

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

STONERIDGE CONTROL DEVICES, INC.,
Patent Owner

IPR2023-00273
Patent 7,021,415 B2

**REPLY 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. SUMMARY

1. I have read the Declaration of Jeffrey L. Stein (Ex. 2005) and provide the following declaration replying to certain of the arguments set forth by Dr. Stein.

2. I disagree with Dr. Stein that Poertzgen and Weiler (and other references that disclose actuators for parking systems) disclose actuators that a POSA would have believed were not appropriate for isolators. A POSA would have been familiar with passive isolators and their uses, design and implementation (*see, e.g.*, Ex. 1010, Ex. 1014, Ex. 1018), and would have known that isolators could be applied to, *e.g.*, Weiler and Poertzgen. None of the prior art, including the background textbook on NVH, teaches that isolators should not be used in what Dr. Stein calls “hard-mounted” or precision systems. Further, the ’415 patent does not mention this as an issue with the then-prior art.

3. I disagree with Dr. Stein that the addition of passive isolators to, *e.g.*, Poertzgen and Weiler, would have destroyed the usefulness of those actuators. While Poertzgen and Weiler generally relate to actuators that have a degree of precision, the addition of passive isolators would not have prevented them from working. Dr. Stein fails to give due credit to the skills of the POSA, who would have had two years of experience working with electromechanical devices such as actuators, and who would have been able to select appropriate isolator materials

and mounting techniques that would not ruin the tolerances of the actuators.

Indeed, the background textbook on NVH (Ex. 1014) provides a lengthy discussion of the theory and practical use of isolators (including passive isolators) for mounting components of cars, including car engines. Car engines have precise tolerances, and provide power to the car's gearbox, which contains gearing that is much more complex than the two-stage gearing described, for instance, in Poertzgen. A POSA would not have believed that isolators were incompatible with systems such as Poertzgen or Weiler based on their alleged complexity or precision.

4. I also disagree with Dr. Stein's arguments that Boucheret's teachings of the use of isolators to dampen NVH from an electric motor in a car would be considered to be inapplicable to electric motors for actuators in a parking brake system. Dr. Stein argues that Boucheret teaches that isolators should only be used in systems where mechanical tolerances are not particularly important. To the contrary, Boucheret does not indicate that mechanical tolerances are unimportant in its motor or the system being driven by its motor. Boucheret provides an example of its motor driving a car's HVAC system and its fan, but there is no support in Boucheret for the argument that mechanical tolerances are unimportant for HVAC systems in cars, including for their motors and fans. A POSA working

on automotive components would not believe that mechanical tolerances are unimportant. This is true for fans, as it is of any other moving part in a car.

5. I also note generally that there is a disconnect between Dr. Stein's arguments regarding Poertzgen, Weiler, and Boucheret and the '415 patent specification and claims. For instance, Dr. Stein focuses on the alleged differences between hard-mounted (precise) and soft-mounted devices, to argue that isolators were known to be useful for the latter but not the former. However, the claims of the '415 patent are not limited to a hard-mounted or soft-mounted device and the patent never discusses any of the alleged problems with, or solutions to, misalignment, delay, etc. caused by using isolators in hard-mounted devices that Dr. Stein posits exist. The '415 patent also is not limited to precise systems, and provides no discussion of how to incorporate isolators (e.g., what shape, size, hardness, or damping ability the isolators should have, or what type of mounting should be used to position them) that would address any of the concerns Dr. Stein raises with respect to introducing isolators in so-called precision systems. Similarly, Dr. Stein talks about, e.g., short-burst motors vs. long-running motors in trying to distinguish Poertzgen and Weiler from Boucheret, but the claims of the '415 patent are not limited to short-burst motors or motors that operate over any particular time period, and the patent specification nowhere discusses any alleged difficulties with using isolators for short-burst motors, or how to overcome them.

