

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

RASSINI SUSPENSIONES, S.A. DE C.V.,
Petitioner,

v.

MUHR UND BENDER KG,
Patent Owner.

IPR2022-00278
Patent 9,868,330 B2

Before SCOTT A. DANIELS, BARRY L. GROSSMAN, and
RYAN H. FLAX, *Administrative Patent Judges*.

DANIELS, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
Denying in-Part and Dismissing in-Part Patent Owner's Motion to Exclude
and Patent Owner's Motion to Strike
35 U.S.C. § 318(a)

I. INTRODUCTION

Rassini Suspensiones, S.A. de C.V. (“Rassini” or “Petitioner”) filed a Petition requesting *inter partes* review of claims 1–5, 8, 10–15, and 17 of U.S. Patent No. 9,868,330 (Ex. 1001, “the ’330 patent”). Paper 2 (“Pet.”). Muhr Und Bender KG, (“Muhr” or “Patent Owner”) filed a Preliminary Response to the Petition. Paper 5 (“Prelim. Resp.”).

Following our Institution Decision (Paper 6, “Inst. Dec.”), Patent Owner filed a Response. Paper 15 (“PO. Resp.”). Petitioner filed a Reply. Paper 20 (“Pet. Rep”). Patent Owner filed a Sur-Reply. Paper 30 (“PO SUR-Reply”). A hearing was held on March 16. A transcript of the hearing has been entered as Paper 38. (“Tr.”). Patent Owner filed a Motion to Exclude Evidence, which Petitioner opposes. Papers 31, 33, 37. Patent Owner also filed a Motion to Strike which Petitioner opposes. Papers. 26, 27.

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a). For the reasons explained below, we determine that claims 1–5, 8, 10–15, and 17 are unpatentable. Patent Owner’s evidence motions are each denied in-part and dismissed in-part.

A. Real Parties in Interest

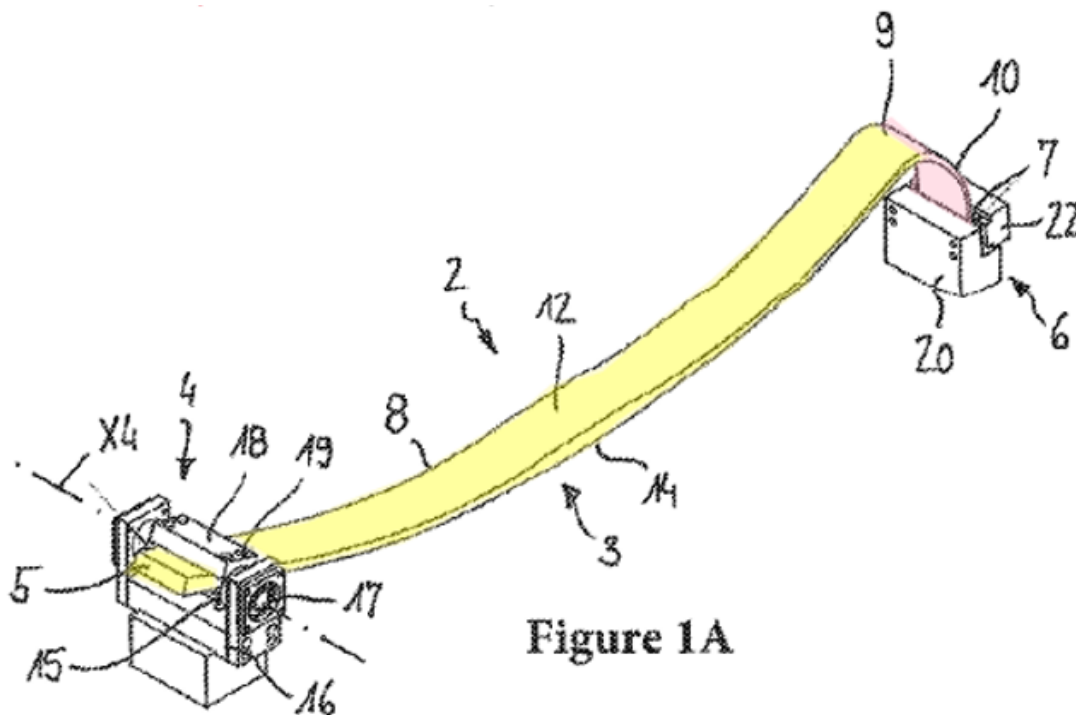
Petitioner states that Rassini Suspensiones, S.A. de C.V., and Rassini International, Inc., are the real parties in interest. Pet. 67. Patent Owner states that it is the patent owner and real party in interest. Paper 3, 1.

B. Related Matters

The parties indicate that they are not aware of any other related proceeding involving the ’330 patent. Pet. 67; Paper 4, 2.

C. The '330 Patent (Ex. 1001)

The '330 patent, titled "Leaf Spring Assembly for Motor Vehicles," issued on January 16, 2018, from U.S. Application No. 14/905,840, which has a filing date of July 23, 2014, and it indicates priority to a PCT application filed January 18, 2016, and to a German application filed on July 23, 2013. Ex. 1001, codes (45), (21), (22), (86), (65). The '330 patent describes a leaf spring assembly for a wheel suspension of a vehicle. *Id.* at Abstract. The '330 patent describes that the leaf spring is made "of fib[er]-reinforced plastics for resiliently supporting a wheel carrier of the motor vehicle." *Id.* at 2:19–21. Figure 1A of the '330 patent, as annotated by the Board, is reproduced below.



Id. at 7:1–36. First receiving device 4 pivotably secures first end 5 of the leaf spring and a second end 7 of the leaf spring is fixed by second receiving device 6. *Id.* It is to be appreciated that in use “[t]he first spring leg 8 serves to receive a wheel carrier, not illustrated, to which a vehicle wheel is fixed.” *Id.*

We note that a wheel and wheel carrier would be positioned on leaf spring assembly 2 approximately in the region of reference numerals 12/14. However, neither Figure 1A nor any other figure of the ’330 patent illustrates the leaf spring assembly 2 installed on a vehicle or carrying a wheel.

The ’330 patent describes that the leaf spring is fixed between the first and second receiving devices in a non-displaceable manner, i.e., the distance between the first and second receiving devices remains fixed. *Id.* at 2:47–51. The benefit of this structure, the ’330 patent describes, is that “the leaf spring is subjected to bending and tensile processes. The tensile and bending stresses occurring in the spring are superimposed on one another and, together, lead to a progressive spring characteristic.” *Id.* at 2:40–44. The ’330 patent explains that

[b]ecause the leaf spring ends are received in a substantially nondisplaceable way, the tensile stress increases progressively with an increasing load, so the spring rate of the same also increases progressively. In the installed state, this means that with an increasing load on the motor vehicle, the suspension becomes stiffer, which has an advantageous effect on the driving comfort and driving stability of the motor vehicle.

Id. at 2:56–63.

Figure 3C of the '330 patent is reproduced below.

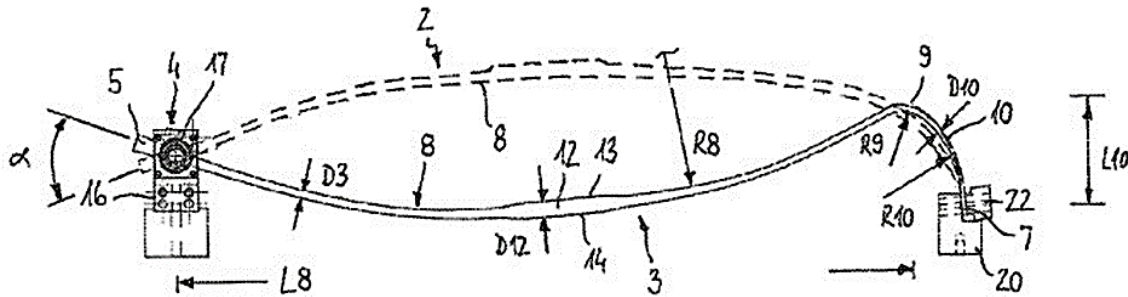


Figure 1C

Figure 3C of the '330 patent, above, is a side elevation view of leaf spring 2 illustrating the loaded condition and a “maximum” upward deflection of the leaf spring in dashed lines. *Id.* at 7:59–60.

