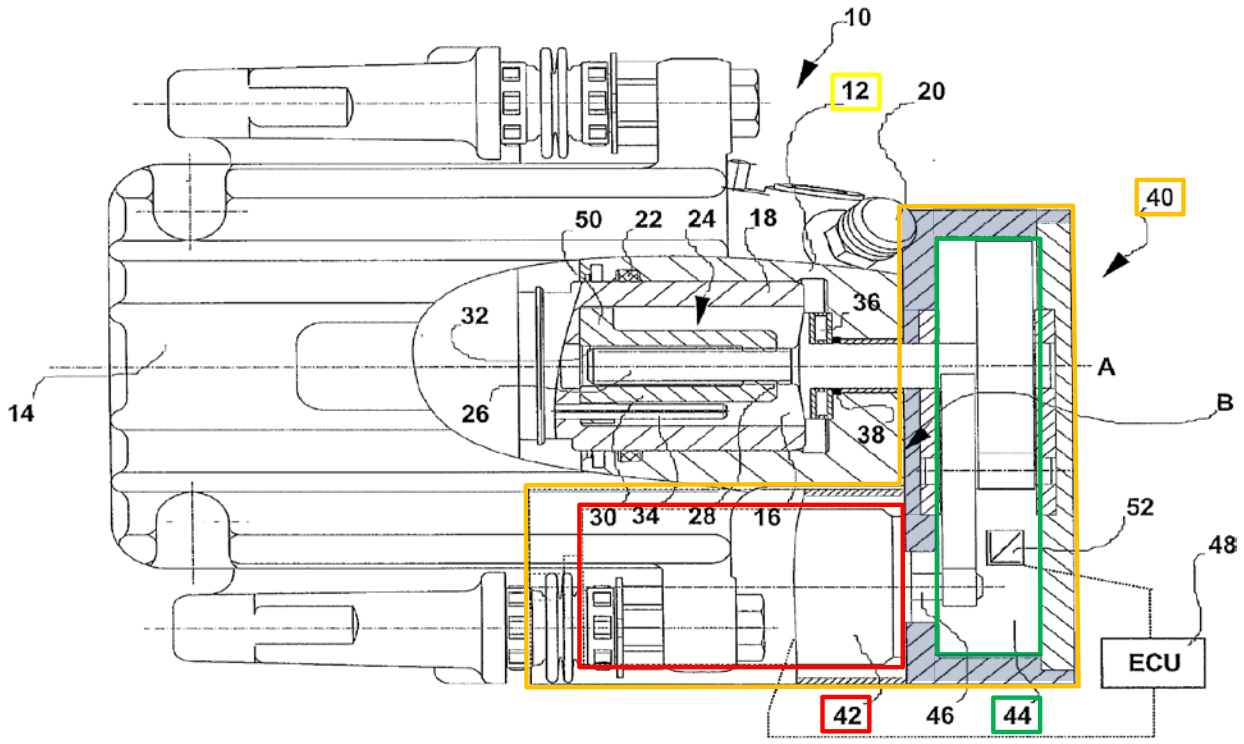
### 8. Independent Claim 16

#### i. Claim Limitations [16A]-[16D]

198. Limitations [16A]-[16D] are identical to limitations [13A]-[13D]. As such and for at least the reasons set forth above, Poertzgen in view of Boucheret teaches or suggests these limitations.

**ii. Claim Limitation [16E]: "a sub-frame isolator having a spring constant and a damping constant, said isolator disposed between said sub-frame and an actuator housing."**

199. Limitation [16E] is virtually identical to limitation [5F], claim 7, and limitation [8F] except that limitation [16E] requires a sub-frame isolator disposed between "*said sub-frame and an actuator housing*" instead of between the sub-frame and the motor (limitation [5F]), the planetary gear set (claim 7) or a remainder of the actuator (limitation [8F]). As set forth above discussing those limitations, Boucheret teaches a component isolator having a spring and damping constant placed between automotive components to dampen NVH. Boucheret's teachings, as well as the general knowledge of a POSA, render obvious the placement of an isolator between the sub-frame and the actuator housing.



Ex. 1007, Figure 1 (annotated)

200. As I discussed in my above opinions with respect to claims 3-5, isolators and their benefits, such as reducing transmission of NVH, were well known and the placement of an isolator between any two components can provide the same known benefit of dampening the transmission of NVH between those components. It would be an obvious design choice for a POSA to position an isolator between a sub-frame to which a motor and gears are mounted and an exterior housing if reduction of NVH transmission between those components was desired as the concept of having an isolator between a subframe and the motor is no different than having an isolator between a motor and its frame or any other automotive components as the components subject to NVH are being isolated from adjacent parts to minimize transmission of NVH. Accordingly, the motivations for a POSA to apply the teachings of Boucheret (and/or the general knowledge of a POSA) into Poertzgen's mechanism by placing an isolator between the motor and its sub-frame are the same motivations that render it equally obvious to couple an isolator between any other components, including between the sub-frame and an exterior housing. In each case, placing a resilient isolator between a component that might generate, be subject to, or generally is in the path of NVH transmission of and its surrounding components is nothing but an obvious and predictable design choice improvement to reduce NVH between those components whether they be a sub-frame and the

motor and/or gears mounted to the sub-frame or a sub-frame and exterior housing, as it combines well-known prior art elements using known methods to obtain the predictable result of damping NVH between those components. Regardless of the actual automotive components, a POSA would have a reasonable expectation of success in reducing the transmission of NVH between those automotive components by placing a resilient isolator between.

201. As such, Poertzgen in view of Boucheret teaches or suggests "*a sub-frame isolator having a spring constant and a damping constant, said isolator disposed between said sub-frame and an actuator housing*" as recited by claim 16 of the '415 Patent. Accordingly, Poertzgen in view of Boucheret renders claim 16 obvious.

### 9. Independent Claim 17

#### i. Claim Limitations [17A]-[17E], [17G]

202. Limitations [17A]-[17B] are identical to limitations [2A]-[2B]. Limitation [17C] is virtually identical to limitations [2C]-[2D] as the structure in Poertzgen that teaches or suggests limitations [2C]-[2D] is the same structure (the drive pulley and driven pulley coupled via a drive belt) that teaches or suggests limitation [17C]. Limitation [17D] is virtually identical to limitation [2E], limitation [17E] is virtually identical to limitation [6E], and limitation [17G] is identical to limitation [2F]. Poertzgen teaches or suggests limitations [17A]-[17E] and [17G]

for at least the reasons described above with respect to these identified identical or virtually identical limitations.

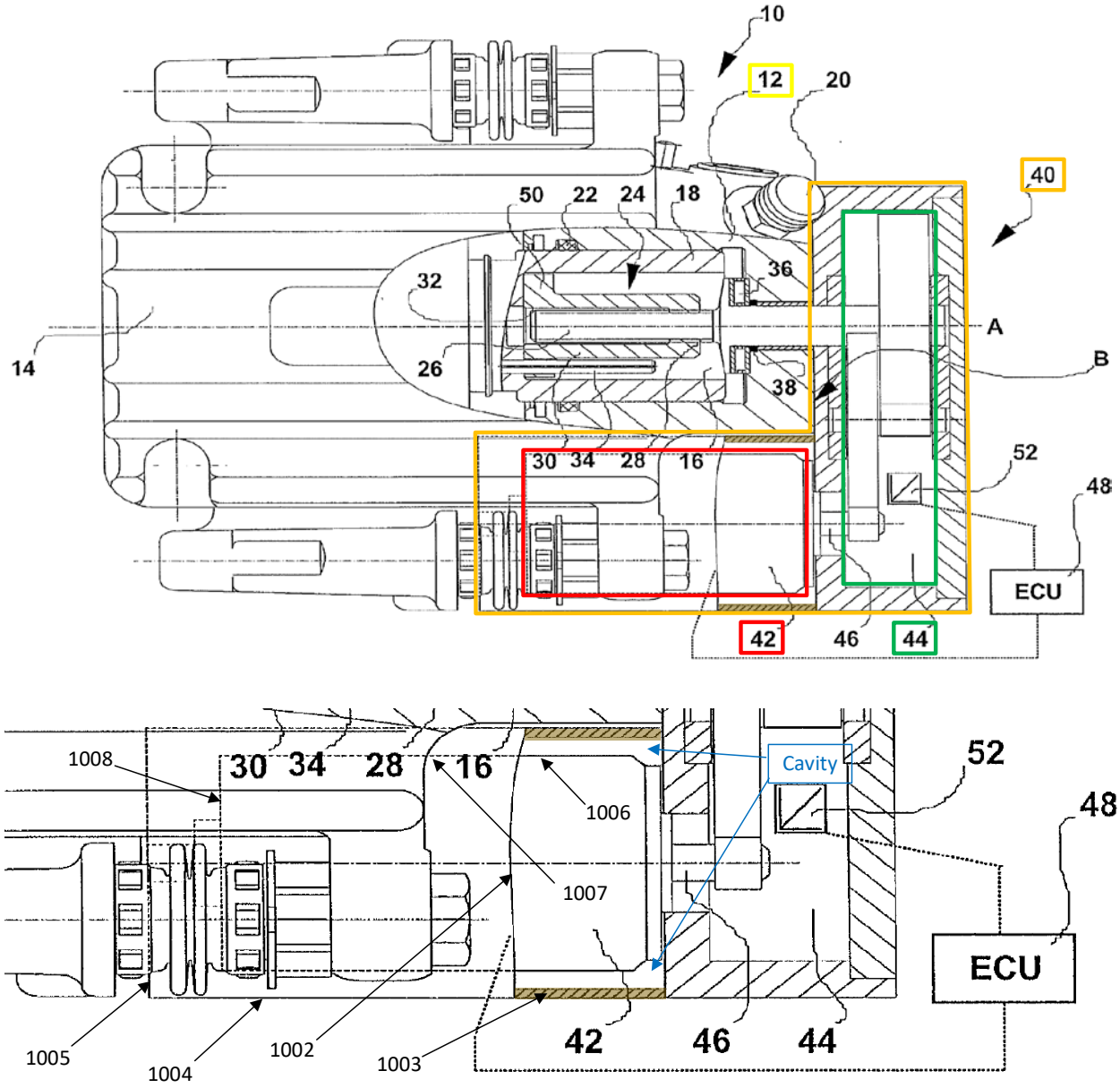
**ii. Claim Limitation [17F]: "and a component isolator having a spring constant and a damping constant disposed between said sub-frame and an actuator housing; and"**

203. Limitation [17F] is virtually identical to limitation [16E], and is likewise rendered obvious by Poertzgen in view of Boucheret for at least the same reasons set forth above with respect to limitation [16E]. As such, Poertzgen in view of Boucheret renders claim 17 of the '415 Patent obvious.

**10. Dependent Claim 18**

204. Claim 18 depends from claim 17 adding that "*said actuator housing comprising a motor isolation cavity receiving at least a portion of said motor, wherein said sub-frame cooperates with said housing to separate said motor from at least one of said drive gear, driven gear and said planetary gear set.*" As explained above, Poertzgen in view of Boucheret renders claim 17 obvious and the additional limitation in claim 18 is virtually identical to that of limitation [9E] and claim 10. Poertzgen teaches or suggests this additional limitation for at least the reasons set forth above with respect to [9E] and 10. Particularly, Poertzgen Figure 1 (reproduced and annotated below), shows an actuator housing comprising a motor isolation cavity that receives the motor 42, and a sub-frame that cooperates with the

housing to separate the motor (**red**) from the various gears (**green**), which are located on the opposite side of the sub-frame.




Ex. 1007, Figure 1 (annotated), top, with details of the motor, and the cavity surrounding it, bottom

205. As such, Poertzgen in view of Boucheret renders claim 18 of the ’415 Patent obvious.

#### 11. Dependent Claim 19

206. Claim 19 depends from claim 17 adding “*a motor isolator having a spring constant and a damping constant, said motor isolator disposed between said motor and said mounted plate*.” Poertzgen in view of Boucheret renders claim 17 obvious for at least the reasons set forth above. Further, claim 19 is virtually identical to that of limitation [5F] as the sub-frame is but one example of a mounted plate and Poertzgen in view of Boucheret teaches or suggests claim 19 for at least the reasons set forth above with respect to limitation [5F].

207. Accordingly, Poertzgen in view of Boucheret renders claim 19 of the ’415 Patent obvious.

### E. Ground C: Claim 1 Is Invalid as Obvious Over Poertzgen in view of Schumann

208. Poertzgen in view of Schumann renders claim 1 of the ’415 Patent obvious.

#### 1. Independent Claim 1

##### i. Claim Limitations [1A]-[1C] and [1E]-[1F]

209. Limitations [1A]-[1C] are identical to limitations [2A]-[2C], and limitations [1E] and [1F] are identical to limitations [2E] and [2F]. As such,

Poertzgen teaches or suggests limitations [1A]-[1C] and [1E]-[1F] for at least the reasons set forth above.

**ii. Claim Limitation [1D]: "said drive gear and said driven gear comprising a worm gear and a worm wheel in meshing equipment."**

210. Limitation [1D] adds that "*said drive gear and said driven gear comprising a worm gear and a worm wheel in meshing engagement*." Poertzgen discloses various well-known gears such as spur gears, belt gears, etc., (*see* Ex. 1007, 2:31-3:8), but does not specifically reference a worm gear and worm wheel. However, worm gears and an associated worm wheel, as well as their operation were well known within the art, and a POSA would have found the specification of a worm gear and worm wheel an obvious and interchangeable design choice (as it would the specification of any well-known type of gearing). Indeed, gearing selection is simply dependent upon well-understood design considerations such as space, efficiency, desirable gear ratio, and geometrical constraints. Ex. 1015, for instance, provides a graphical overview of some available choices. Ex. 1016 is a different overview of possible types of gears. Worm gears are represented as Figure 12, and pages A148-A149. The same Ex. 1016 shows spur gears (Figure 3, pages A145-A146) as well as planetary gears (Figure 4, page A146). Planetary gears are classified as a type of spur gears with internal (ring) gear meshing. Ex. 1017, a classic treatise of gear technology, lists gear types in Table 2.1, titled: "General

Comparison of Gear Types". This includes spur gears and worm gears (cylindrical and double-enveloping) among others. According to the Index, the phrase "Worm gears" appears in 41 distinct places in the book, with the word "worm" by itself appearing a number of other times. Ex. 1017 at 17-18.

211. Schumann explicitly discloses the use of a worm gear and worm wheel in a parking brake actuator. Ex. 1009, Abstract, 2:21-61, 4:29-36 ("As a locking gear, a worm gear (not shown) can for instance be considered, instead of the spindle gear 18, 20 used in the exemplary embodiment."). Schumann expressly considers various well-known gear types (as any POSA would do), and as an example, selects one of the known and possible design choices such as a spindle gear for an electric brake and substitutes that gear with a worm gear when the brake is limited to a parking-brake function to provide self-locking capability. Ex. 1009, 4:33-36.