A. Poertzgen and Weiler Can Accommodate Isolators

6. Dr. Stein argues that adding isolators to a “precise” system such as Poertzgen or Weiler *could* harm it by introducing too much slack and imprecision. This is different than saying the system would be harmed by adding isolators. Any component, no matter how simple or obvious, can be designed or constructed poorly, or manufactured shoddily, which could yield a suboptimal product. A POSA attempting to succeed, however, would have been able to introduce a passive isolator to an actuator without causing it to produce an unpredictable, uncontrollable or imprecise output. For instance, pressing or sandwiching a cushion between the exterior of the motor and the sub-frame could be readily achieved without causing the motor to be so insecurely mounted to the frame that it unpredictably spins in place or lurches when the motor is actuated such that gears cannot reliably be coupled to its driveshaft. In this regard it is worth noting that isolators need not be particularly soft, pliable, thick, or physically unstable. Isolators come in various sizes, stiffnesses, etc. and a stiff isolator would meet the claims of the ’415 patent, just as a soft isolator would. Notably, the ’415 claims do not require any particular degree of isolation, just the presence of an isolator. A POSA would be aware of the various materials available and be able to fashion or purchase an isolator that would allow for a stable, secure mounting.

7. Moreover, Dr. Stein provides little to no explanation of why or exactly how isolators would prevent the Poertzgen or Weiler system from working, other than reiterating that isolators may cause catastrophic misalignment of components. Nor does he explain how or why the '415 patent, also an electric parking brake system, would still work properly after adding isolators.

8. Dr. Stein also states that sensors would not be able to reliably measure a location of the nut being driven by the actuator, for instance, in Poertzgen. He thus ignores the capability of the POSA to place and design the sensor in the presence of isolators, and to adjust the controls accordingly, if needed at all. In any event, neither Poertzgen, Weiler, nor the '415 claims require any sensors. Ex. 1007, 3:17-20 (referencing sensor in preferred embodiment), claims 1-6 (claims not requiring a sensor); Ex. 1012, 5:27-6:3 (referencing sensor in preferred embodiment), claims 1-14 (claims not requiring a sensor); Ex. 1001, claims 1-21 (claims not requiring a sensor). Moreover, Poertzgen teaches the use of a sensor that can directly measure the location of the nut (located outside of the actuator) on its spindle. Such a direct measurement would not be prevented by having isolators inside the actuator between, e.g., the motor and housing, the motor and the sub-frame, the sub-frame and housing, or the gears and the sub-frame. Even with such isolators, the motor's driveshaft will rotate the gears which will rotate the output of the actuator, moving the nut, and the sensor can be positioned to directly sense the location of the nut as

it moves. Indeed, such a sensor would be independent of what causes the nut to move.

9. Dr. Stein focuses on an argument that isolators would prevent Poertzgen (and/or Weiler) from indirectly measuring the location of the nut by using, e.g., a Hall sensor that measures the rotation of the gears. However, such a sensor would not be expected to be disrupted by any isolators, even if one were to assume counterfactually that the isolators would likely cause axial or radial movement of the motor body with respect to the subframe, for instance. Axial movement of the motor would not appreciably affect the rotation of the gears at all, or the ability of a Hall sensor to measure the rotational movement of the gearing or reliably determining the position of the nut being moved by the output of the actuator. Radial movement of the motor also would not prevent the sensor from identifying the rotation of the gears, even assuming it did affect the amount of the rotation (which it would not be expected to do). A Hall sensor determines the rotation of gears, for instance, by signaling when each tooth of a gear passes. Thus, if a gear had 100 teeth, each trigger of the sensor would indicate a 3.6 degree movement of the gear. A passive isolator would not change the gearing ratios on the output of the actuator. With or without an isolator (even one that cause some axial or radial movement of the motor, for instance), if the Hall sensor were placed, e.g., to measure the final gear of the actuator and the gear had 100 teeth, each trigger of the sensor would still represent

3.6 degrees of rotation of the actuator output. Even if the sensor were placed so as to monitor the rotation of the driveshaft of the motor, it could do so accurately, even if one were assume counterfactually that an isolator, e.g., between the body of the motor and the subframe would change the amount of rotation of the driveshaft. Finally, even if an initial twisting of the motor (which need not occur because the mounting would be stable) did somehow affect the rotation in the drive train or drive shaft sensed by the sensor (which it would not), the control system of the motor, designed and implemented after incorporation of the isolators, could readily account and correct for the effect of the isolator on the motor's rotation in its calculations and control loop.