D. Illustrative Claims

Claim 1 is independent. Each of claims 2–5, 8, 10–15, and 17 ultimately depends on independent claim 1. Claim 1 is reproduced below and illustrates the claimed subject matter including certain limitations of importance italicized:¹

1. [1 pre] A leaf spring assembly for a wheel suspension of a motor vehicle, comprising:

[1a] a leaf spring of fiber-reinforced plastics for resiliently supporting a wheel carrier of the motor vehicle, [1b] the leaf spring comprising a first end portion, [1c] a spring portion extending from the first end portion, [1d] a second end portion, [1e] a bendable portion extending from the second end portion,

[1f] *wherein the spring portion extends substantially in a longitudinal direction of the motor vehicle in an installed state and is configured to accommodate the wheel carrier,* [1g] *wherein the spring portion and the bendable portion are connected to each other by a curved transition portion and*

¹ For consistency and convenience, we refer to Petitioner’s claim reference sub-numbering nomenclature [1 pre]–[1o].

[1h] wherein the spring portion is longer than the bendable portion;

[1i] a first receiving device for supporting the first end portion;

[1j] a second receiving device for supporting the second end portion;

[1k] wherein the first receiving device and the second receiving device are provided so as to hold the first end portion and the second end portion in a non-displaceable way relative to one another, [1l] *wherein the leaf spring, with an increasing load due to vertical forces introduced from the wheel carrier, is increasingly subjected to tensile loading;*

[1m] further wherein at least one of the first and second receiving devices provides pivotable support to the associated one of the first end portion and the second end portion around a pivot axis extending transversely to a longitudinal axis of the vehicle;

[1n] and further wherein in the installed state of the leaf spring the first end portion and the spring portion extending therefrom are positioned towards a front end of the motor vehicle, [1o] and the second end portion and the bendable portion extending therefrom are positioned towards a rear end of the motor vehicle.

Ex. 1001, 12:10–44.

E. Prior Art and Asserted Grounds

We instituted a trial based on all asserted claims and grounds of unpatentability as follows:²

Ground	Claim(s) Challenged	35U.S.C.§	Reference(s)/Basis
1	1–5, 8, 10–14, 17	103	Enomoto ³
2	15	103	Enomoto, Glover ⁴

II. ANALYSIS

A. Legal Standards Concerning Patentability

A patent claim is unpatentable under 35 U.S.C. § 103 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 at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. 35 U.S.C. § 103; *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). “[W]hen a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result.” *KSR*, 550 U.S. at 416 (citing *United States v. Adams*, 383 U.S. 39, 50–51 (1966)). The question of obviousness is resolved based on underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the

² Petitioner supports its challenges with a Declaration of Robert H. Wagoner, Ph.D. (Ex. 1002), and Patent Owner relies on the Declaration of Scott A. Dilling, P.E. *See infra*.

³ JP 3872719 B2 (pub. Jan. 24, 2007) (Ex. 1006).

⁴ U.S. 9,765,838 B2 (iss. Sept. 19, 2017) (Ex. 1018).

prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

The record of the proceeding does not include any argument or evidence directed to objective indicia of non-obviousness.

The Supreme Court has made clear that we apply “an expansive and flexible approach” to the question of obviousness. *KSR*, 550 U.S. at 415. Whether a patent claiming the combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 417. To support this conclusion, however, it is not enough to show merely that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). Rather, obviousness additionally requires that a person of ordinary skill at the time of the invention “would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention.” *Id.*

Accordingly, an obviousness determination generally requires a finding “that a person of ordinary skill in the art would have been motivated to combine or modify the teachings in the prior art and would have had a reasonable expectation of success in doing so.” *Univ. of Strathclyde v. Clear-Vu Lighting LLC*, 17 F.4th 155, 160 (Fed. Cir. 2021) (citing *OSI Pharms.*, 939 F.3d at 1382 (quoting *Regents of Univ. of Cal. v. Broad Inst., Inc.*, 903 F.3d 1286, 1291 (Fed. Cir. 2018))). “Whether the prior art discloses a claim limitation, whether a skilled artisan would have been motivated to modify or combine teachings in the prior art, and whether she would have had a reasonable expectation of success in doing so are

questions of fact.” *Strathclyde*, 17 F.4th at 160. In determining whether there would have been a motivation to combine prior art references to arrive at the claimed invention, it is insufficient to simply conclude the combination would have been obvious without identifying any reason why a person of skill in the art would have made the combination. *Metalcraft of Mayville, Inc. v. The Toro Co.*, 848 F.3d 1358, 1366 (Fed. Cir. 2017). Moreover, in determining the differences between the prior art and the claims, the question under 35 U.S.C. § 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 164 (Fed. Cir. 1985) (“It is elementary that the claimed invention must be considered as a whole in deciding the question of obviousness.”); *see also Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1537 (Fed. Cir. 1983) (“[T]he question under 35 U.S.C. § 103 is not whether the differences themselves would have been obvious. Consideration of differences, like each of the findings set forth in *Graham*, is but an aid in reaching the ultimate determination of whether the claimed invention *as a whole* would have been obvious.”).

As a factfinder, we also must be aware “of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning.” *KSR*, 550 U.S. at 421. Applying these general principles, we consider the evidence and arguments of the parties.

B. Level of Ordinary Skill in the Art

Factors pertinent to a determination of the level of ordinary skill in the art include (1) the educational level of the inventor; (2) the type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the

technology, and (6) educational level of workers active in the field. *Env't'l. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696–697 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1381–82 (Fed. Cir. 1983)). Not all such factors may be present in every case, and one or more of these or other actors may predominate in a particular case. *Id.* Moreover, these factors are not exhaustive but are merely a guide to determining the level of ordinary skill in the art. *Daiichi Sankyo Co. Ltd, Inc. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007).

In determining a level of ordinary skill, we also may look to the prior art, which may reflect an appropriate skill level. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Additionally, the Supreme Court informs us that “[a] person of ordinary skill is also a person of ordinary creativity, not an automaton.” *KSR*, 550 U.S. at 421.

Petitioner proposes that a person of ordinary skill in the art (POSITA) at the time of the '330 patent “would have [had] a B.S. engineering degree in materials, mechanical, metallurgical or an equivalent degree, and at least five years’ experience in the automotive industry with automotive structural and operational parts.” Pet. 7 (citing Ex. 1002 ¶ 34). Petitioner asserts further that “additional education may substitute for lesser work experience and vice versa.” *Id.*

Patent Owner argues that Petitioner’s definition is ambiguous.

PO Resp. 10. Patent Owner instead proposes that

a person of ordinary skill in the art of the '330 patent would be someone who had a bachelor or graduate degree in mechanical engineering or closely related field that includes courses which teach the basic principles of statistics, dynamics, and strength of materials along with knowledge of automotive or truck suspensions systems *and about five years of experience*

designing vehicle suspension systems and/or components or related systems in industry or academia.

Id. at 16 (emphasis added).

Patent Owner alternatively proposes “a person of ordinary skill in the art could have about 10 years of experience designing vehicle suspension components or related systems, without a four-year undergraduate degree, and such a person would typically have experience designing suspension components on large passenger vehicles and/or heavy trucks.” *Id.*

The parties mainly agree that a person of ordinary skill in the art would include a person with a mechanical engineering degree or a degree in a similar engineering field and five years of relevant practical automotive experience. *Compare id. with* Pet. 7. The difference between the parties’ asserted levels of ordinary skill in the art is that Patent Owner proposes a more specific level of experience, that is, “about five years of experience *designing vehicle suspension systems and/or components or related systems in industry or academia.*” *Id.* (emphasis added). This is important, Patent Owner argues, because Petitioner’s definition, and “[Dr.] Wagoner’s ‘spectrum’ of POSITA knowledge . . . is overly broad, capturing skilled artisans in remote arts unrelated to the subject matter of the patent at issue.” *Id.* at 12 (citing *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1361–63 (Fed. Cir. 2006)). According to Patent Owner, “Petitioner’s expert [Dr.] Wagoner gave inconsistent and vacillating testimony regarding what a POSITA would or would not have experience with.” *Id.* at 12–15 (citing Ex. 2011, 21:23–22:23, 67:15–70:6, 114:6–111, 65:9–17).