212. As taught in Schumann, (and as would be known by a POSA in any event, as seen more generally in Exhibits 1015, 1016, and 1017), a POSA would have been motivated to use a worm gear and wheel as a drive gear and a driven gear in Poertzgen's parking brake actuator as this choice of a worm gear and wheel (indeed, using any geometry of well-known gear pairs) is nothing more than the design choice of using a known technique (having a worm gear and worm wheel in driving engagement to drive an output in a parking brake actuator) to improve a device design (*e.g.*, Poertzgen's parking brake actuator) in the same way due to other

design considerations. Indeed, using any geometry of well-known types of gear pairs would be an obvious application of a known technique to improve Poertzgen's parking brake actuator based on other design factors and the benefit of Schumann's express description of worm gears and wheels (and their well-known advantage and benefits as exemplarily described in Ex. 1007, 2:12-3:8; Ex. 1009, 4:29-36, Figure 1) would have been appreciated by a POSA when considering Poertzgen's other design parameters particularly given the similarities in the parking brake actuators described in Schumann and Poertzgen. Generally speaking, worm gears are known to "provide considerably higher reduction ratios than simple crossed-axis gear sets". Ex. 1017 at page 2.19. As pointed out by Schumann in Ex. 1009 at 4:33, they can be self-locking. This is also said in Ex. 1017 at page 2.21: "A worm set can be used where irreversibility is desired, since, if the lead angle is less than the friction angle, the wheel cannot drive the worm. Usually, worms with lead angles less than 5° are self locking." "Irreversibility" here is used interchangeably with self-locking. The use of a worm gear in a parking brake application, where the brake must be maintained in the engaged position, would thus have been obvious for a POSA at the time.

213. Further, a POSA would have recognized that the worm gear and wheel of Schumann would operate in Poertzgen to transfer motion from the electric motor to drive an actuator output in the same manner as it operates in Schumann. As such,

the substitution of various types of well-known and interchangeable gear pairs for other gear pairs, including meshing worm gears and wheels, was well within the general knowledge of the POSA and provides a reasonable expectation of success as no technical hurdles exist for this type of known substitution and utilizing worm gears and wheels would be a simple mechanical modification to Poertzgen that a POSA could readily accomplish.

214. As such, Poertzgen in view of Schumann teaches or suggests "*said drive gear and said driven gear comprising a worm gear and a worm wheel in meshing engagement*" as recited in claim 1 of the '415 Patent. Since Poertzgen in view of Schumann teaches or suggests all claim elements of claim 1, claim 1 of the '415 Patent is, thus, rendered obvious in view of Poertzgen and Schumann.

### F. Ground D: Claims 6, 10-13 Are Invalid as Obvious Over Poertzgen in view of Drennen

215. Claims 6 and 10-13 of the '415 Patent are rendered obvious by Poertzgen in view of Drennen.

#### 1. Independent Claim 6

##### i. Claim Limitations [6A]-[6D], [6F]

216. Limitations [6A]-[6C], [6F] are identical to limitations [2A]-[2C], [2F], and limitation [6D] is identical to limitation [2E]. Poertzgen teaches or suggests each of the limitations [6A]-[6D] and [6F] at least for the same reasons described above for limitations [2A]-[2C], [2E], and [2F].

**ii. Claim Limitation [6E]: "a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame"**

217. As discussed above, Poertzgen teaches or suggests "*a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame*." In addition to Poertzgen, Poertzgen and Drennen also teach or suggest "*a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame.*"

218. As noted above with respect to limitation [2E], Poertzgen discloses the use of a planetary gear in combination with a belt gear (or drive) as a two-stage reduction gear. Ex. 1007, 2:31-3:8. Poertzgen also explains that its electric motor 42 and reduction gears 44, which are located on opposite sides of a plate, together comprise a subassembly 40. Ex. 1007, Abstract, 2:24-30, 8:5-16. This subassembly "can be manipulated independently and combined with various vehicle brakes of one type" (Ex. 1007, 2:24-25, 8:9-11), and provides both manufacturing benefits and greater flexibility with respect to the attachment of the subassembly to the various brakes it would actuate. *Id.*, 2:24-30.

219. Drennen discloses a similar electromechanical brake actuator with a pulley assembly 62 that includes mounting block 126 (the claimed sub-frame). Ex. 1011, 5:38-45, 7:26-32, Figure 2. As can be seen in Drennen's Figure 2 (reproduced

and annotated below), a motor 12 (**red**) and pulley gears 64 and 66 (**green**) are mounted on mounting block 126 (**orange**).

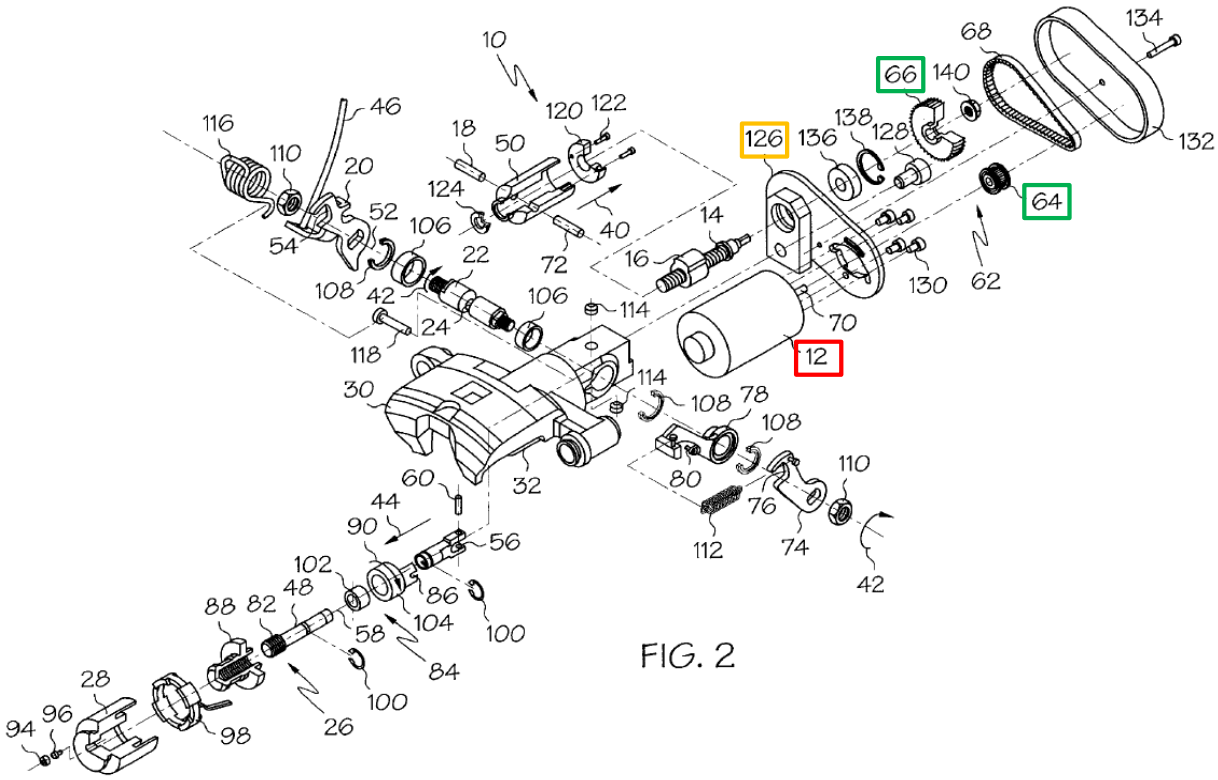
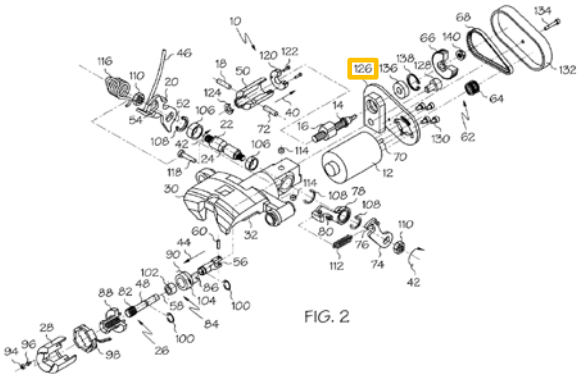
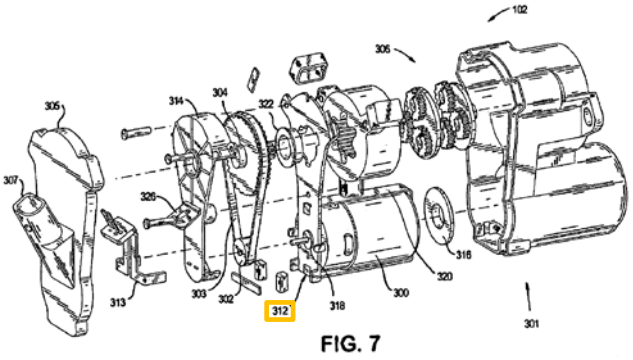



FIG. 2

Ex. 1011, Figure 2 (annotated)

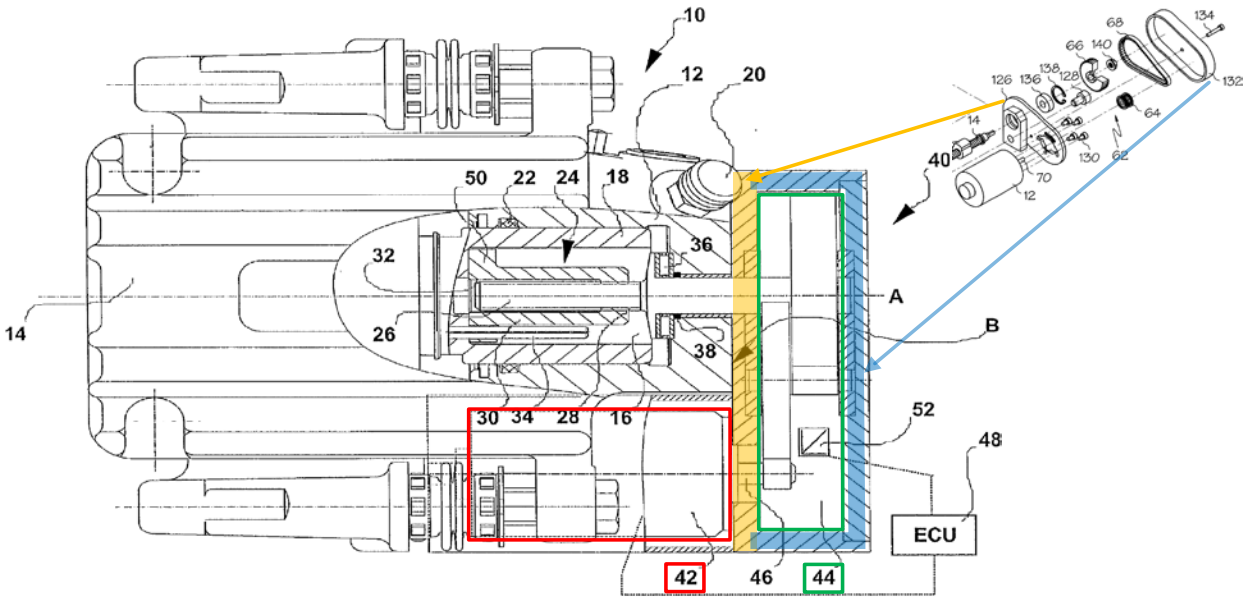
220. As seen in the annotated figures of Drennen and the '415 Patent below, the mounting block 126 (denoted in **orange**) to which the motor 12 and various gears are mounted is essentially the same as the sub-frame 312 shown in Figure 7 of the '415 Patent, to which the motor 300 and various gears, *e.g.*, 302, 304, 306 are mounted. This is made visually obvious as both figures are isometric views, showing three-dimensional renditions of the "mounting block" (Drennen) and "subframe" ('415).




Ex. 1011, Figure 2 (annotated) Ex. 1001, Figure 7 (annotated)

221. It would have been obvious to a POSA that the components of Poertzgen's subassembly 40, such as the electric motor 42 and the reduction gears 44, could be mounted to a sub-frame, such as the mounting block 126 of Drennen, thereby forming a motor and planetary gear mounts on a sub-frame as required by limitation [6E] of the '415 Patent. Below, annotated Figure 1 of Poertzgen and an annotated excerpt of Figure 2 of Drennen illustrates such a combination.




Ex. 1007, Figure 1 (annotated) and Ex. 1011, Figure 2 (annotated excerpt)

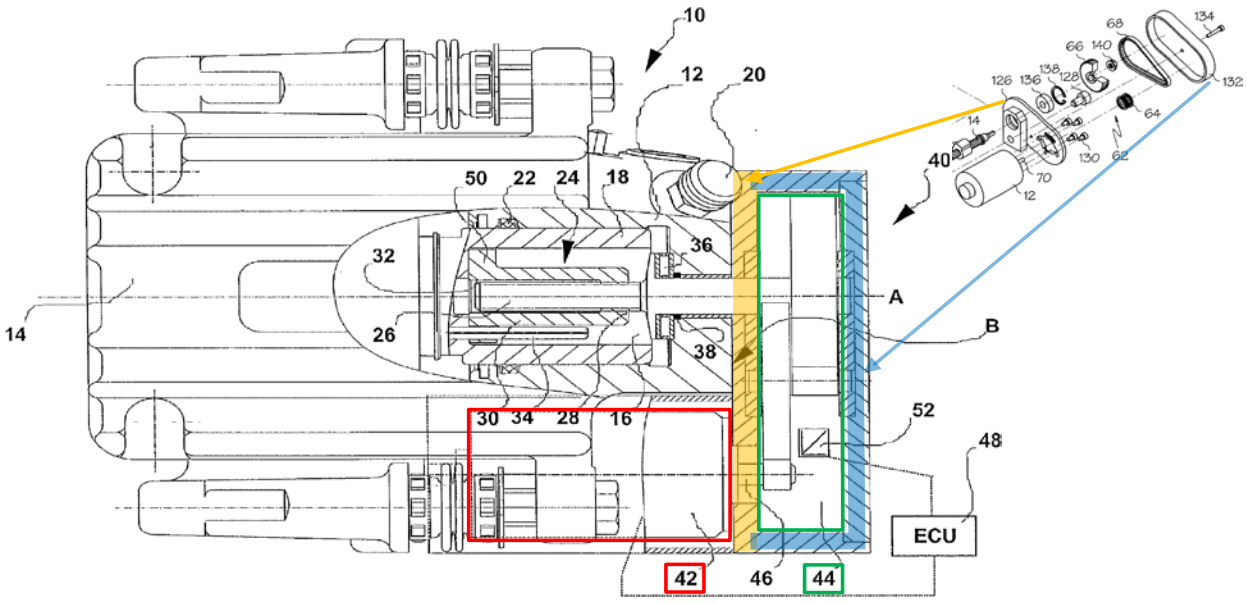
222. Combining the teachings of Poertzgen and Drennen would have been obvious to a POSA. Mounting Poertzgen's electric motor 42 and two-stage reduction gear on a sub-frame, as taught by Drennen, is the use of a known technique (mounting brake actuator components such as a motor and gears on a sub-frame) to improve a similar device (Poertzgen's actuator subassembly containing a motor and gears) in the same way (maintaining structural stability and alignment of components in a subassembly) combines well-known prior art elements (Poertzgen's subassembly 40, containing a motor and gears, and Drennen's mounting block for the motor and gears in a subassembly) according to well-known methods (mounting Poertzgen's motor and gears to a mounting block) to yield predictable results (providing component alignment and structural support to the subassembly). Further, a POSA would have had a reasonable expectation of success in using Drennen's sub-frame in Poertzgen's subassembly as mounting components on a sub-frame utilizes well-known and simple manufacturing techniques that were within the skill level of a POSA.