10. In this regard, it should be remembered that the reduction ratio can be large in these actuators, well over 100 (Ex. 2010, for instance, mentions a ratio of 141:1), so that it takes more than 100 rotations of the motor to cause 1 rotation of the output of the actuator. This would greatly minimize the practical effect of any error.¹ I also note that the '415 patent provides no discussion of these types of

¹ To the extent Dr. Stein argues that the reduction ratio of the gear train would become unpredictable with the use of passive isolators, he is wrong. A POSA would be able to insert isolators between, e.g., the motor and the sub-frame, or the

“precision” issues at all and does not require any particular type of mounting to be used with the isolators, further indicating that a POSA was capable of (1) achieving stable, predictable mountings even with the use of isolators, and (2) choosing isolators with appropriate physical characteristics to allow for such mountings. As noted above, the POSA, if he wanted a sensor to sense the location of the nut being moved by the actuator could have done so either directly or indirectly, even when isolators are used. This would be true of either Poertzgen or Weiler.

11. I also disagree that adding isolators to Poertzgen would somehow prevent it from actuating a parking brake within about one second.² Dr. Stein opines that an isolator would introduce a delay into Portzgen’s actuator that somehow might prevent it from opening or closing a parking brake within about one second, which is preferred by Poertzgen. To begin, Poertzgen does not require a particular time for actuation, it simply states a preference that it occur in about one second. Ex. 1007,

gears and the subframe, without disrupting the ability of the gears to mesh as intended.

² Although, with respect to a parking brake, an actuation of about one second may be considered quick, slight deviations in the engagement time of a parking brake is not the safety issue that it would be for a car’s regular brakes, which operate much faster.

9:5-7. In any event, passive isolators would not prevent this from occurring. The driveshaft of a motor, with or without an isolator could be controlled to rotate sufficiently quickly to close the parking brake within one second. Dr. Stein does not explain exactly why he thinks an isolator would prevent this. Perhaps he believes that, if isolators are used, the motor's driveshaft will not rotate (or will rotate hardly at all), but rather will stay in place while the outer casing of the motor instead rotates in place because of the isolator. This is not realistic. As noted above, a POSA would have been able to readily mount the exterior of a motor to a subframe securely, such that the rotation of the driveshaft is not adversely affected.

12. The examples in the background textbook (Ex. 1014) of using isolators for engine mounts further indicates that a POSA would appreciate that isolators can be integrated into systems that require precision, and even systems that are driving gear trains much more complex than that of the relatively simple system discussed in Poertzgen, for instance. The gearbox of an automobile that mediates the power and torque of the engine's output (such as a six or eight speed automatic gear box) is much more complex than the gearing systems being discussed in the Poertzgen, Wieler, or the '415 patent.

B. Boucheret's Concepts Regarding the Use of an Isolator Would be Applicable to Poertzgen and Weiler

13. Dr. Stein attempts to distinguish Boucheret from Poertzgen, Weiler, and the '415 patent by suggesting that (1) Boucheret is limited to motors that power fans for the HVAC system of a car, and (2) that such fans (allegedly unlike Poertzgen's and Weiler's systems) generally operate at set speeds (creating simple vibrations) and have loose tolerances that allow for the use of passive isolators. From this premise, Dr. Stein argues Boucheret's system is so different than the motor and gear train of Poertzgen or Weiler, that Boucheret's concept of using a passive isolator would not be attempted by the POSA in Poertzgen or Weiler. I disagree.

14. First, Boucheret is not limited to motors driving HVAC fans. Ex. 1010, 3:3-7 (describing fan application as an example), 4:44-45 (Boucheret not limited to examples), claims 1-15 (claims not requiring fans). Second, to a POSA, the concept of using an isolator would not be limited to the particular application (even if there were one) in Boucheret. A POSA would have been well aware of passive isolators and their uses to minimize NVH. See, generally, Ex. 1014. As I noted in my original declaration, prior art going back to the 1930s (Ex. 1018) showed electric motors with passive isolators mounted axially to dampen NVH. Third, while fans do generally operate at set speeds once they reach their intended speed, they can be set to different speeds (a fan for the AC system of an automobile would have many speeds at which it could be set), and they operate at variable speeds as they are ramping up and down

between speeds. Thus, it is not true that vibrations from a motor for an HVAC fan are necessarily as simple as Dr. Stein suggests.