We disagree that Petitioner’s proposed level of ordinary skill in the art is ambiguous and that Dr. Wagoner’s opinions and testimony as to the level

of skill in the art are “overly broad.” PO Resp. 12. As an initial matter, Patent Owner’s narrower view of the person of ordinary skill in the art, and related questions during Dr. Wagoner’s deposition, appear intended to support its position that Dr. Wagoner lacks sufficient experience with suspension systems so as to compromise his testimony as to the knowledge and technical abilities of a person of ordinary skill. *See, e.g.*, Ex. 2011 21:3–30:4. Dr. Wagoner’s deposition testimony, however, was consistent with Petitioner’s broader level of ordinary skill in the art that encompasses experience with “automotive structural and operational parts,” a definition that could, but might not, specifically include suspension design. *See* Ex. 2011, 21:23–22:23 (Dr. Wagoner explaining that some persons of ordinary skill in the art “may or may not” have a working knowledge of vehicle suspension systems).

The Federal Circuit has clarified recently that “[t]o offer expert testimony from the perspective of a skilled artisan in a patent case—like for claim construction, validity, or infringement—a witness must at least have ordinary skill in the art.” *Kyocera Senco Indus. Tools Inc. v. Int’l Trade Comm’n*, 22 F.4th 1369, 1376–77 (Fed. Cir. 2022). While Patent Owner maligns Dr. Wagoner as someone who could not testify as to the level of ordinary skill in the art because his background does not include specifically designing vehicle suspension systems as a whole, we are not persuaded in this case to limit the level of ordinary skill in the art to artisans who design complete vehicle suspension systems. Also, we note that Patent Owner filed a Motion to Exclude Dr. Wagoner’s testimony (discussed *infra*), but did not move to exclude his testimony on the basis that he is not a POSITA (and therefore not qualified as an expert under *Kyocera*). Paper 31, 2–5. As discussed below, Dr. Wagoner’s experience in the field of automotive and

materials engineering doubtless extends his level of skill well-beyond that of a person of ordinary skill in the art with respect to the subject matter claimed, namely, a leaf spring assembly. *See, e.g.*, Ex. 1002 ¶¶ 56–105 (Dr. Wagoner presenting a detailed historical and technological chronology of leaf spring design, production, and use).

We are compelled to address certain of Patent Owner’s arguments regarding Dr. Wagoner’s qualifications, because Patent Owner’s arguments in this proceeding depend at least in part on the Board not crediting Dr. Wagoner’s testimony and his finite element analysis (“FEA” or “FE analysis”) and his related conclusions as to obviousness under Section 103. *See* PO Resp. 2 (Patent Owner arguing that “Petitioner’s expert Dr. Robert H. Wagoner (‘Dr. Wagoner’), and the Finite Element Analysis (‘FEA’ or ‘FE analysis’) he offers would not be relied upon by a POSITA and should be given little or no weight.”).

With respect to Patent Owner’s citation to *DyStar*, Patent Owner insinuates that Dr. Wagoner is not a person of ordinary skill in the art because he is not a designer of vehicle suspension systems. PO Resp. 12–13. We acknowledge that in *DyStar* the Federal Circuit determined that “substantial evidence does not support the jury’s finding that a person of ordinary skill is a dyer with no knowledge of chemistry.” *DyStar*, 464 F.3d at 1362. However, in *DyStar*, the Federal Circuit determined that “a dyer” was, “a person of only high school education whose skill set is limited to ‘flipping the switches.’” *Id.* at 1362. Entirely different in this case, Dr. Wagoner holds a Ph.D. in Metallurgical Engineering from the Ohio State University and is a Professor Emeritus of the Materials Science and Engineering Department at the Ohio State University who, for thirty years, “taught undergraduate and graduate courses in materials science, materials

engineering, and metallurgy.” Ex. 1002 ¶ 6. Dr. Wagoner testifies that he was also “Staff Research Scientist at the General Motors Research Laboratories from 1977 until 1983 and [] managed research projects and maintained working connections with the U.S. and international automotive and materials industries on topics related to material processing, forming, and mechanical properties for the past 40 years.” *Id.* ¶ 7.

Based at least on Dr. Wagoner’s high level of academic and technical experience, the facts that Dr. Wagoner may not have specifically designed a complete automotive suspension and was not willing to commit to a person of ordinary skill specifically understanding how an air spring suspension works, does not in our opinion make his testimony less credible or technically insightful in this case. *See* PO Resp. 13 (Patent Owner arguing that Dr. “Wagoner’s POSITA definition is imprecise and is divorced from the purpose of the patent, namely improving ride handling and comfort by using a progressive leaf spring”). To the contrary, Dr. Wagoner presented a thorough discussion and testimony regarding the nature of progressive leaf springs. *See* Ex. 1002 ¶ 77 (Dr. Wagoner explaining, *inter alia*, that “[a] POSITA would know . . . that after 2000 many examples of optimized integral eyes were disclosed with FRP leaf springs, particularly with modern progressive designs such as Greco”).

Moreover, Patent Owner’s focus on an air spring, an altogether different component of a vehicle suspension system than the claimed leaf spring, and whether Dr. Wagoner has specific experience with air springs, is frankly a distraction in this case. The ’330 patent is directed specifically to “the need for a *leafspring* assembly for motor vehicles which is easy to produce and can easily be mounted and which, when under load, comprises a progressive spring rate.” Ex. 1001, 2:9–12 (emphasis added). First,

nowhere in the '330 patent is an air spring described, or claimed, for that matter. Also, Patent Owner brings up air spring technology by referring to the prior art, in particular, Enomoto, which describes an air spring positioned between a leaf spring and a vehicle chassis. *See* Ex. 1007, Fig. 1. Petitioner and Dr. Wagoner, however, rely on Enomoto specifically for the characteristics and construction of a leaf spring, and do not rely on, or refer to, in any aspect of their obviousness analysis, an air spring. *See* Pet. 12–13. It is well-settled that Petitioner's obviousness analysis with respect to an air spring need not incorporate all the structure and elements disclosed in Enomoto's suspension. *See In re Lemelson*, 397 F.2d 1006, 1009 (CCPA 1968) (The Court explaining that "[t]he use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned. They are part of the literature of the art, relevant for all they contain.").

Moreover still, Dr. Wagoner testifies in his declaration that prior to his teaching career he was, for six years, a Staff Research Scientist at the General Motors Research Laboratories in Warren, Michigan. Ex. 1002 ¶ 9. During his career Dr. Wagoner has "authored over 300 journal articles, 2 books, 2 text books, and 4 proceeding volumes dealing with the forming and deformation of metals and alloys." *Id.* ¶ 10. Dr. Wagoner testifies that he is "a member of the National Academy of Engineering ('NAE') and Fellow or equivalent of . . . the Society of Automotive Engineers ('SAE'), [and] the American Society of Mechanical Engineers ('ASME')." *Id.* ¶ 12. Dr. Wagoner explains that part of his research support is "derived from several partnerships with industry, including General Motors, Chrysler, the Auto/Steel Partnership, and the Edison Materials Technology Center (EMTEC)." *Id.* ¶ 13.

We determine on this basis that Dr. Wagoner is familiar with basic and, undoubtedly, advanced principles of mechanical engineering and materials testing, including those for the testing and analysis of materials and structures for vehicle leaf springs such as FE analysis. *See Kyocera*, 22 F.4th at 1377 (“[I]t would be improper to require an expert witness to possess ordinary skill in the art and *nothing more*. If that were the case, ‘a person of exceptional skill in the art would be disqualified from testifying as an expert because [he is] not ordinary enough.’” (quoting *Endress + Hauser, Inc. v. Hawk Measurement Systems Pty.*, 122 F.3d 1040, 1042 (Fed. Cir. 1997))). Accordingly, Patent Owner does not persuade us that Dr. Wagoner is not sufficiently qualified to provide helpful testimony and evidence in this proceeding.