223. As such, Poertzgen in view of Drennen teaches or suggests "*a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame*" as recited by claim 6 of the '415 Patent. Thus, Poertzgen in view of Drennen render claim 6 obvious.

### 2. Dependent Claim 10

224. Claim 10 depends from claim 9 adding that "*said covering member comprises a sub-frame*." As set forth above claims 9 and 10 are taught by Poertzgen as the covering member of Poertzgen in the claimed sub-frame. In addition, Poertzgen in view of Drennen as described above with respect to claim 6 also teaches or suggests that "*said covering member comprises a sub-frame.*"

225. As seen below in the annotated Poertzgen Figure 1 and Drennen Figure 2, the mounting block 126 of Drennen (the claimed sub-frame) covers the motor cavity in the Poertzgen and Drennen combination as Poertzgen's electric motor 42, in its cavity, would be mounted to and covered by the mounting block 126 (sub-frame) of Drennen.



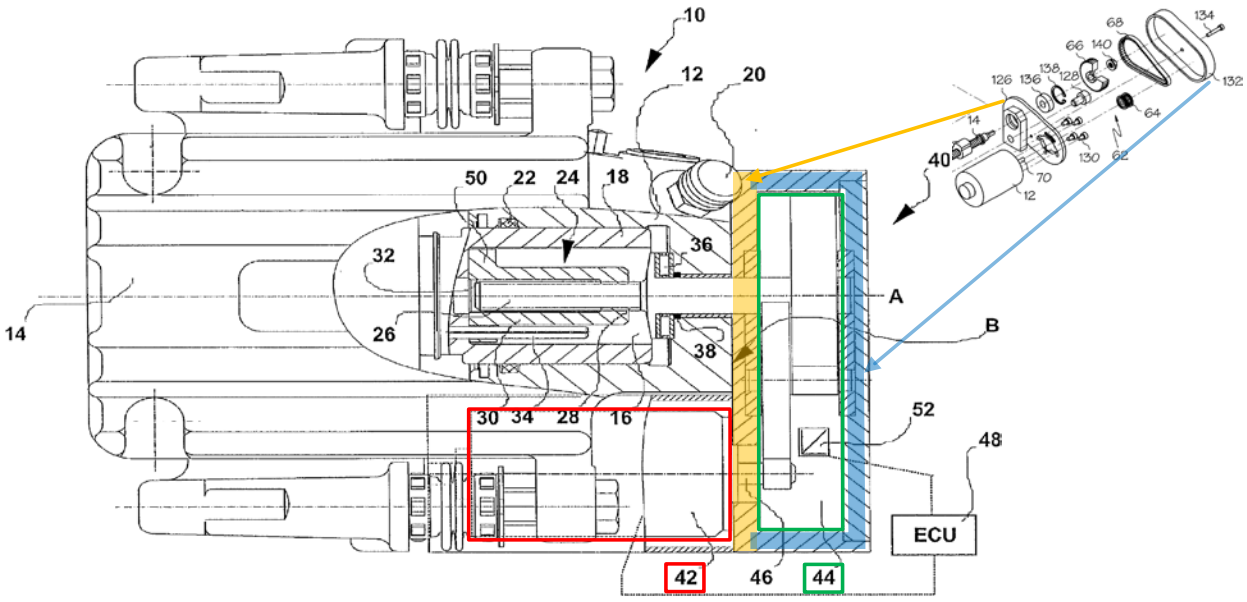

Ex. 1007, Figure 1 (annotated) and Ex. 1011, Figure 2 (annotated excerpt)

226. A POSA's motivations to incorporate the mounting block 126 of Drennen (sub-frame) and Poertzgen's subassembly 40 are set forth above with respect to claim 6. As such, Poertzgen in view of Drennen renders claim 10 of the '415 Patent obvious.

### 3. Independent Claim 11

227. As set forth above, claim 11 is rendered obvious by Poertzgen. In addition, claim 11 is rendered obvious by Poertzgen in view of Drennen. The motivation to incorporate the teachings of Drennen into Poertzgen's subassembly 40 are set forth above with respect to claim 6.

228. In the Poertzgen and Drennen combination described above, claim 11's "*motor and at least one of said driven gear and said planetary gear set*" that is taught or suggested by Poertzgen is mounted on a sub-frame as taught or suggested by Drennen. As described above, the Drennen sub-frame separates the gears in the gear cavity of the Poertzgen and Drennen combination from the motor and the motor cavity. Further, the actuator housing of the Poertzgen and Drennen combination (depicted below from annotated Poertzgen Figure 1 and annotated Drennen Figure 2) forms a cavity receiving at least a portion of the planetary gear set (outlined in **green**).




Ex. 1007, Figure 1 (annotated) and Ex. 1011, Figure 2 (annotated excerpt)

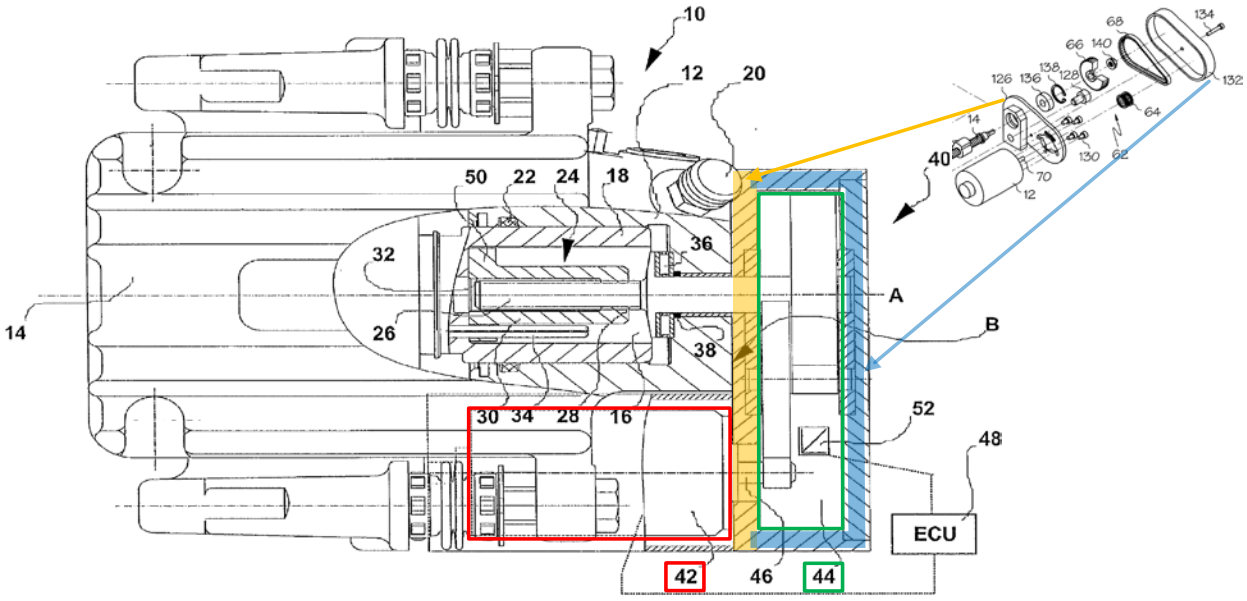
229. As such, Poertzgen in view of Drennen renders claim 11 of the '415 Patent obvious.

#### 4. Dependent Claim 12

230. Claim 12 depends from claim 11 adding that the parking brake system "*further comprising an actuator housing defining a planetary gear set cavity receiving at least a portion of said planetary gear set, wherein cooperation between said housing and said sub-frame separate said planetary gear set from a remainder of said actuator.*"

231. As described above, claim 12 is rendered obvious by Poertzgen. Claim 12 is also rendered obvious by Poertzgen in view of Drennen. The motivation to incorporate the teachings of Drennen into Poertzgen's subassembly 40 are set forth above with respect to claim 6.

232. Further, as seen in the Figure below showing the Poertzgen and Drennen combination, Poertzgen in view of Drennen teaches or suggests claim 12's "*cooperation between said housing and said sub-frame separate said planetary gear set from a remainder of said actuator*". As described above, this is because the sub-frame (**yellow**) separates the gears in the gear cavity (**green**) of the Poertzgen and Drennen combination from the motor and the motor cavity (**red**). Further, the actuator housing of Poertzgen and Drennen combination forms a cavity receiving at least a portion of the planetary gear set (outlined in **green**).




Ex. 1007, Figure 1 (annotated) and Ex. 1011, Figure 2 (annotated excerpt)

233. As such, Poertzgen in view of Drennen renders claim 12 of the '415 Patent obvious.

### 5. Independent Claim 13

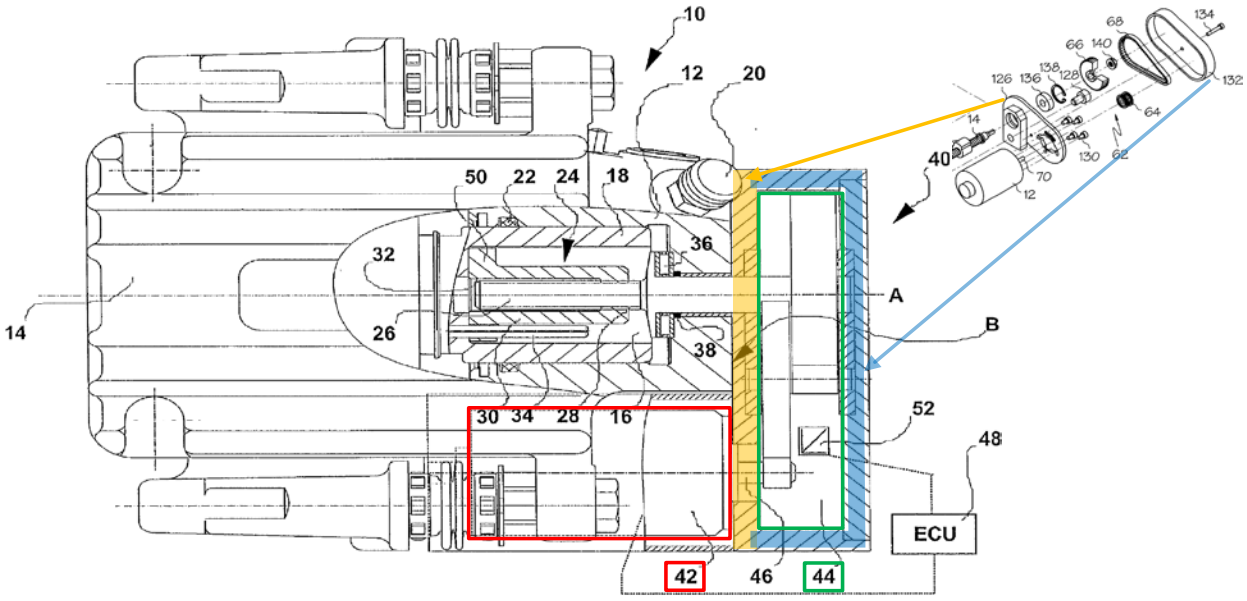
234. As described above, claim 13 is rendered obvious by Poertzgen. Claim 13 is also rendered obvious by Poertzgen in view of Drennen. The motivation to incorporate the teachings of Drennen and Poertzgen's subassembly 40 are set forth above with respect to claim 6.

235. The Poertzgen and Drennen combination teaches or suggests limitations [13D] and [13E] because as shown in the above annotated figure combining exemplary disclosures of Poertzgen and Drennen, the gears and motor of the combination are mounted on the sub-frame, and the motor is separated from the remainder of the actuator by the motor housing and sub-frame covering the motor cavity. As such, Poertzgen in view of Drennen renders claim 13 of the '415 Patent obvious.

## G. Ground E: Claims 5, 7-8, 14-19 Are Invalid as Obvious Over Poertzgen in view of Boucheret and Drennen

236. Claims 5, 7-8, and 14-19 of the '415 Patent all require a sub-frame and one or more isolators located between various components and the sub-frame. As explained above, Poertzgen in view of Boucheret renders claims 5, 7-8, and 14-19 obvious. In addition, claims 5, 7-8, and 14-19 are rendered obvious by Poertzgen in view of Boucheret and Drennen.

237. As explained above with respect to claims 6 and 10-13 and the annotated figures below, it would have been obvious to a POSA to have the Poertzgen's motor and gears of Poertzgen mounted to Drennen's sub-frame.




Ex. 1007, Figure 1 (annotated) and Ex. 1011, Figure 2 (annotated excerpt)

238. The motivations for using Drennen's mounting plate 126 (the sub-frame) with Poertzgen's subassembly 40 are also described above with respect to claims 6 and 10-13. The motivations for using various isolators, as taught by Boucheret, between various components, including between the sub-frame and various other components, are set forth above with respect to the discussion of combining Poertzgen and Boucheret. The motivations for using isolators between two components in general, and placing them between the sub-frame and other components, do not change regardless of whether it is Poertzgen's sub-frame, or the sub-frame described in the combination of Poertzgen and Drennen.

239. As such, Poertzgen in view of Boucheret and Drennen render claims 5, 7-8, and 14-19 obvious.

## H. Ground F: Claims 6 and 10-13 Are Invalid as Obvious Over Poertzgen in View of Weiler

### 1. Independent Claim 6

#### i. Claim Limitations [6A]-[6D] and [6F]

240. Limitations [6A]-[6C], [6D], and [6F] are identical to limitations [2A]-[2C], [2E], and [2F], and Poertzgen teaches or suggests these limitations for at least the reasons described above.