15. Regardless of whether there are fewer or more frequencies generated by a motor, they still may be measured and modeled. Once identified, isolators designed to minimize those frequencies would be used. This process is generally described (but still in much more detail than it is described in the '415 patent) in the background textbook, Ex. 1014. Thus, even if one were to assume counterfactually that the system powered by Boucheret's motor was necessarily simpler than that of Poertzgen, it still wouldn't prevent a POSA from applying isolators to minimize vibrations in Poertzgen.

16. Much like Dr. Stein mischaracterizes Boucheret's motor as being limited to steady state use, he also mischaracterizes the examples in the background textbook. Dr. Stein tries to minimize the teaching of the examples of Ex. 1014 that use isolators for mounting car engines. He states that car engines operate at "steady-state vibrations and excitations." Ex. 2005, ¶ 123. This is simply wrong (as anyone who drives a car and is stopping, starting, accelerating, braking, swerving, and progressing over rough and smooth terrain, would know), and Ex. 1014 itself states the opposite. Ex. 1014, 187 (noting vibrations are speed dependent), 197 (engine vibration "varies with engine operating conditions"), 207 ("the variable operating conditions of automotive engines presents a complex problem in vibration

isolation,” affected by “vehicle maneuvering and terrain inputs”). Passive isolators are used in all types of automotive systems to minimize NVH generated by moving parts (even complex ones), and a POSA would have recognized this.

17. I also note that, whether the motor generates simple or complex frequencies (although a POSA would be able to minimize either) or operates in short bursts or for extended periods of time is immaterial to the claims of the '415 patent. The '415 patent claims are not limited to short burst actuators, and do not require a particular degree of damping of any particular frequency or frequencies. The claims cover simple and complex systems. Nor is there a particular discussion in the patent of how to design an isolator to minimize complex vs. simple vibrations. This is another example of Dr. Stein attempting to create distinctions that are not supported by the prior art, and are not discussed or claimed in the '415 patent.

18. To the extent that Dr. Stein argues that a POSA would not appreciate that the motor or gears of Poertzgen or Weiler generate NVH to be dampened, I disagree. A POSA is familiar with electromechanical systems such as actuators, and is certainly aware that moving parts, such as motors and gears can generate NVH. Indeed, the background textbook on NVH, Ex. 1014, repeatedly identifies imbalance in moving parts (which is inevitable) as a common source of NVH. Ex. 1014, 187, 188, 197.

19. Finally, Dr. Stein argues that the use of multiple isolators is not obvious because a POSA would think multiple isolators are unnecessary. I disagree. The use of either single or multiple isolators is obvious, and whether a designer uses one or more than one depends on how much damping he wants to achieve of various vibration frequencies. The art I cited in my opening declaration all used multiple isolators. Ex. 1010, Ex. 1014, Ex. 1018. Boucheret explicitly states that more or fewer isolators can be used. Ex. 1010, 4:44-56. Ex. 1014 likewise discusses using various isolators because one isolator may not be capable of sufficiently minimizing all unwanted vibration. Ex. 1014, 197, 210-211. Indeed, Dr. Stein's argument that Poertzgen, because of its short burst motor, has a more complicated vibration profile ironically supports the use of additional isolators for additional dampening of additional frequencies. In any event, it is a misnomer for Dr. Stein to talk of redundancy with respect to additional isolators placed at different locations. The additional isolators are not redundant, although each is obviously operating as expected to dampen vibrations. Having a second isolator further down the path of transmission of NVH will provide additional dampening, and thus is not "redundant" in the sense of having no purpose.

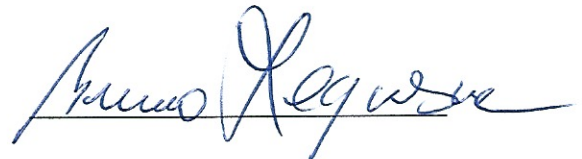
20. Under penalty of perjury, all statements made herein of my own knowledge are true, and I believe that all statements made herein on information and belief to be true. I have been warned and I am aware that willful false statements

are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code.

21. 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 October 27th, 2023 in Fitchburg, Wisconsin 53711.

A handwritten signature in blue ink, appearing to read 'Bruno Lequesne', written over a horizontal line.

Dr. Bruno Lequesne