Getting back to the definition of a person of ordinary skill in the art, we are not persuaded that Patent Owner’s proposed specific experience “*designing vehicle suspension systems and/or components*” is required for the hypothetical level of ordinary skill in the art. Patent Owner argues that the definition should be “faithful to the ’330 patent, related art, and Federal Circuit precedent.” POResp. 16. We agree. Notably, the ’330 patent is titled “Leaf Spring Assembly for Motor Vehicle.” Ex. 1001, code (54). The Abstract of the ’330 patent describes “[a] leaf spring assembly for a wheel suspension of a motor vehicle comprises a leaf spring of fibre-reinforced plastics for resiliently supporting a wheel carrier of the motor vehicle.” *Id.*, code (57). We appreciate that a leaf spring may be a component of a wheel suspension; however, apart from reciting a “wheel carrier,” the ’330 patent does not describe or reveal additional technical details of a vehicle suspension as a whole. Every figure of the ’330 patent illustrating the leaf

spring assembly shows only a “leaf spring assembly” and no more, as shown for example in Figure 3A reproduced below.

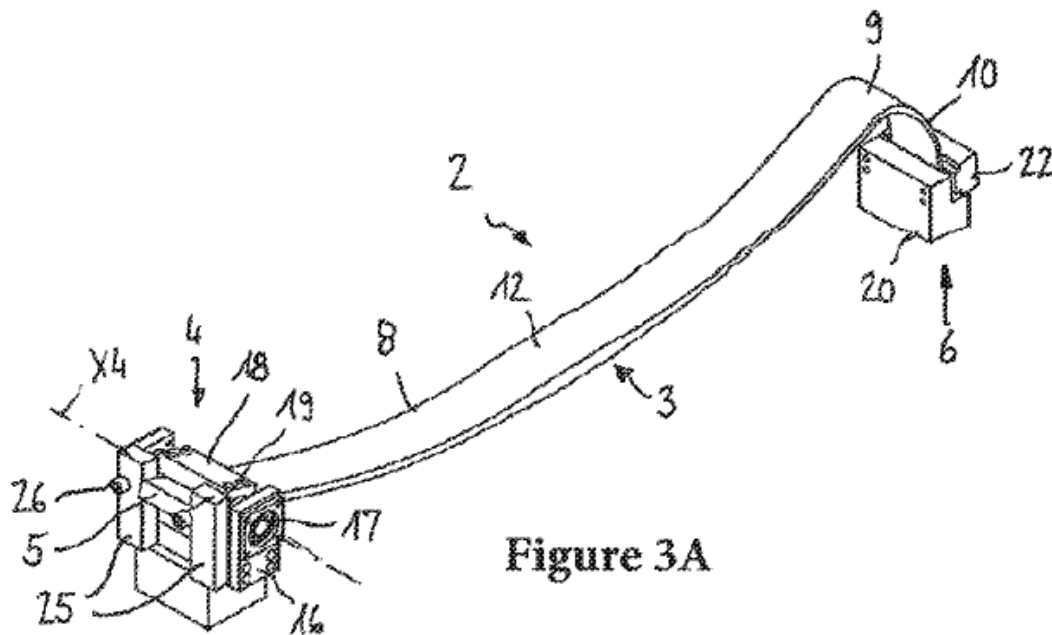


Figure 3A of the '330 patent illustrates fiber-reinforced plastic leaf spring assembly 2 including the first spring leg (spring portion) 8, second spring leg (bendable portion) 10, and transition portion 9. Indeed, the figures never even illustrate a “wheel carrier.” Although the claims parrot the Abstract, reciting “a leaf spring assembly *for* a wheel suspension of a motor vehicle” (emphasis added), the claims positively recite only elements of the leaf spring assembly. *See, e.g., id.* at 12:10–14:25. Nowhere does Patent Owner point us to any relevant substantive description in the '330 patent of wheel suspensions including, for example, air springs. *See* PO Resp. 10–18. As Petitioner persuasively points out, “[n]either the patent drawings nor the specification disclose[s] a leaf spring as part of any particular wheel suspension.” Pet. Reply 1. Even Enomoto, titled “Leaf Spring for Suspension Structure,” focuses almost entirely on describing and claiming the leaf spring structure itself. *See generally* Ex. 1007. Enomoto really only

describes air spring 4 in terms of the functional suspension environment, such as “when a vertical load acts on the vehicle, the leaf spring 25 and the air spring 4 flex, absorbing the load.” *Id.* at 14:7–9. Considering *Kyocera*, we are persuaded that the level of ordinary skill proposed by Petitioner and Dr. Wagoner is faithful to the disclosure and teachings set forth in the ’330 patent as well as the prior art.

We also agree that the scope of an ordinary artisan in the field of leaf springs *includes* a person who designs vehicle suspension systems, for example, Mr. Dilling. But we are not persuaded to narrow the level of ordinary skill *only* to a designer of complete vehicle suspension systems as Patent Owner proposes. Considering the nature of the claimed invention relating to a “leaf spring assembly,” and Dr. Wagoner’s vast education and experience in the arts of metal forming (and deformation) and materials science as well as experience and research in the automotive field and with FEA, we determine that Dr. Wagoner is a person of at least ordinary, if not extraordinary, skill in the art and is qualified to testify as to the perspective of a person of ordinary skill in the art of leaf spring design, regardless of his level of experience designing complete vehicle suspension systems. Indeed, during his deposition, Patent Owner’s declarant, Mr. Dilling, who holds a Bachelor and Master’s degree in mechanical engineering, confirmed that his own education level was sufficient:

Q. Okay. But so your ability to understand and work with leaf springs would be based on your education as well as your work with suspension systems; is that fair?

A. Yes.

Q. Would you be able to work with leaf springs based on your education?

A. Yes.

Ex. 1027, 59:4–11.

Where both parties essentially agree that a person of ordinary skill in the art would include a person with a mechanical engineering degree and experience in the automotive industry, Petitioner’s position is persuasive that “[a] person with an engineering education and relevant automotive experience would be qualified to understand the kinematics, forces and stresses experienced by a leaf spring during operation.” Reply 8. Based on the complete record before us, we do not alter our determination of the level of ordinary skill in the art from our Institution Decision, which is, as proposed by Petitioner, that a person of ordinary skill in the art “would have [had] a B.S. engineering degree in materials, mechanical, metallurgical or an equivalent degree, and at least five years’ experience in the automotive industry with automotive structural and operational parts,” where “[a]dditional education may substitute for lesser work experience and vice-versa.” Pet. 7 (citing Ex. 1002 ¶ 34).

C. Claim Construction

We interpret a claim “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b) (2020). Under this standard, we construe the claim “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *Id.* Furthermore, we expressly construe the claims only to the extent necessary to determine whether to institute *inter partes* review. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the

controversy.” (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

In our Institution Decision, we agreed with Petitioner’s proposed construction of “tensile loading” (in claims 1, 10, and 12), which is “when the horizontal components of the reaction force imposed on each leaf spring end by a respective receiving device are directed in opposite directions away from each other.” Inst. Dec. 8; Pet. 10–11 (citing Ex. 1002 ¶ 143).

In its Response, Patent Owner argues that “Petitioner’s proposed construction is incomplete insofar as it ignores that the leaf spring *is in its installed state* and the tensile loading is in response to increasing vertical forces from the wheel carrier.” PO Resp. 18 (emphasis added). Patent Owner contends that “tensile loading” means “when the horizontal components of the reaction force imposed on each leaf spring end by a respective receiving device are directed in opposition directions away from each other *when vertical forces are introduced from a wheel carrier of a vehicle while in its installed state.*” *Id.* at 22 (emphasis added). Patent Owner’s construction adds the additional requirement that the imposed reaction forces occur “when vertical forces are introduced from a wheel carrier of a vehicle while in its installed state.” *Id.*

Addressing Patent Owner’s proposed construction, we first note that Petitioner is not “ignoring” the leaf spring in the “installed state” or that tensile loading occurs when increasing vertical forces occur through “the wheel carrier.” Petitioner’s position is that, as recited in the claims, “[t]hese are well-accepted statements of intended use.” Pet. Reply 9 (citing *Ericsson, Inc. v. D-Link Sys., Inc.*, 773 F.3d 1201, 1217 (Fed. Cir. 2014); *Finjan, Inc. v. Secure Computing Corp.*, 626 F.3d 1197, 1204–1205 (Fed. Cir. 2010)).