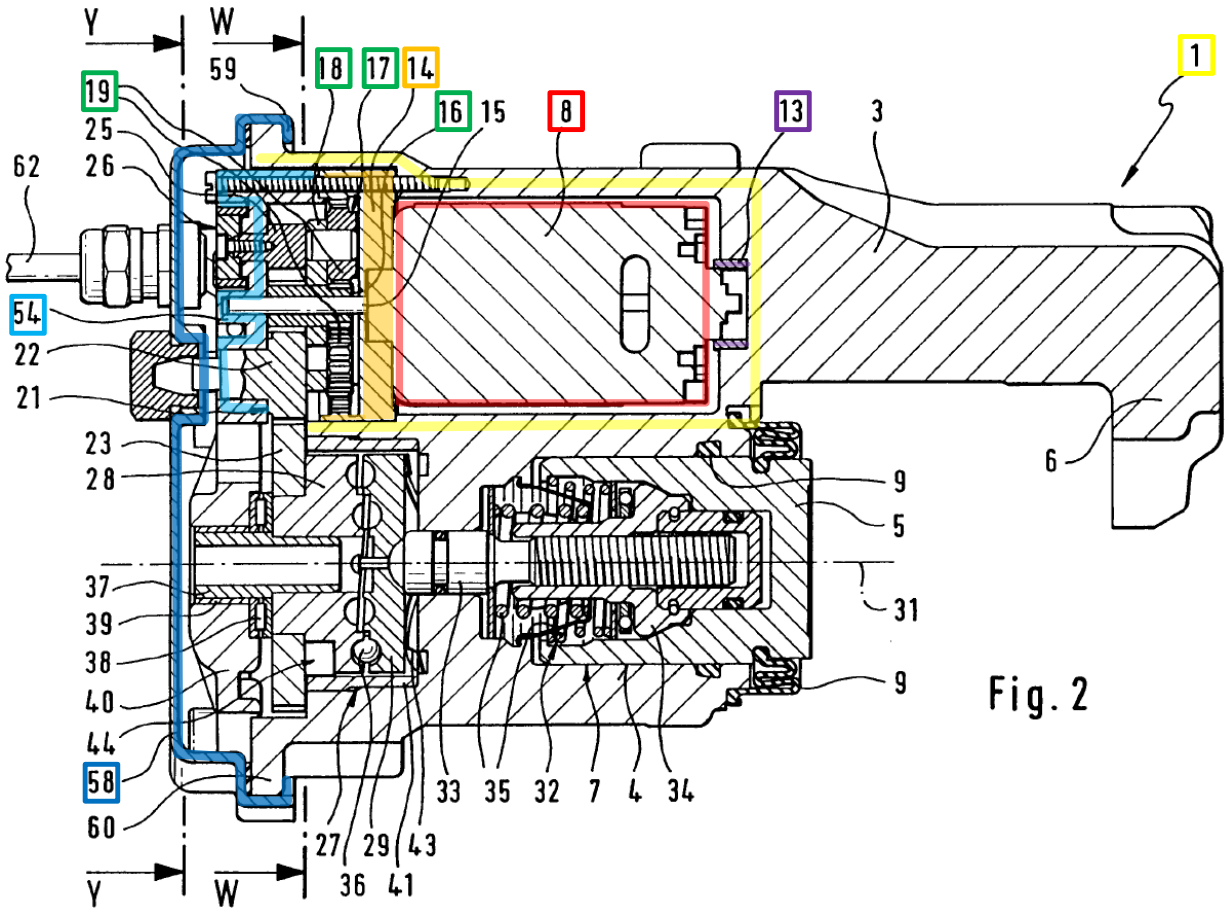
#### ii. Claim Limitation [6E]: "a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame"

241. As described above, Poertzgen teaches or suggests "*a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame*". Additionally, Poertzgen and Weiler also teach or suggest "*a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame.*"

242. As described above, Poertzgen teaches or suggests using a planetary gear in combination with a belt gear as a two-stage reduction gear. Ex. 1007, 2:31-3:8. Poertzgen further describes that its electric motor 42 and reduction gears 44 together comprise a subassembly 40 which "can be manipulated independently and combined with various vehicle brakes of one type" to provide manufacturing

benefits, and greater flexibility with respect to the attachment of the subassembly to the various brakes it would actuate. Ex. 1007, Abstract, 2:24-30, 8:5-16.

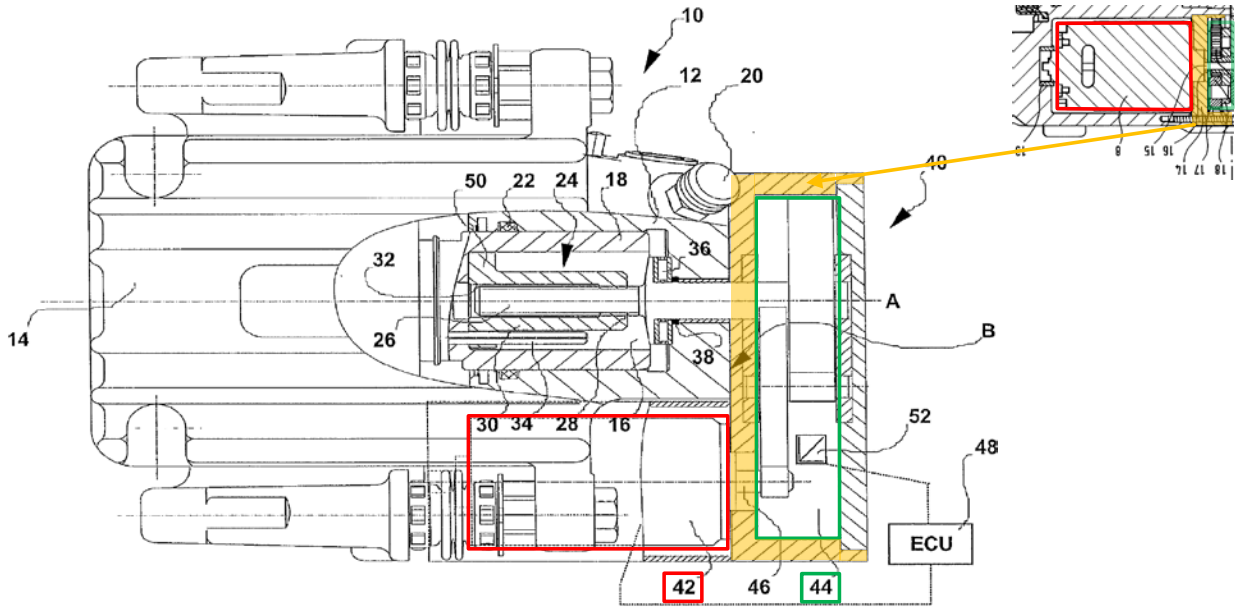
243. As can be seen in Figure 2 (reproduced and annotated below), Weiler describes a similar electromechanical brake actuator with a subassembly including, *e.g.*, planetary gears 17, 18, 19 (**green**) and electric motor 8 (**red**) that includes a bearing plate 14 (**orange**) (the claimed sub-frame). Ex. 1012, 2:17-28, 5:22-25, 6:10-7:2, 8:16-9:6, 13:28-14:9, Figures 1-4.




Ex. 1012, Figure 2 (annotated)

244. Weiler's bearing plate 14 (to which the motor 8 and the various gears, *e.g.*, sun gear 16 and planetary gears 17-19, are mounted) is essentially the same as the sub-frame 312 shown in Figure 7 of the '415 Patent, to which the motor 300 and various gears, *e.g.*, 302, 304, 306 are mounted.

245. As shown in the annotated figures below, it would have been obvious to a POSA that the components of Poertzgen's subassembly 40 (*e.g.*, electric motor 42 and reduction gears 44), could have been mounted to Weiler's bearing plate 14 (the sub-frame), thereby forming a motor and at least one planetary gear set mounted on a sub-frame.




Ex. 1007, Figure 1 (annotated) and Ex. 1012, Figure 2 (rotated excerpt, annotated)

246. Mounting Poertzgen's electric motor 42 and two-stage reduction gears 44 on Weiler's sub-frame was obvious as it simply uses known techniques

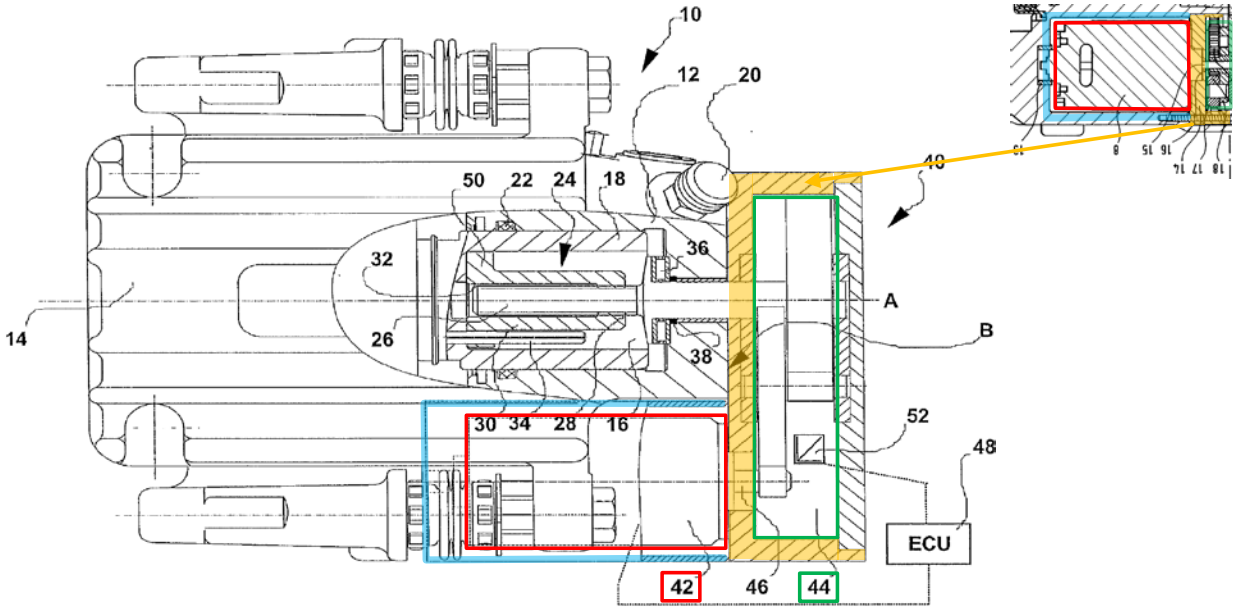
(mounting brake actuator components such as a motor and gears on a sub-frame) to improve a similar device (Poertzgen's actuator subassembly containing a motor and gears) in the same way of maintaining structural stability and alignment of components in a subassembly allowing for beneficial modular construction. A POSA would have had a reasonable expectation of success in mounting Poertzgen's subassembly on Weiler's sub-frame as such simple manufacturing techniques (mounting components on a sub-frame) were well-known and within the skill level of the POSA. Further, the proposed combination combines well-known prior art elements such as Poertzgen's subassembly 40 (including an electric motor and gears), and Weiler's bearing plate for the motor and gears in a subassembly according to known methods of mounting motors and gears to a mounting plate to yield predictable results: providing component alignment and structural support to the subassembly and allowing for modular construction.

247. As such, Poertzgen in view of Weiler teaches or suggests "*a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame*" as recited by claim 6 of the '415 Patent. Thus, Poertzgen in view of Weiler renders claim 6 obvious.

**2. Dependent Claim 10**

248. Claim 10 depends from claim 9 adding that "*said covering member comprises a sub-frame.*" As explained previously, Poertzgen teaches or suggests all

the limitations of claims 9 and 10. Additionally, Weiler's bearing plate 14 (the claimed sub-frame) (orange) covers the motor cavity in the combined Poertzgen and Weiler combination, as described above with respect to claim 6, because Poertzgen's motor, in its cavity, would be mounted to and covered by the sub-frame of Weiler.




Ex. 1007, Figure 1 (annotated) and Ex. 1012, Figure 2 (rotated excerpt, annotated)

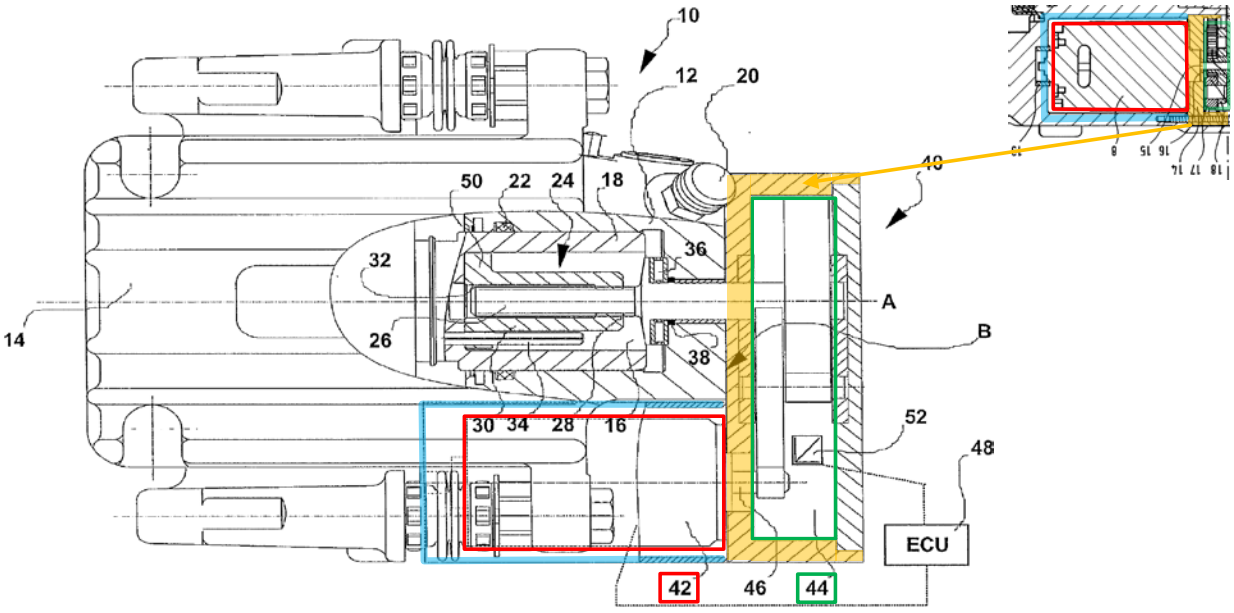
249. The motivations for incorporating the bearing plate 14 (sub-frame) of Weiler and Poertzgen's subassembly 40 are set forth above regarding the discussion with respect to claim 6. As such, Poertzgen in view of Weiler renders claim 10 obvious.

### 3. Independent Claim 11

250. As explained above, Poertzgen renders claim 11 obvious. Additionally, claim 11 is rendered obvious by Poertzgen in view of Weiler. The motivations for

incorporating the bearing plate 14 (sub-frame) of Weiler and Poertzgen's subassembly 40 are set forth above with respect to claim 6.

251. In the Poertzgen and Weiler combination described above and as shown in the figure below, the "*motor and at least one of said driven gear and said planetary gear set*" as required by claim 11 are mounted on a sub-frame (**orange**) as taught by Weiler.




Ex. 1007, Figure 1 (annotated) and Ex. 1012, Figure 2 (rotated excerpt, annotated)

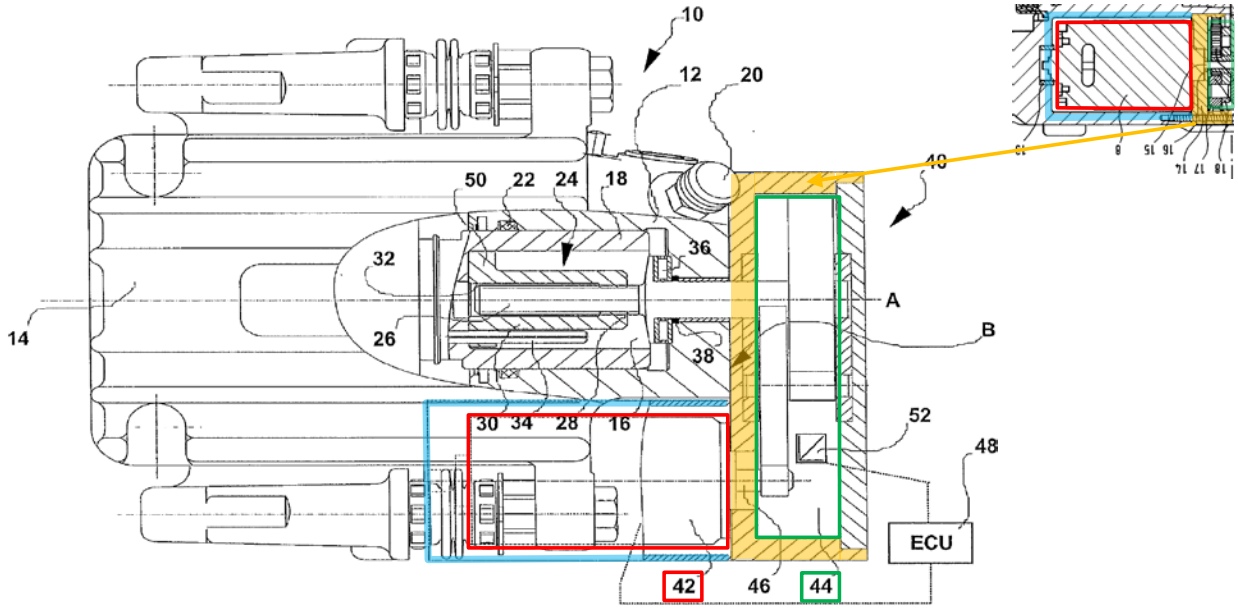
252. As such, Poertzgen in view of Weiler renders claim 11 obvious.

### 4. Dependent Claim 12

253. As explained above, Poertzgen renders claim 12 obvious. Additionally, claim 12 is rendered obvious by Poertzgen in view of Weiler. As set forth above, Poertzgen in view of Weiler renders claim 11, from which claim 12 depends, obvious. Further, the motivations for incorporating the bearing plate 14 (sub-frame)

of Weiler and Poertzgen's subassembly 40 are set forth above with respect to claim 6.

254. As seen in the figure below, the Poertzgen and Weiler combination teaches or suggests "*cooperation between said housing and said sub-frame separate said planetary gear set from a remainder of said actuator*" as recited in claim 12. This is because the sub-frame (**orange**) separates the gears in the gear cavity (**green**) of Poertzgen from the motor (**red**) and the motor cavity of Poertzgen (**light blue**).




Ex. 1007, Figure 1 (annotated) and Ex. 1012, Figure 2 (rotated excerpt, annotated)

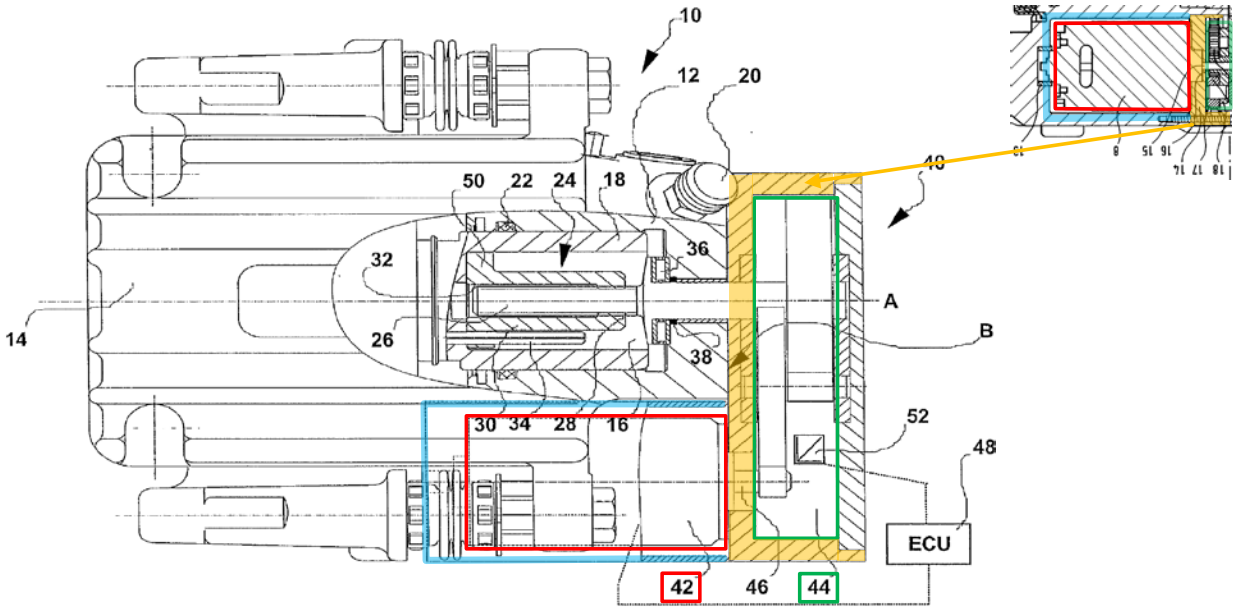
255. As such, Poertzgen in view of Weiler renders claim 12 obvious.

### 5. Independent Claim 13

256. As explained above, Poertzgen renders claim 13 obvious. Additionally, claim 13 is rendered obvious by Poertzgen in view of Weiler. The motivations for

incorporating the bearing plate 14 (sub-frame) of Weiler and Poertzgen's subassembly 40 are set forth above with respect to claim 6.

257. Claim 13 recites that "*said motor and at least a portion of said drive train*" are mounted on a sub-frame and "*cooperation between said housing and said sub-frame separate said motor from a remainder of said actuator*" and this is taught or suggested by Poertzgen and Weiler because as shown for example in the annotated figure below the gears and motor are mounted on the sub-frame, and the motor (**red**) is separated from the remainder of the actuator by the motor housing (**light blue**) and sub-frame (**orange**) covering the motor cavity.



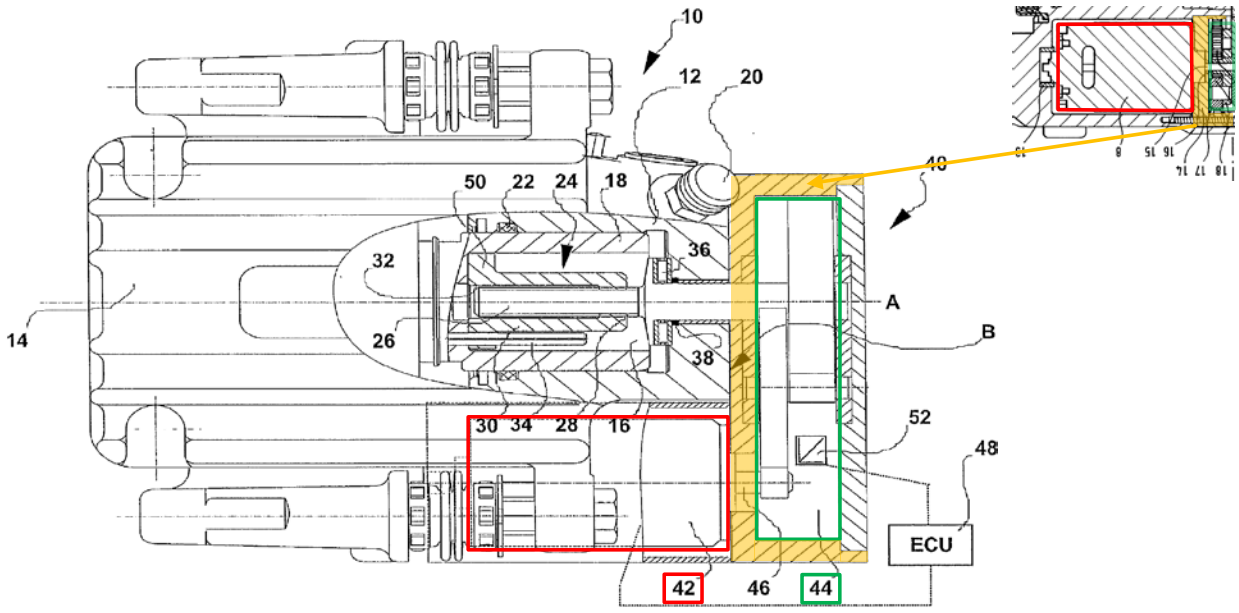

Ex. 1007, Figure 1 (annotated) and Ex. 1012, Figure 2 (rotated excerpt, annotated)

258. Thus, Poertzgen in view of Weiler renders claim 13 of the '415 Patent obvious.

## I. Ground G: Claims 5, 7-8, and 14-19 Are Invalid as Obvious Over Poertzgen in view of Boucheret and Weiler

259. Claims 5, 7-8, and 14-19 of the ’415 Patent all require a sub-frame and one or more isolators located between various components and the sub-frame. As explained previously above, Poertzgen in view of Boucheret renders claims 5, 7-8, and 14-19 obvious. Additionally, claims 5, 7-8, and 14-19 are rendered obvious by Poertzgen in view of Boucheret and Weiler.

260. As explained above with respect to claims 6 and 10-13 and the figure below, it would have been obvious to a POSA to have Poertzgen’s motor and gears mounted to Weiler’s sub-frame.




Ex. 1007, Figure 1 (annotated) and Ex. 1012, Figure 2 (rotated excerpt, annotated)

261. The motivations for using Weiler’s bearing plate 14 (the claimed sub-frame) with Poertzgen’s subassembly 40 are set forth above with respect to claims 6

and 10-13. The motivations for using various isolators, as taught by Boucheret, between various components, including between the sub-frame and various other components, are set forth above with respect to the Poertzgen and Boucheret combination. These motivations for using isolators between two components in general, and placing them between the sub-frame and other components as particularly required by claims 5, 7-8, and 14-19, do not change whether it is the Poertzgen sub-frame, or the sub-frame from the Poertzgen and Weiler combination.

262. As such, Poertzgen in view of Boucheret and Weiler renders claims 5, 7-8, and 14-19 obvious.

### J. Ground H: Claims 20-25 Are Invalid as Obvious Over Weiler

263. As set forth below, Weiler renders claims 20-25 obvious.

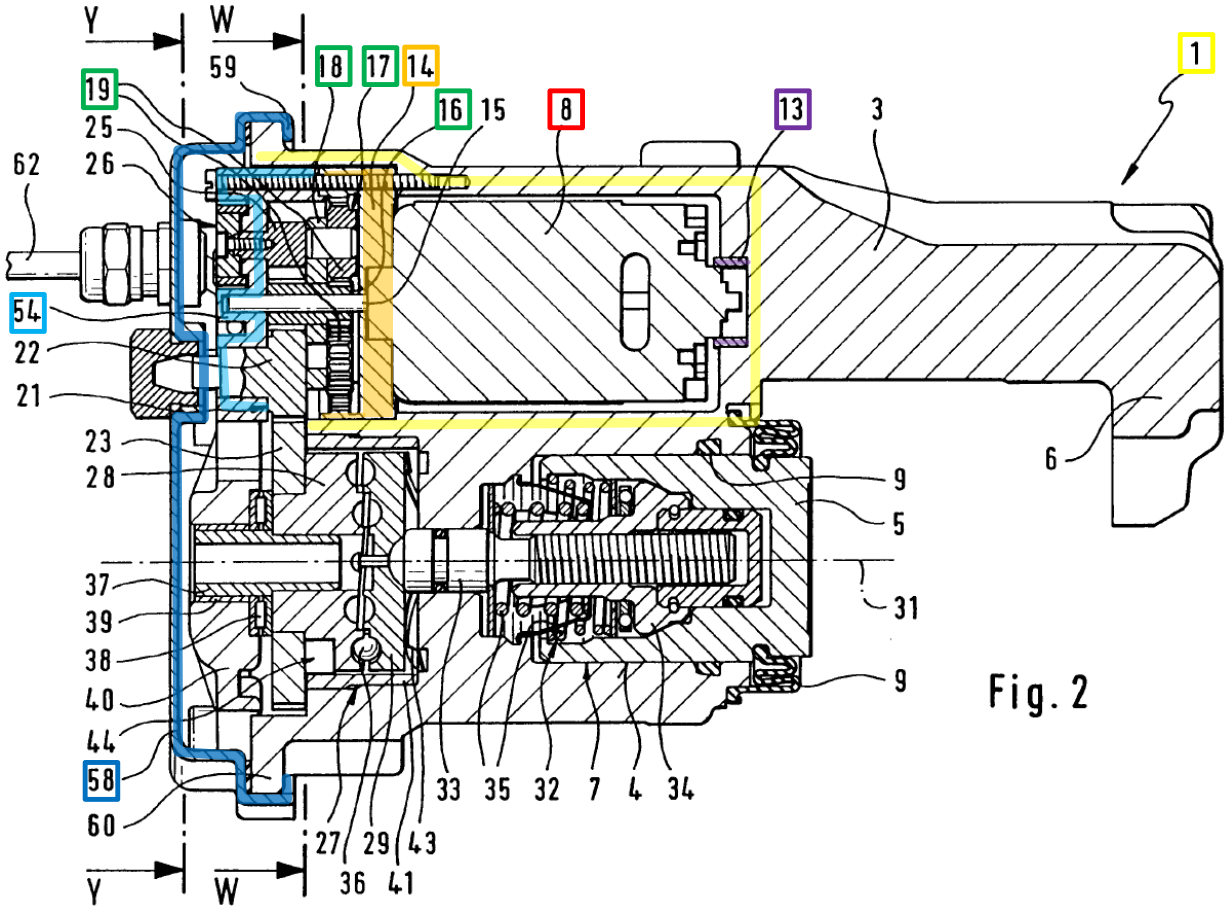
#### 1. Independent Claim 20

##### i. Claim Limitation [20A]: "20. A method of assembling an actuator comprising:"

264. Weiler teaches or suggests "*a method of assembling an actuator*." Particularly, Weiler describes the assembly of an actuator for an electromechanical parking brake. Ex. 1012, Abstract, 2:17-28, 5:17-25, 6:10-7:2, 8:16-25, 13:28-14:29, Figures 1-4.