We agree with Petitioner. Claim 1 recites “a leaf spring of fiber-reinforced plastics *for* resiliently supporting a wheel carrier of the motor vehicle,” and then goes on to recite specific elements of the leaf spring. Ex. 1001, 12:12–13 (emphasis added). Claim 1 also recites “wherein the leaf spring, with an increasing load due to vertical forces introduced from the wheel carrier, is increasingly subjected to tensile loading.” *Id.* at 12:30–33. This functional language—that is—how the leaf spring operates—does not require that the wheel carrier *is* physically on the leaf spring, or that a load *is* actively applied to the leaf spring via the wheel carrier, only that the leaf spring has the capability to support a wheel carrier and receive forces through the wheel carrier that cause tensile loading. For instance, the recitation of the leaf spring being “increasingly subjected to tensile loading” is a functional step recited in an apparatus claim. The “tensile loading” therefore occurs because of the underlying characteristics and physical structure of the leaf spring assembly. The fact that a vertical force would need to be applied to subject the claimed leaf spring to tensile loading does not impact the structural requirements for the claimed leaf spring structure itself. *See, e.g., Finjan*, 626 F.3d at 1204–1205 (“In this case, Finjan’s non-method claims describe capabilities without requiring that [] any software components be ‘active’ or ‘enabled.’”).

Similarly, we are persuaded that the “installed state” clauses in claim 1 are also a statements of intended use, for example:

wherein the spring portion extends substantially in a longitudinal direction of the motor vehicle *in an installed state* and *is configured to* accommodate the wheel carrier.

Ex. 1001, 12:17–20 (emphases added). Again, *how* the leaf spring assembly is capable of being physically arranged relative to the motor vehicle when

installed does not alter or impact the structural requirements of the leaf spring assembly itself, other than allowing for that installation. Here, the clause provides an association or arrangement of the leaf spring with the motor vehicle to define a particular capability or purpose that is served by the leaf spring. And, that the leaf spring “*is configured* to accommodate the wheel carrier” simply imparts structural capability to the leaf spring itself. It is well established that claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. *See, e.g., In re Schreiber*, 128 F.3d 1473, 1477–78 (Fed. Cir. 1997). In order to satisfy the functional limitations in an apparatus claim, the prior art apparatus must be capable of performing the claimed function. *Id.* at 1478. Thus, a prior art reference need not expressly envision the device being actually used to perform the claimed functions. Although in this case, there is certainly evidence that the prior art is not only capable of performing the recited functions, but that a person of ordinary skill in the art would have understood the prior art to be directed to the same use and progressive performance characteristics for automotive vehicles. *See* Ex. 1007, 4:29–38 (Enomoto describing: “The leaf spring for a suspension structure . . . provided with eyes pivotably supported by horizontal pins in brackets attached to the chassis frame side on both end sections in the lengthwise direction, is formed substantially rectilinearly towards the eyes towards the front of the vehicle on the side of the vehicle further forward than the axle.”).

To be clear, we determine that the plain meaning of the claim language with respect to the functional nature of “installed state” and “increasing load due to vertical forces” is recited in the nature of an intended use and claim 1 encompasses the claimed leaf spring assembly whether or

not it is actually installed in a vehicle or vertical forces from a wheel carrier are actively impacting the leaf spring assembly. Statements of intended use in an apparatus claim do not distinguish the claim over the prior art apparatus. *In re Sinex*, 309 F.2d 488, 492 (CCPA 1962).

Our understanding of the claim language is consistent with the descriptions of intended use in the specification of the '330 patent expressly describing the possible arrangements and orientations of the leaf spring in a vehicle:

It applies to all the above-mentioned examples that *in the installed state* the first end 5 and, respectively, the long spring leg 8 are positioned in the front of the vehicle, and accordingly that the second end 7 and, respectively, the second receiving device 6 are positioned at the rear. A reversed arrangement is also possible.

Id. at 11:56–61. Patent Owner’s proposed claim language, specifically the dependent clause “when vertical forces are introduced from a wheel carrier of a vehicle while in its installed state,” to a great extent simply reiterates what is already expressly recited in claim 1. *Id.* at 22. That is, claim 1 expressly recites a leaf spring and that tensile loading would occur due to “increasing load due to vertical forces introduced from the wheel carrier” when the leaf spring is “in an installed state.”

Considering the prosecution history, our determination is consistent with the Examiner’s claim interpretation and application of the prior art during prosecution of the application that issued as the '330 patent. The Examiner found that the leaf spring disclosed in the applied prior art reference Greco (Ex. 1011) was capable of transitioning from compression to tension. Ex. 1004, 85. The Examiner rejected claim 19, which became issued claim 1, with the same “installed state” and “increasing load due to

vertical forces” recitations, because Greco disclosed a leaf spring assembly and “[t]he spring is inherently believed to be subject to increased tensile loading as the vertical load on the vehicle is increased. Although not applied.” Ex. 1004, 85. This statement by the Examiner was disputed to some extent, but not necessarily overcome by Applicant during examination. *See id.* at 27–28 (Applicant arguing that “Greco is subjected to compression loading”). The Applicant’s assertion that Greco’s leaf spring was subject to compression loading does not negate that it can also be subjected to tensile loading. And, in order to overcome the Greco reference, Applicant subsequently amended claim 19 to include specific alignment and positioning limitations of the leaf spring in the “installed state.” *See id.* at 23 (Applicant adding, in part, “in the installed state . . . the spring portion extending therefrom [is] positioned towards a front end of the motor vehicle”).⁵ Given the unambiguous nature of such intended use claim language, we discern no reason to rewrite or alter our previous claim construction, which is the plain meaning of the term.

As discussed above, the first part of Patent Owner’s claim construction is almost exactly the same as Petitioner’s proposed claim construction. *Compare* Pet. 10–11, *with* PO Resp. 22. Because the parties agree on at least this language and because we determine that Patent Owner’s proposed additions to Petitioner’s claim construction are superfluous and alter the plain meaning of the claims, we are not persuaded

⁵ Patent Owner argues that “the Examiner withdrew the rejection that Greco was capable of tensile loading, and Patent Owner received a Notice of Allowance.” PO Resp. 20. We do not agree with Patent Owner’s characterization of this reason for allowance, nor do we agree that the amended claim language mirroring the previous intended use recitations “require” the leaf spring to be in the installed state. *Id.*

to change our previous determination, that is—the meaning of “tensile loading” is “*when the horizontal components of the reaction force imposed on each leaf spring end by a respective receiving device are directed in opposite directions away from each other.*” Inst. Dec. 8 (emphasis added).

Finally, even if we accepted Patent Owner’s claim construction, including the clause “when vertical forces are introduced from a wheel carrier of a vehicle while in its installed state,” this is also a statement of intended use, and as discussed in detail below in our analysis of the patentability grounds, we are persuaded that Enomoto’s leaf spring is capable of transitioning from compression to tension in the “installed state.” Similarly, even if the phrase “in an installed state” is considered to include structural limitations, as we discuss below, Enomoto discloses such structural limitations.

D. Ground 1: Claims 1–5, 8, 10–14, and 17 – Obviousness over Enomoto (Ex. 1007)

On the complete record before us, Petitioner has shown by a preponderance of the evidence that claims 1–5, 8, 10–14, and 17 would have been obvious over Enomoto.