### ii. Claim Limitation [20B]: "mounting a motor and a gear train to a sub-frame"

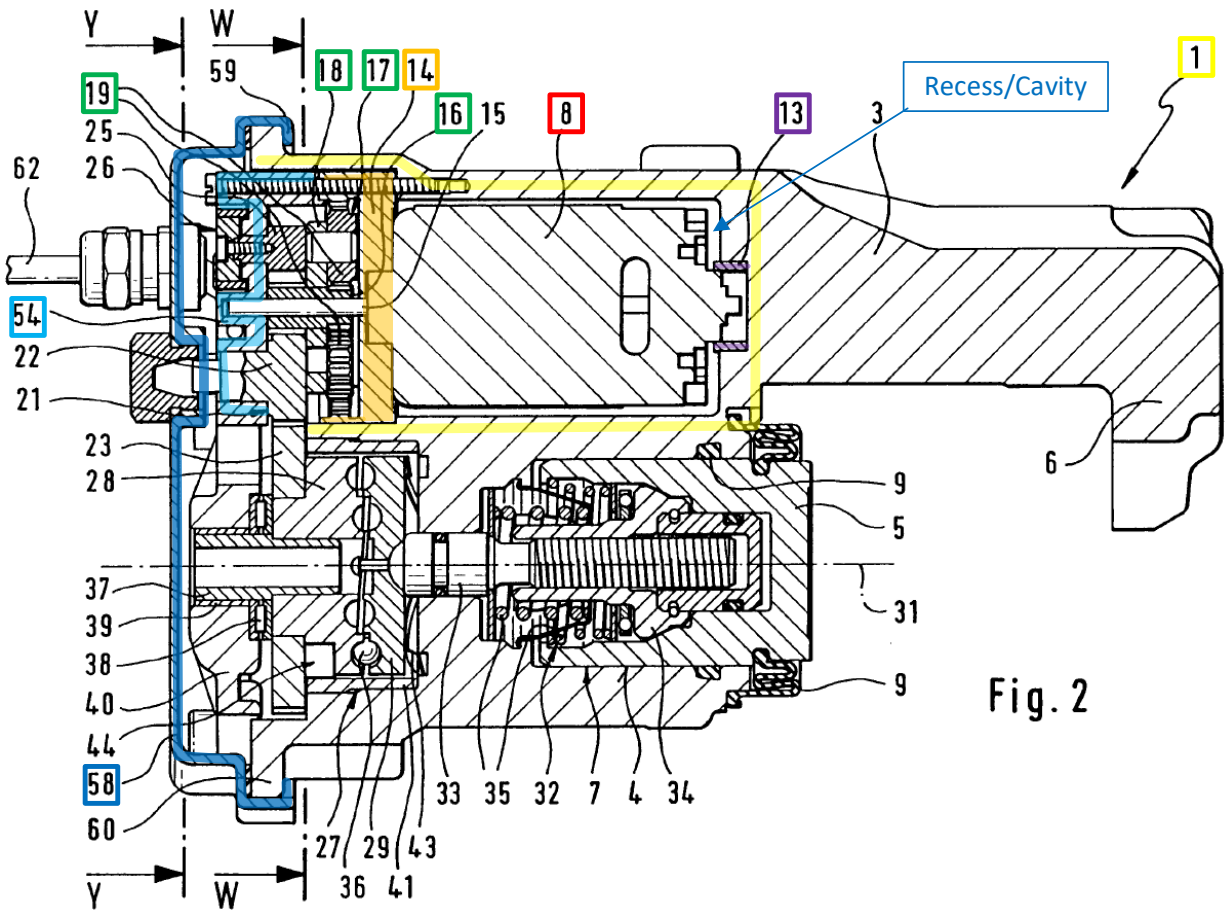
265. Weiler teaches or suggests "*mounting a motor and a gear train to a sub-frame.*" For example and as can be seen in Weiler Figure 2 (reproduced and annotated below), Weiler describes that motor 8 (**red**) and gears, such as 16-19 (**green**), are mounted on bearing plate 14 (**orange**) (the recited *sub-frame*). *See also* Ex. 1012 at 2:17-28, 5:17-25, 6:10-7:2, 8:16-25, 13:28-14:29, Figures 1-4.




Ex. 1012, Figure 2 (annotated)

### iii. Claim Limitation [20C]: "coupling said sub-frame to a portion of an actuator housing to at least partially enclose said motor in a motor isolation cavity defined by said portion of said actuator housing and said sub-frame."

266. Weiler teaches or suggests "*coupling said sub-frame to a portion of an actuator housing to at least partially enclose said motor in a motor isolation cavity defined by said portion of said actuator housing and said sub-frame.*" Ex. 1012, 2:17-28, 5:17-25, 6:10-7:2, 8:16-25, 13:28-14:29, Figures 1-4. Weiler describes "actuator unit [motor 8], reduction gear, and actuator element are disposed in a housing-like recess of the brake caliper." Ex. 1012, 2:17-28, 8:16-25, 13:28-14:29. As shown in Weiler Figure 2 (reproduced and annotated below), the recess of Weiler is the "*motor isolation cavity*" defined by a portion of the "*actuator housing*" (the housing around the recess, shown in **yellow**) and the sub-frame (bearing plate 14, shown in **orange**, positioned over the cavity). A POSA would have understood from Weiler that the portion of the brake caliper surrounding the "housing-like recess 12," houses the actuator's motor and is a portion of the actuator housing. Ex. 1012, 8:18-21.




Ex. 1012, Figure 2 (annotated)

267. As such, Weiler teaches or suggests all the limitations of claim 20 and, therefore, renders claim 20 of the '415 Patent obvious.

**2. Dependent Claim 21**

268. Claim 21 depends from claim 20 adding the step of "*coupling a second sub-frame to said sub-frame to enclose at least a portion of said gear train in a cavity defined by said sub-frame and said second sub-frame.*" Weiler teaches or suggests all claims limitation of claim 20 for at least the reasons set forth above. Weiler also discloses that at least a portion of gears 16-19 (collectively labeled 10 in Weiler

Figure 1) are enclosed in a cavity which is defined by gear cover 54 in Figure 2 (the claimed *second sub-frame*) coupled to bearing plate 14 (the claimed *sub-frame*). Ex. 1012, 2:17-28, 5:17-25, 6:10-7:2, 8:16-25, 13:28-14:29, Figures 1-4. Accordingly, the bearing wall 14 (**orange**) and gear cover 54 (**light blue**) of Weiler enclose the gears of Weiler much like sub-frames 312 (**orange**) and 314 (**light blue**) shown in Figure 7 of the '415 Patent (reproduced and annotated below).

269. Additionally, a POSA who would have the knowledge that a sub-frame is advantageous, would understand and expect that duplicating this component will provide similar results. Such a POSA would know to consider using as many sub-frames as the design may require.

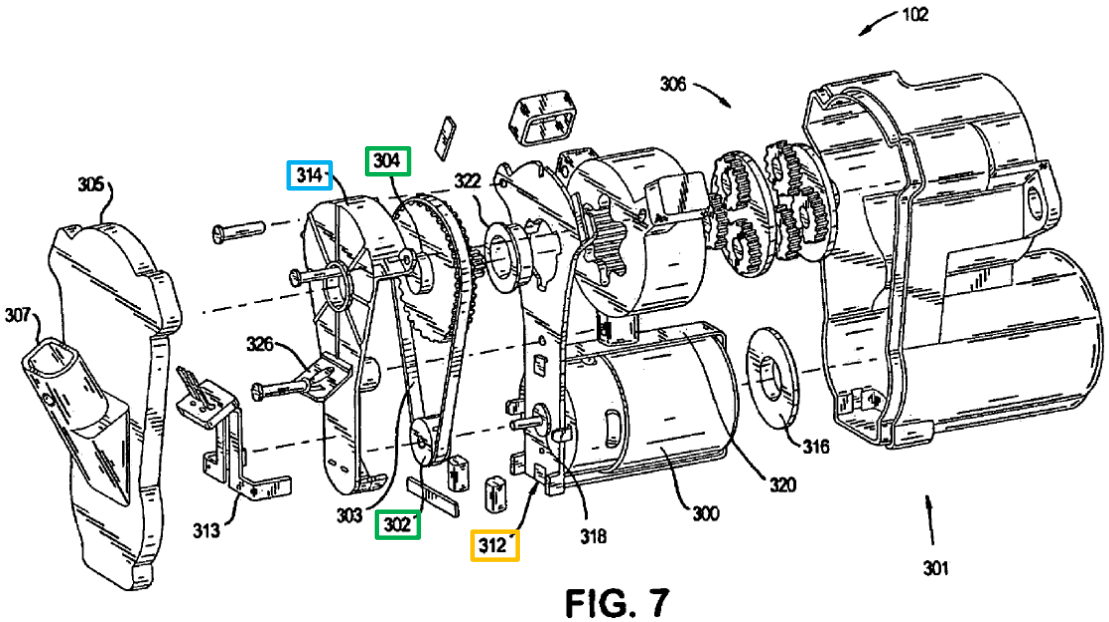


FIG. 7

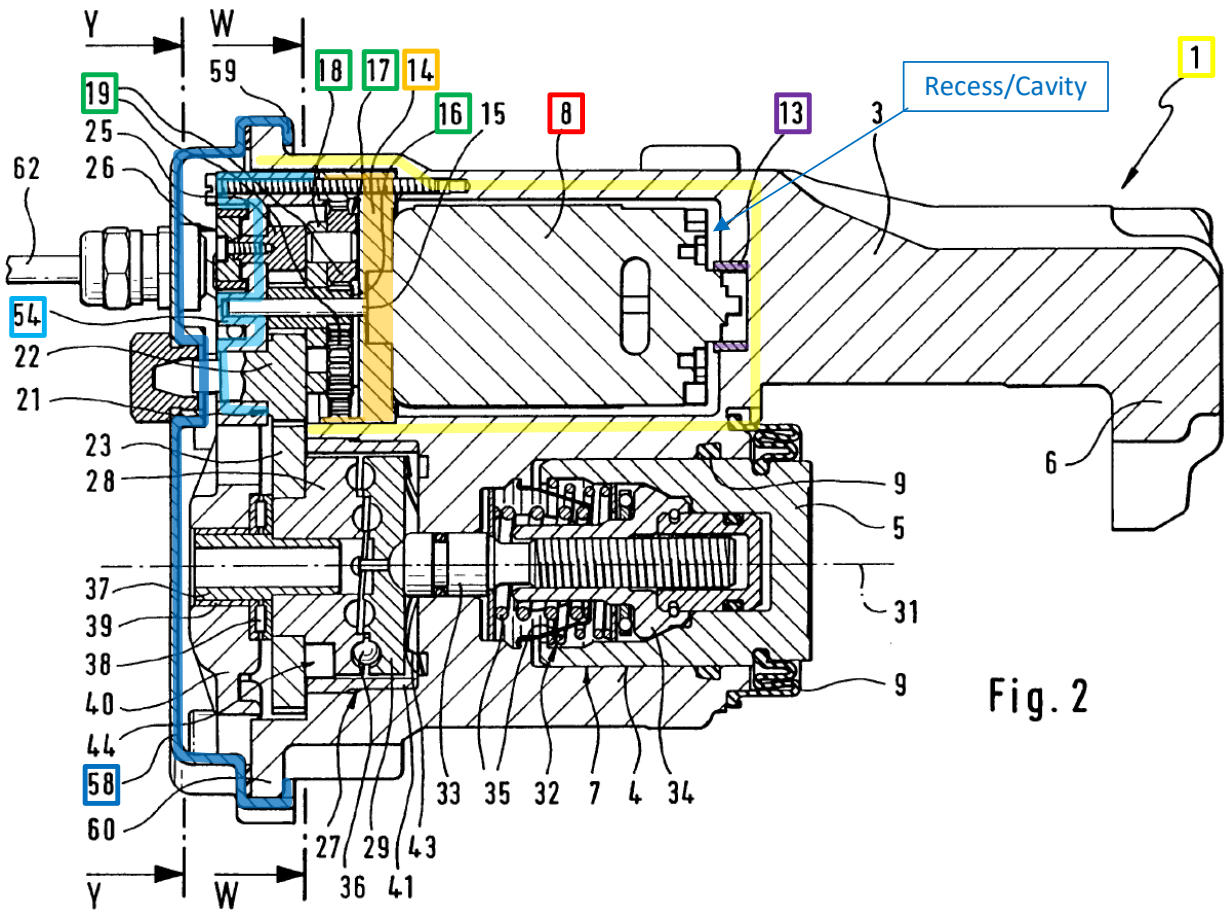
Ex. 1001, Figure 7 (annotated)

270. As such, Weiler renders claim 21 of the '415 Patent obvious.

### 3. Dependent Claim 22

271. Claim 22 depends from claim 21 adding the step of "*coupling a second portion of said actuator housing to said portion of said actuator housing to enclose said sub-frame and said second sub-frame at least partially within said actuator housing.*" Weiler teaches claim 21 for at least the reasons set forth above.

272. As can be seen in the below reproduced and annotated Weiler Figure 2, Weiler discloses that housing cover 58 (**dark blue**) is coupled to the housing containing the motor cavity (indicated with the added caption "Recess/Cavity") enclosed by the caliper housing (**yellow**) in order to enclose both the bearing plate 14 (the claimed *sub-frame*) and the gear cover 54 (the claimed *second sub-frame*) within the actuator housing. *See also* Ex. 1012, 2:17-28, 5:17-25, 6:10-7:2, 8:16-25, 13:28-14:29, Figures 1-4.




Ex. 1012, Figure 2 (annotated)

273. In this respect, the Weiler housing cover 58 encloses bearing plate 14 and gear cover 54 (the sub-frames) within the actuator housing like the actuator housing main portion 301 (**yellow**) and top portion 305 (**dark blue)** do in the ’415 Patent—as can be seen in Figure 7 of the ’415 Patent, reproduced and annotated below.

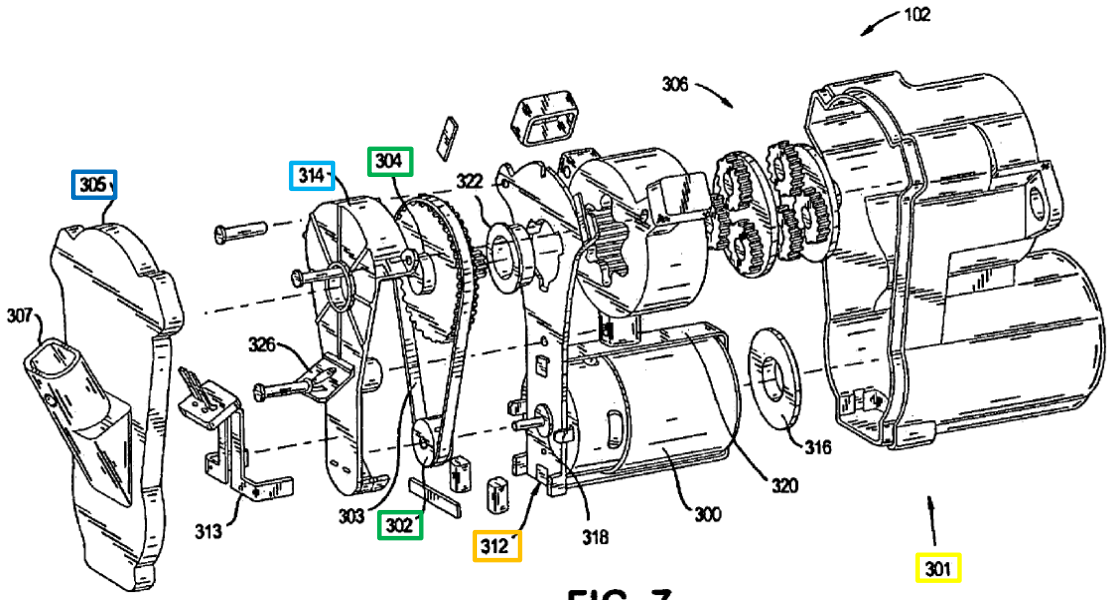



FIG. 7

Ex. 1001, Figure 7 (annotated)

274. As such, claim 22 of the '415 Patent is obvious in view of Weiler.

**4. Dependent Claim 23**

275. Claim 23 depends from claim 20 adding the step of "*providing at least one motor isolation bushing between said portion of said actuator housing and said motor*." Weiler teaches claim 20 for at least the reasons set forth above.

276. Further, as can be seen in the below reproduced and annotated Weiler Figure 2, Weiler discloses that electric motor 8 is held between bearing bush 13 (**purple**) (the recited *motor isolation bushing*) and bearing plate 14. Ex. 1012, 8:16-25, Figure 2. The bearing bush 13 (**purple**) is positioned between the motor 8 (**red**) and the actuator housing (**yellow**). Reading the figure in more details: The location of "13" is between the motor's shell (denoted by the solid line delineating 8) and the

rest of the brake mechanism 3, also a housing for the motor (as shown with a yellow rectangle). The portion 3 of the brake mechanism is “a bridge section”. The role of bridge section 3 is explained at Ex. 1012, 7:23-8:7, where the inventor provides a brief summary of disk brake operation. As POSAs know, the bridge 3 will be subjected to strong forces during braking, and the bridge 3 will flex significantly. The role of bushing 13 is therefore: “Within the brake caliper 1, the electric motor 8 is accommodated… via a bearing bush 13…” Ex. 1012, 8:24-25. Bushing 13 holds the motor within the brake caliper (serving as outer housing for the motor), isolates the motor from the bridge movements, and also isolates the bridge (motor housing) and overall mechanism from motor vibrations.

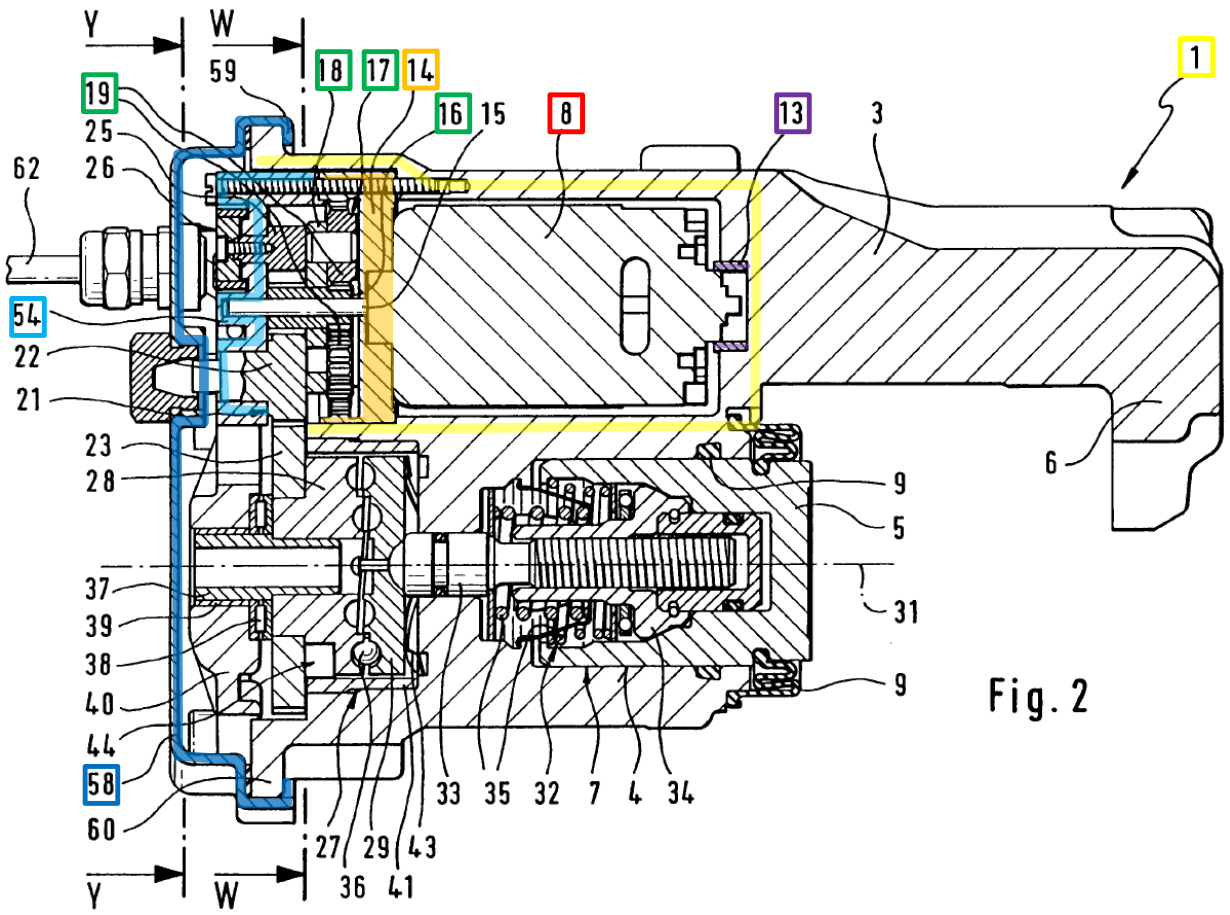



Fig. 2

Ex. 1012, Figure 2 (annotated)

277. The bearing bush 13 thus helps to isolate the motor from the housing, as it is physically interposed between the two, much like the positioning of the bushing 316 in the '415 Patent. To the extent that the term "*motor isolation bushing*" requires the bushing not only to be interposed between and physically separating the motor from the housing, but also to be made of a material known for reducing NVH (such as certain plastics or rubber, for instance), this would still be obvious in view of Weiler and the general knowledge of the POSA. Weiler does not disclose what the bushing material(s) is (are), and thus does not say that the bushing is made of

metal, plastic, rubber, other materials, or a combination thereof, but having automotive bushings made of or including rubber or plastic or the like (generally, materials with desirable spring and damping constants) to provide for reduction of NVH was a well-known design choice for a POSA, as seen, for instance, by the discussion of using basic rubber cushions as isolators in Ex. 1014 and the discussion of using cushioning bearings including rubber in references going back to the 1930s such as Ex. 1018. When a POSA wanted to dampen NVH, as was often the case with respect to electric motors, he would know to use commonly available bearings or bearing assemblies including dampening materials, with appropriate spring and damping constants. This is simply using known elements for their intended purpose to achieve the expected result. As such, Weiler, simply with the general knowledge of the POSA, still would render claim 23 obvious.

**5. Dependent Claim 24**

278. Claim 24 depends from claim 20 adding the step recited in claim 23 and the step of "*providing a second motor isolation bushing between said sub-frame and said motor.*" Weiler, with the general knowledge of the POSA, teaches claims 20 and 23 for the reasons set forth above. Further, as explained above, isolators such as bushings were well-known to a POSA. Having an isolator bushing between the motor and the sub-frame is equally as obvious as having one between the motor and

the housing and a routine design choice for a POSA, depending upon the vibration or noise path, as well as the desired amount of isolation from NVH.

279. As shown in the annotated figure below, a POSA would have understood that the bushing 13 between the motor and the housing in Weiler helped to isolate the motor, and that duplicating a well-known component already described in Weiler, for its same intended purpose, in another location such as between the motor and sub-frame (the other component abutting the motor) to further isolate the motor and reduce NVH would have been obvious. That this was generally known in the art can be seen, for instance, from the disclosure of having two rubber bearings on either side of an electric motor in references going back to the 1930s, such as Ex. 1018. Ex. 1018, 1:1-27, 2:5-11, 2:31-74, 2:89-98, claims 1-2. This is an example of applying a known technique (using bushings between two parts for isolation) already disclosed in Weiler in a similar device (Weiler's own actuator) in the same way (to isolate the motor).

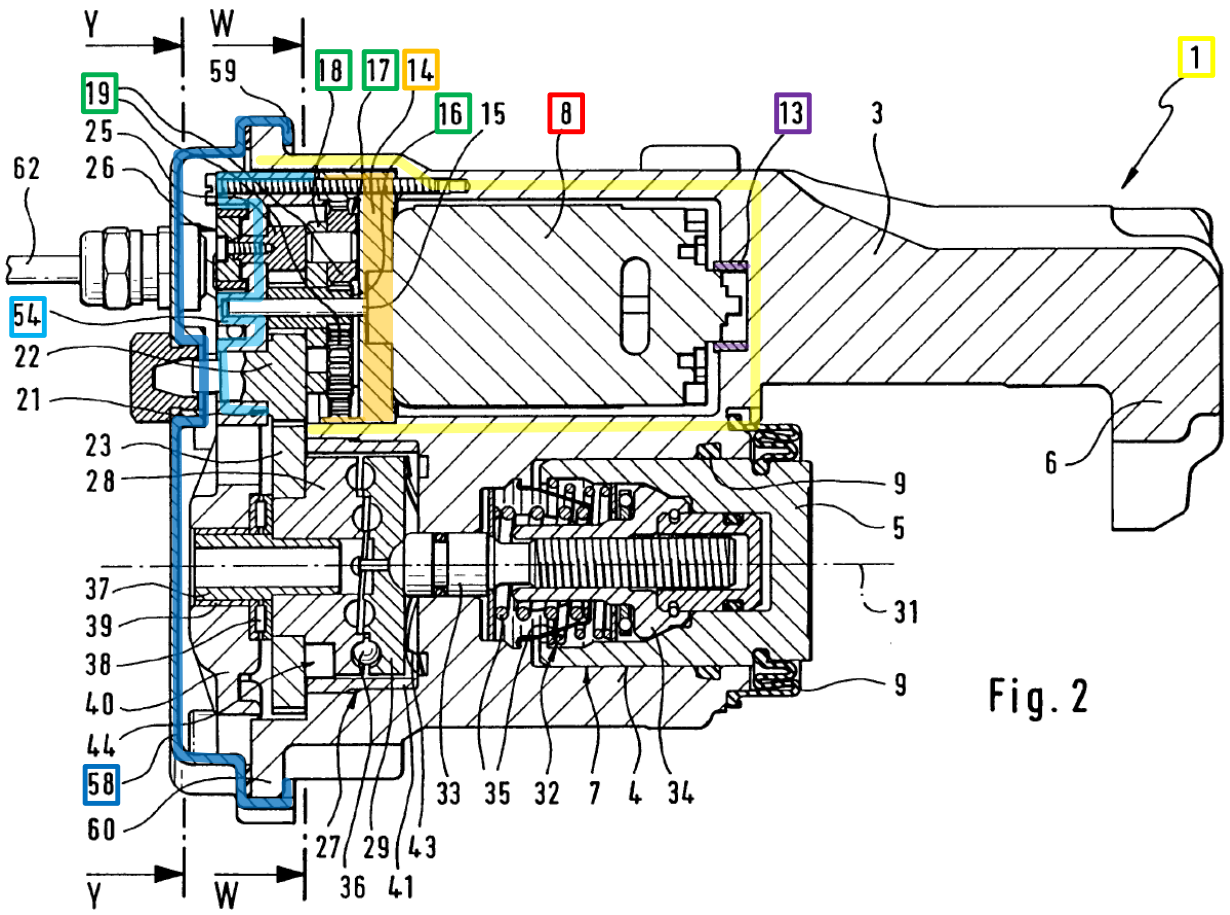



Fig. 2

Ex. 1012, Figure 2 (annotated)

280. As such, claim 24 is also obvious in view of Weiler.

### 6. Dependent Claim 25

281. Claims 25 depends from claim 20 adding the step of "*providing at least one isolation bushing between said portion of said actuator housing and said sub-frame.*" Weiler teaches claim 20 for at least the reasons set forth above. Further, as explained above, isolators such as bushings were well-known to a POSA. As described above, having an isolator bushing between other components such as the motor and the sub-frame is equally as obvious as having one between the motor and

the housing and is merely a duplication of well-known components already described in Weiler in another location and being used for their intended purpose, as part of a routine design choice, depending upon the vibration or noise path, as well as the desired amount of isolation of the motor from NVH.