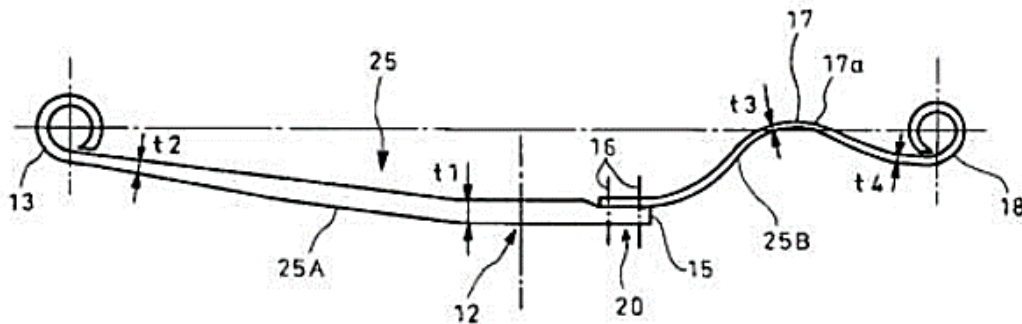
1. Enomoto⁶ (Ex. 1007)

Titled “Leaf Spring for Suspension Structure,” Enomoto is Japanese Patent Publication No. JP3872719, which was published on October 27, 2006 (also indicates a publication date of January 24, 2007). Ex. 1007, codes (11), (24), (45). There is no dispute that Enomoto is prior art. *See generally* PO Resp.

⁶ We refer to the English translation of Enomoto, Ex. 1007, in our analysis.

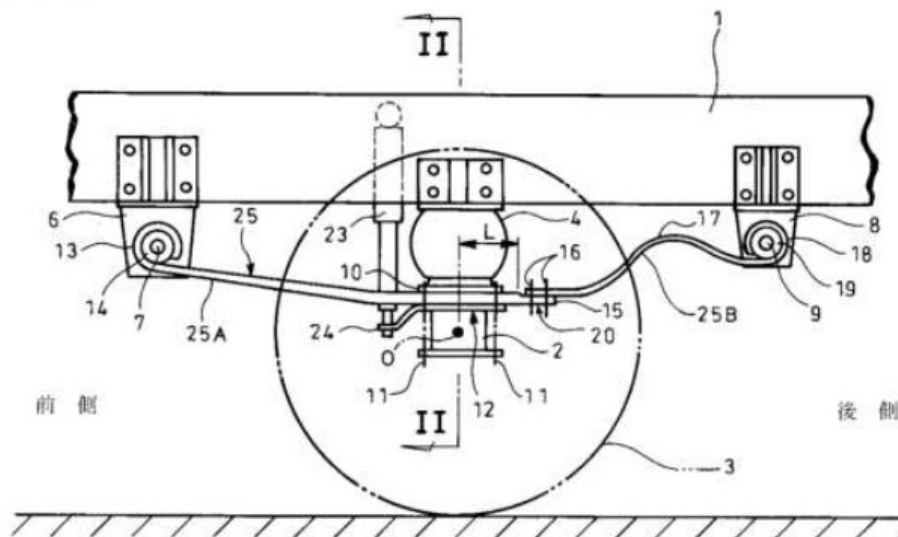
Enomoto describes a vehicle suspension leaf spring having a thick forward leaf 25A portion that is attached to an eye on the vehicle chassis and a thinner rear leaf 25B portion “which is provided with top and bottom curved sections partway through,” and is similarly attached to the vehicle chassis by an eye. Ex. 1007 code (54), ¶ 16.

Enomoto’s Figure 3 is reproduced below.



Enomoto’s Figure 3, above, is a side elevation view of two-part leaf spring 25 including forward leaf 25A and rear leaf 25B connected at linking section 20. *Id.* ¶ 25. Enomoto’s Figure 1 is reproduced below.

FIG. 1



Enomoto’s Figure 1, above, illustrates attachment of leaf spring 25 to vehicle chassis (frame) 1 at eyes 13, 18, and to vehicle axle 2 at fixing

section 12. Air spring 4 is positioned between chassis 1 and leaf spring 25, and shock absorber 23 is connected to chassis 1 and axle 2. *Id.* ¶ 26.

Enomoto describes that

[i]n the suspension structure in FIG. 1 provided with the leaf spring 25, when a vertical load acts on the vehicle, the leaf spring 25 and the air spring 4 flex, absorbing the load. The load is transmitted to the chassis frame 1 from the eyes 13, 18 formed on the front and back end sections of the leaf spring 25, via the bushings 14, 19 and the horizontal pins 7, 9 as well as via the air spring 4. Vertical vibration acting on the vehicle is attenuated by the shock absorber 23.

Id. ¶ 48.

2. Independent Claim 1

We consider initially the elements of claim 1.

(a) Petitioner's Arguments

i. Preamble [1pre] – a leaf spring assembly for a wheel suspension of a motor vehicle

To the extent the preamble of claim 1 is limiting, Petitioner asserts that “Enomoto teaches a leaf spring for a vehicle suspension system.” Pet. 13 (citing Ex. 1007 ¶¶ 1, 15). There is no dispute that Petitioner is correct and we agree that Enomoto does teach a leaf spring for a vehicle suspension system. *See generally* Ex. 1007.

ii. Limitation [1a] – a leaf spring of fiber-reinforced plastics for resiliently supporting a wheel carrier of the motor vehicle

Petitioner acknowledges that Enomoto does not expressly disclose any particular material for its leaf spring. Pet. 14. On the other hand, Petitioner asserts that “usage of a composite material, such as fiber-reinforced plastics, as a substitution for metal leaf springs, is well-known as fiber-reinforced plastics are lighter than metal materials and can also be more cost effective

when integrating multiple parts.” *Id.* at 14. Petitioner, supported by Dr. Wagoner, argues that fiber-reinforced plastics have been used for decades for leaf springs and “[i]ndeed, at this time only two types of material had been used for leaf springs: steel and fiber-reinforced plastic.” *Id.* (citing Ex. 1002 ¶ 77). Dr. Wagoner testifies that “[b]y the end of the 2000’s and the start of the 2010’s, car makers were designing new production cars with FRP springs . . . [a]ny POSITA, or even anyone with inferior skill in the leaf spring art would know that only two materials are used for leaf springs: steel and FRP.” Ex. 1002 (citing <https://www.automotive-iq.com/chassis-systems/articles/lightweight-materialsreducing-weight-suspension-systems>; <https://www.compositesworld.com/news/worlds-first-glass-fiber-leaf-spring-for-40-ton-trucks>). Petitioner also points out that during prosecution of the ’330 patent the Examiner wrote that “[f]iber reinforced plastic/composite leaf springs are notoriously well-known in the art,” and that the applicant, i.e., Patent Owner, did not challenge the Examiner’s statement. *Id.* (alteration in original) (citing Ex. 1004, 86).

Dr. Wagoner testifies that a person of ordinary skill in the art would be motivated to form Enomoto’s leaf spring out of fiber-reinforced plastic first, because it was a well-known substitute material for metal, and a person of ordinary skill in the art could take “advantage of its light weight” compared to metal. Ex. 1002 ¶ 160 (citing, *inter alia*, Ex. 1011, U.S. Patent No. 6,435,485 to Greco (issued Aug. 20, 2002) explaining that “[r]ecently, fiberglass has replaced steel in longitudinal leaf springs because it significantly reduces weight.”). Second, Dr. Wagoner testifies that a person of ordinary skill in the art would consider such a substitution “also because

FRP's processing would make the problematic joint of Enomoto unnecessary." *Id.*

iii. Limitation [1b] – the leafspring comprising a first end portion

Petitioner asserts that Enomoto's leaf spring 25 has a "front end" having eye 13 connected to pin 7 that is secured to the chassis. Pet. 18 (citing Ex. 1007 ¶¶ 26, 47, Fig. 1).

iv. Limitation [1c] – a spring portion extending from the first end portion

For limitation 1[c], Petitioner asserts that the claimed "spring portion" is taught by "Enomoto's leaf spring 25 includ[ing] a 'forward leaf 25A' that extends from the eye 13 located toward the vehicle front." Pet. 19 (citing Ex. 1002 ¶¶ 40, 48).

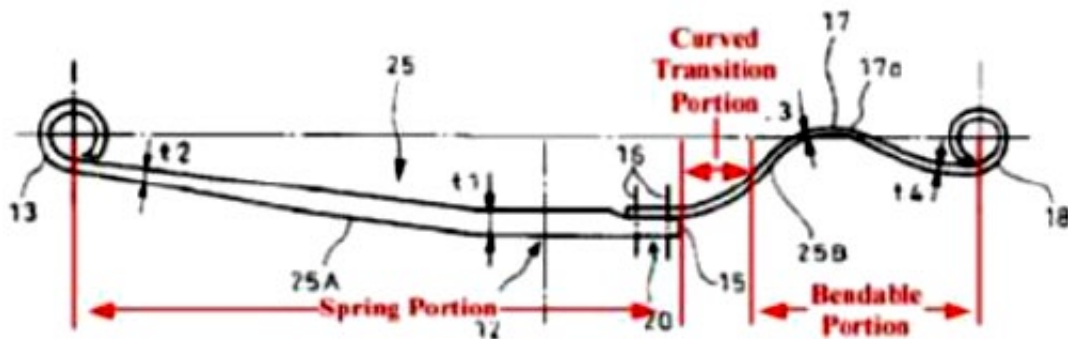
v. Limitation [1d] – a second end portion

Petitioner asserts that "Enomoto's leaf spring 25 also has a 'rear end' . . . that extends 'towards the back of the vehicle' and '[a]n eye 18 formed curved into a cylinder' on the rear end thereof." Pet. 22 (citing Ex. 1007 ¶ 27, Fig. 3).

vi. Limitation [1e] – a bendable portion extending from the second end portion

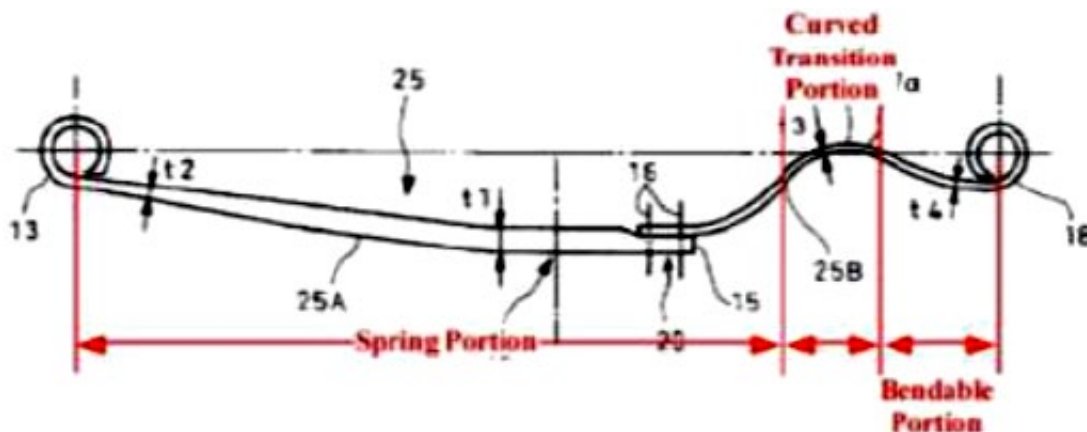
Petitioner asserts that Enomoto's rear leaf spring 25B has a curved transition portion and a bendable portion that "moves vertically and bends to accommodate for the change in length of the spring portion when it is subjected to load from the axle." Pet. 24 (citing Ex. 1002 ¶ 172). Petitioner provides two alternatives for the specific structural "curved transition portion," and "bendable portion," referred to as "Position 1" and "Position 2." *Id.* at 24–25 (emphasis omitted). Position 1 and Position 2 are shown in

Petitioner's annotated versions of Enomoto's Figure 3, respectively, reproduced below.



Petitioner's annotated Figure 3 from Enomoto, above, illustrates the relative positions of the curved transition portion and bendable portion at Position 1, which starts at a section of the leaf spring immediately adjacent the connection point between the spring and bendable portions. *Id.* at 27–28.

The alternative is shown in the second annotated figure below:



Petitioner's second annotated Figure 3 from Enomoto, above, illustrates the relative positions of the curved transition portion and bendable portion in Position 2, which starts in the middle of the annotated bendable portion at a peak of its curved shape. *Id.* Dr. Wagoner testifies that a person of ordinary skill in the art "would understand that this section at the rear of the Enomoto leaf spring after the change in curvature from the curved section 17 satisfies

the claimed bendable portion as it bends to accommodate for the change in the length of the spring portion.” Ex. 1002 ¶ 172.

- vii. *Limitation 1[f] – wherein the spring portion extends substantially in a longitudinal direction of the motor vehicle in an installed state and is configured to accommodate the wheel carrier*

Petitioner asserts that considering Enomoto’s Figure 1, “‘forward leaf 25A’ is fixed to the ‘axle 2’ at fixing section 12 and the forward leaf 25A thus extends in the longitudinal direction.” Pet. 26 (citing Ex. 1007 ¶ 26, Ex. 1002 ¶¶ 173, 211).

- viii. *Limitation 1[g] – wherein the spring portion and the bendable portion are connected to each other by a curved transition portion*

Petitioner asserts that considering either structural alternative shown in Position 1 and Position 2, “[t]he curved transition portion serves as a transition from the thick spring portion to the vertically curving bendable portion.” Pet. 28 (citing Ex. 1007 ¶ 21, Ex. 1002 ¶ 174).

- ix. *Limitation 1[h] – wherein the spring portion is longer than the bendable portion*

Petitioner asserts that “Enomoto’s figures make clear that the ‘spring portion’ of the leaf spring 25 is longer than the ‘bendable portion.’” Pet. 29. Dr. Wagoner testifies that in considering Enomoto’s design, he prepared “finite element models and found them in agreement with the ratios disclosed in the specification text. This lends confidence in the use of Enomoto proportions from the figures.” Ex. 1002 ¶ 175 (citing *id.*, Figs. 31(b)-(c)).

x. Limitation [1i] – a first receiving device for supporting the first end portion

According to Petitioner, on Enomoto's leaf spring "[t]he eye 13 is received on the bracket face between its top and bottom surfaces and encapsulates the pin 7 and is thus received by the bracket and supported by the pin 7 through the bushing and meets element 1i." Pet. 33 (citing Ex. 1002 ¶¶ 176–178).

xi. Limitation [1j] – a second receiving device or supporting the second end portion

Petitioner asserts that "Enomoto's leaf spring 25 includ[e]s an 'eye 18' formed on the end directed toward the back of the vehicle. The 'eye 18' is pivotably supported by a 'horizontal pin 9'." Pet. 34. Dr. Wagoner testifies that "Element 1j is the same as Element 1i, except at the right / rear / second end of the leaf spring. Figure 32 shows that the Enomoto connection meets this claim element for the same reasons as for Element 1i." Ex. 1002 ¶ 180 (citing *id.* Fig. 32).