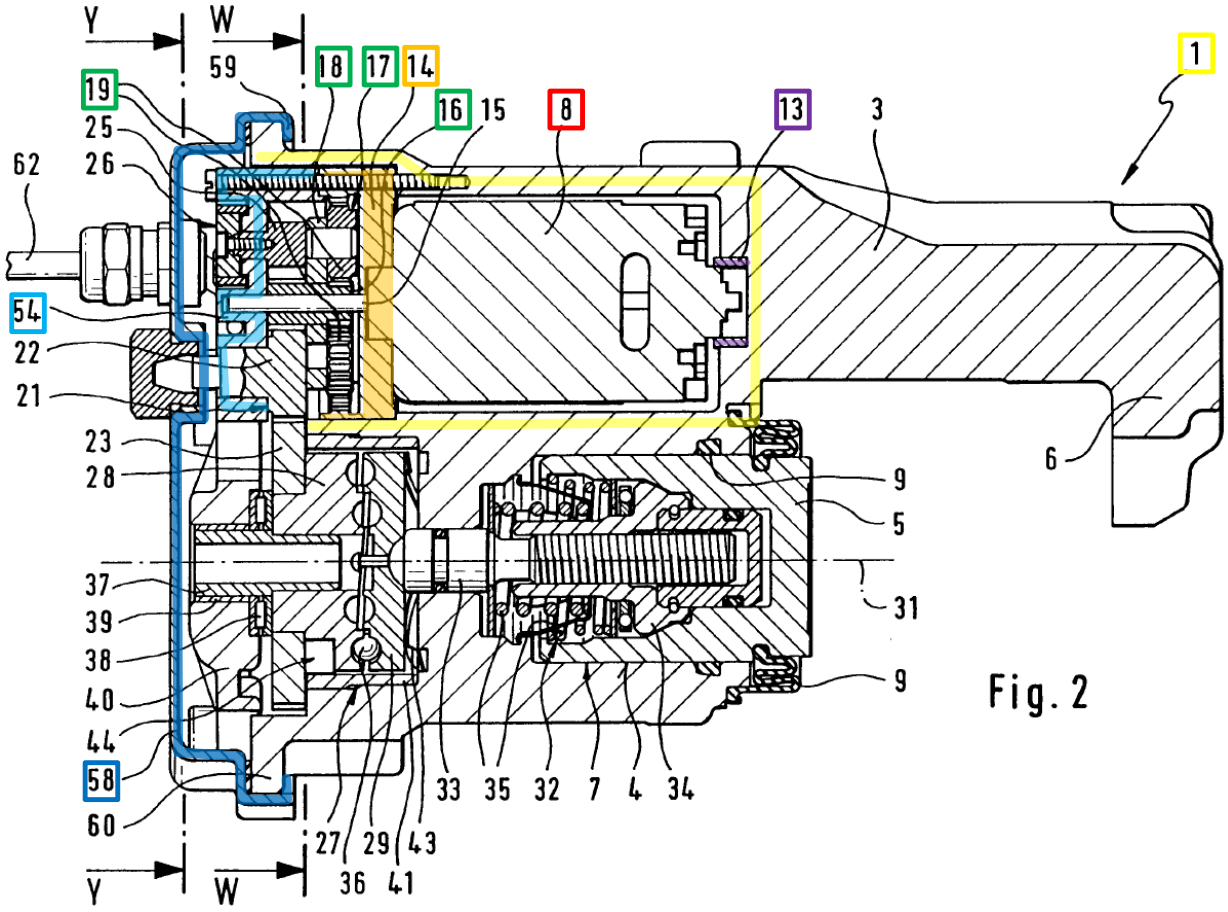



Fig. 2

Ex. 1012, Figure 2 (annotated)

282. Therefore, claim 25 also is obvious in view of Weiler.

### K. Ground I: Claims 23-25 Are Invalid as Obvious Over Weiler in view of Boucheret

283. Claims 23-25 require an isolation bushing located between the motor and the frame, the motor and the housing, and/or the frame and the housing. Claims 23-25 are rendered obvious by Weiler in view of Boucheret.

284. As explained above, Boucheret teaches the use of an isolator between a motor and its surroundings to reduce NVH. The motivations for placing isolators between various components such as particularly required by claims 23-25 (including between Weiler's motor and housing, motor and frame, and frame and housing) to reduce NVH, as taught by Boucheret, is part of a routine design choice as described above with respect to the Poertzgen and Boucheret combination and does not change whether Boucheret's teaching is applied to Poertzgen's actuator or Weiler's actuator. In both cases, the addition of isolating cushions is simply an example of using a known component for its intended purpose to achieve the expected result.

285. As such, Weiler in view of Boucheret renders obvious claims 23-25 of the '415 Patent.

## VII. CONCLUDING STATEMENT

286. In conclusion, as set forth above, all claims of the '415 Patent are unpatentable as rendered obvious by the aforementioned prior art references.

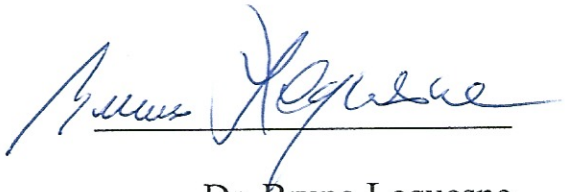
287. Prior to working on this declaration, I had never heard of the inventors on the ’415 Patent, nor had I heard of the ’415 Patent. I have never heard anyone offer praise for the ’415 Patent, nor am I aware of any commercial success attributable to the ’415 Patent. I am unaware of any copying of the alleged invention of the ’415 Patent. Thus, I am unaware of any secondary considerations supporting the nonobviousness of the ’415 Patent.

288. Under penalty of perjury, all statements made herein of my own knowledge are true, and I believe that all statements made herein on information and belief to be true. I have been warned and I am aware that willful false statements are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code.

289. In signing this Declaration, I understand that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in the case and that cross-examination will take place in the United States. If cross examination is required of me, I undertake to appear within the United States during the time allotted for cross-examination, and within the limits of my ability so to do.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on November 29th, 2022 in Menomonee Falls, Wisconsin.



Dr. Bruno Lequesne

## CLAIM LISTING APPENDIX

U.S. Pat. No. 7,021,415

| Designation | Claim Language |
|---|---|
| **Claim 1** | |
| [1A] | 1. An electrically actuated parking brake system comprising: |
| [1B] | a vehicle power source; |
| [1C] | an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear, |
| [1D] | said drive gear and said driven gear comprising a worm gear and a worm wheel in meshing engagement, and |
| [1E] | at least one planetary gear set coupled to said driven gear for driving an actuator output; and |
| [1F] | a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position. |
| **Claim 2** | |
| [2A] | 2. An electrically actuated parking brake system comprising: |
| [2B] | a vehicle power source; |
| [2C] | an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear, |
| [2D] | said drive gear and said driven gear coupled via a drive belt, and |
| [2E] | at least one planetary gear set coupled to said driven gear for driving an actuator output; and |
| [2F] | a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position. |
| **Claim 3** | |
| [3A] | 3. An electrically actuated parking brake system comprising: |
| [3B] | a vehicle power source; |

| Designation | Claim Language |
|---|---|
| [3C] | an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear, and |
| [3D] | at least one planetary gear set coupled to said driven gear for driving an actuator output, |
| [3E] | said actuator further comprising a component isolator having a spring constant and a damping constant, said isolator coupled between said motor and a remainder of said; and |
| [3F] | a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position. |
| **Claim 4** | |
| [4] | 4. The system according to claim 3, wherein said component isolator comprises a first portion and a second portion, and said first portion is coupled to a first end of said motor and said second portion is coupled to a second end of said motor. |
| **Claim 5** | |
| [5A] | 5. An electrically actuated parking brake system comprising: |
| [5B] | a vehicle power source; |
| [5C] | an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear, |
| [5D] | at least one planetary gear set coupled to said driven gear for driving an actuator output, and |
| [5E] | a sub-frame, said motor being mounted on said sub-frame, |
| [5F] | said actuator further comprising a component isolator having a spring constant and a damping constant, said isolator coupled between said motor and said sub-frame; and |
| [5G] | a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position. |
| **Claim 6** | |
| [6A] | 6. An electrically actuated parking brake system comprising: |
| [6B] | a vehicle power source; |

| Designation | Claim Language |
|---|---|
| [6C] | an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear, |
| [6D] | and at least one planetary gear set coupled to said driven gear for driving an actuator output, and |
| [6E] | a sub-frame, said motor being mounted on said sub-frame and said at least one planetary gear set being mounted on said sub-frame; and |
| [6F] | a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position. |
| **Claim 7** | |
| [7] | 7. The system according to claim 6, further comprising a component isolator having a spring constant and a damping constant, said isolator coupled between said at least one planetary gear set and said sub-frame. |
| **Claim 8** | |
| [8A] | 8. An electrically actuated parking brake system comprising: |
| [8B] | a vehicle power source; |
| [8C] | an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear, |
| [8D] | at least one planetary gear set coupled to said driven gear for driving an actuator output, |
| [8E] | and a sub-frame, said motor being mounted on said sub-frame, |
| [8F] | said actuator further comprising a sub-frame isolator having a spring constant and a damping constant, said isolator coupled between said sub-frame and a remainder of said actuator; and |
| [8G] | a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position. |
| **Claim 9** | |
| [9A] | 9. An electrically actuated parking brake system comprising: |
| [9B] | a vehicle power source; |

| Designation | Claim Language |
|---|---|
| [9C] | an electromechanical actuator comprising a motor having a drive shaft, a drive gear coupled to said drive shaft, a driven gear coupled to said drive gear, and |
| [9D] | at least one planetary gear set coupled to said driven gear for driving an actuator output, |
| [9E] | and further comprising an actuator housing defining a motor cavity receiving at least a portion of said motor and a covering member disposed adjacent said motor cavity, thereby separating said motor from a remainder of said actuator; and |
| [9F] | a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position. |
| **Claim 10** | |
| [10] | 10. The system according to claim 9, wherein said covering member comprises a sub-frame. |
| **Claim 11** | |
| [11A] | 11. An electro-mechanical actuator comprising: |
| [11B] | a motor having a drive shaft; |
| [11C] | a gear train coupled to said drive shaft for driving an output of said actuator, said gear train comprising a driven gear coupled to a planetary gear set; and |
| [11D] | a sub-frame, said motor and at least one of said driven gear and said planetary gear set being mounted on said sub-frame. |
| **Claim 12** | |
| [12] | 12. The electromechanical actuator according to claim 11, further comprising an actuator housing defining a planetary gear set cavity receiving at least a portion of said planetary gear set, wherein cooperation between said housing and said sub-frame separate said planetary gear set from a remainder of said actuator. |
| **Claim 13** | |
| [13A] | 13. An electro-mechanical actuator comprising: |
| [13B] | a motor having a drive sha[f]t; |
| [13C] | a gear train coupled to said drive shaft for driving an output of said actuator; |
| [13D] | a sub-frame, said motor and at least a portion of said drive train being mounted on said sub-frame; and |

| Designation | Claim Language |
|---|---|
| [13E] | an actuator housing, said housing defining a motor cavity receiving at least a portion of said motor, wherein cooperation between said housing and said sub-frame separate said motor from a remainder of said actuator. |
| **Claim 14** | |
| [14] | 14. The electromechanical actuator according to claim 13, further comprising a first motor isolator having a spring constant and a damping constant, said isolator disposed between said sub-frame and said motor. |
| **Claim 15** | |
| [15] | 15. The electromechanical actuator according to claim 14, further comprising a second motor isolator having a spring constant and a damping constant, said isolator disposed between said motor and said housing. |
| **Claim 16** | |
| [16A] | 16. An electro-mechanical actuator comprising: |
| [16B] | a motor having a drive shaft; |
| [16C] | a gear train coupled to said drive shaft for driving an output of said actuator; |
| [16D] | a sub-frame, said motor and at least a portion of said drive train being mounted on said sub-frame; and |
| [16E] | a sub-frame isolator having a spring constant and a damping constant, said isolator disposed between said sub-frame and an actuator housing. |
| **Claim 17** | |
| [17A] | 17. An electrically actuated parking brake system comprising: |
| [17B] | a vehicle power source; |
| [17C] | an actuator comprising a motor having a drive shaft coupled to a drive pulley, a driven pulley coupled to said drive pulley via a drive belt, and |
| [17D] | a planetary gear set coupled to said driven pulley for driving an output of said actuator, |
| [17E] | at least said motor and planetary gear set mounted on a sub-frame, |

| Designation | Claim Language |
|---|---|
| [17F] | and a component isolator having a spring constant and a damping constant disposed between said sub-frame and an actuator housing; and |
| [17G] | a brake caliper coupled to said actuator output, said actuator output being configured for driving said brake caliper between an engaged position and a released position. |
| **Claim 18** | |
| [18] | 18. The system according to claim 17, said actuator housing comprising a motor isolation cavity receiving at least a portion of said motor, wherein said sub-frame cooperates with said housing to separate said motor from at least one of said drive gear, driven gear and said planetary gear set. |
| **Claim 19** | |
| [19] | 19. The system according to claim 17, further comprising a motor isolator having a spring constant and a damping constant, said motor isolator disposed between said motor and said mounted plate. |
| **Claim 20** | |
| [20A] | 20. A method of assembling an actuator comprising: |
| [20B] | mounting a motor and a gear train to a sub-frame; |
| [20C] | coupling said sub-frame to a portion of an actuator housing to at least partially enclose said motor in a motor isolation cavity defined by said portion of said actuator housing and said sub-frame. |
| **Claim 21** | |
| [21A] | 21. A method according to claim 20, said method further comprising: |
| [21B] | coupling a second sub-frame to said sub-frame to enclose at least a portion of said gear train in a cavity defined by said sub-frame and said second sub-frame. |
| **Claim 22** | |
| [22A] | 22. A method according to claim 21, said method further comprising: |
| [22B] | coupling a second portion of said actuator housing to said portion of said actuator housing to enclose said sub-frame and said second sub-frame at least partially within said actuator housing. |
| **Claim 23** | |
| [23A] | 23. A method according to claim 20, said method further comprising: |

| Designation | Claim Language |
|---|---|
| [23B] | providing at least one motor isolation bushing between said portion of said actuator housing and said motor. |
| **Claim 24** | |
| [24A] | 24. A method according to claim 20, said method further comprising: |
| [24B] | providing a first motor isolation bushing between said portion of said actuator housing and said motor; and |
| [24C] | providing a second motor isolation bushing between said sub-frame and said motor. |
| **Claim 25** | |
| [25A] | 25. A method according to claim 20, said method further comprising: |
| [25B] | providing at least one isolation bushing between said portion of said actuator housing and said sub-frame. |