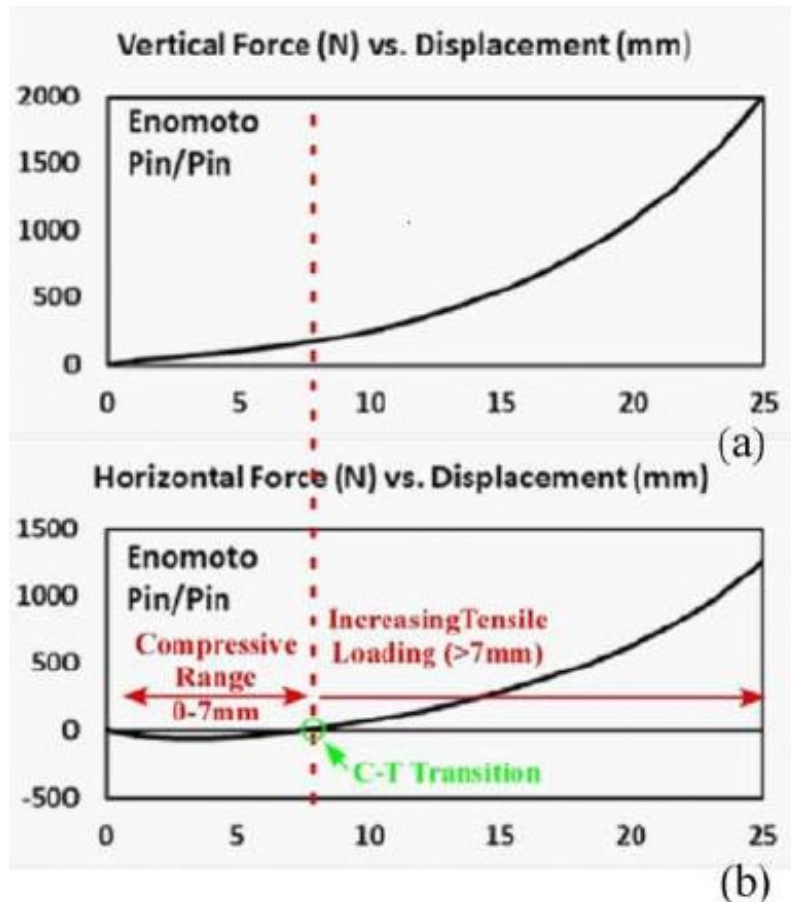
xii. Limitation [1k] – wherein the first receiving device and the second receiving device are provided so as to hold the first end portion and the second end portion in a non-displaceable way relative to one another

Petitioner argues that, unlike the prior art that used shackles permitting longitudinal movement of the leaf spring, and just as recited in claim 1, Enomoto's "brackets 6, 8 are fixed to the chassis frame and keep the horizontal pins 7, 9 in the same location while the eyes 13, 18 rotate about the pins." Pet. 35 (citing Ex. 1007 ¶ 47). Dr. Wagoner provides testimony confirming that Enomoto's "Figure [1] shows clearly that the brackets [6] and [8] are bolted securely to the chassis frame member and therefore are non-displaceable." Ex. 1002 ¶ 181.

- xiii. Limitation [11] – wherein the leaf spring, with an increasing load due to vertical forces introduced from the wheel carrier, is increasingly subjected to tensile loading*

Petitioner asserts that “[t]his [claimed] condition is a functional result of the claimed leaf spring shape and the connection of its ends in a non-displaceable way relative to each other.” Pet. 35 (citing Ex. 1002 ¶¶ 182–184). Dr. Wagoner testifies in support that it was well known to a person of ordinary skill in the art that “[a]ny leaf spring with non-displaceable ends will, when deflected sufficiently, be subjected to increasingly tensile loading . . . [t]his behavior is an inherent result of stretching the spring to a length longer than its initial, relaxed length, by deflecting it upward sufficiently.” Ex. 1002 ¶¶ 183–184 (citing *Id.* ¶¶ 78–87, 127–146). Using finite-element simulations and analysis, Dr. Wagoner computed the horizontal forces on the pins in Enomoto’s leaf spring, as shown in the graphs of Dr. Wagoner’s annotated version of Figure 33, reproduced below. *Id.* ¶ 186.⁷

⁷ Figure 33 in ¶ 186 is an annotated version of Dr. Wagoner’s Figure 21 found in previous ¶ 116.



Dr. Wagoner’s annotated Figure 33, in the lower graph (b), above, illustrates that “[u]p to 7mm of deflection, the loading is compressive. At 7mm deflection, it is neutral and is labelled the ‘C-T Transition’ on Figure 33 for the transition from compressive loading to tensile loading. For deflections larger than 7mm the loading is tensile and increasing.” *Id.* ¶¶ 116, 186.

- xiv. *Limitation [1m] – further wherein at least one of the first and second receiving devices provides pivotable support to the associated one of the first end portion and the second end portion around a pivot axis extending transversely to a longitudinal axis of the vehicle*

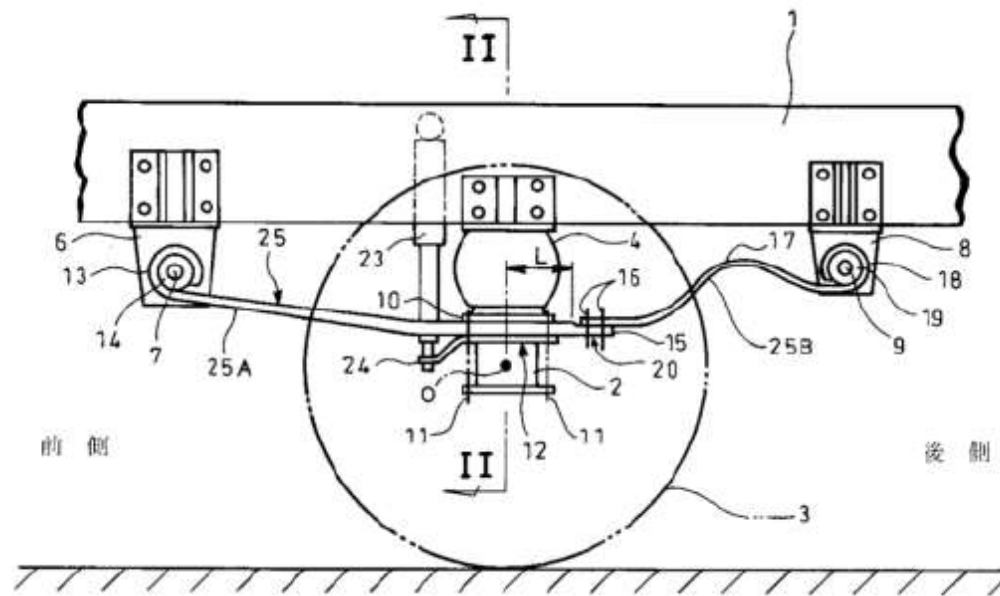
Petitioner asserts that “Enomoto teaches that at one end ‘[t]he eye 13 is pivotably supported on the horizontal pin 7 by a bushing 14.’” Pet. 40 (citing Ex. 1007 ¶ 26). Petitioner points out, also, that Enomoto “teaches

that at the other end “[t]he eye 18 is pivotably supported on the horizontal pin 9 by a bushing 19.” *Id.* (alteration in original) (citing Ex. 1007 ¶ 27). Petitioner argues further that because the pivot axis is parallel to the pin axis and the eye axes, the eyes 13, 18 are “oriented transversely or perpendicular to the longitudinal axis as required by element 1m.” *Id.* at 41 (citing Ex. 1002 ¶ 193).

- xv. *Limitations [1n] and [1o] – wherein in the installed state of the leaf spring the first end portion and the spring portion extending therefrom are positioned towards a front end of the motor vehicle, and the second end portion and the bendable portion extending therefrom are positioned towards a rear end of the motor vehicle*

Petitioner argues that Enomoto’s eye 13 at the forward end of forward leaf spring 25A is positioned towards the front of the vehicle, and that eye 18 formed by rear leaf spring 25B, i.e., the bendable portion, is positioned towards the rear of the vehicle. Pet. 41–42 (citing Ex. 1007 ¶¶ 24, 26, 27, 47, Fig. 1). Enomoto’s Figure 1 is reproduced below.

FIG. 1



Enomoto's Figure 1 above, depicts leaf spring 25 as it is attached to vehicle chassis 1 at eyes 13, 18, along with shock 23 and air spring 4.

(b) Patent Owner's Arguments

Patent Owner focuses most on disputing Dr. Wagoner's analysis and conclusion that Enomoto discloses the limitation [11] in claim 1 "wherein the leaf spring with increasing load due to vertical forces introduced from the wheel carrier is increasingly subject to tensile loading" and as recited in limitation [1a] whether the skilled artisan would substitute FRP for steel. *See, e.g.*, PO Resp. 1–5. Thus, we begin our discussion with these limitations and related arguments.

- i. Whether Enomoto teaches a leaf spring capable of being subject to tensile loading when subjected to increasing load due to vertical forces from a wheel carrier*

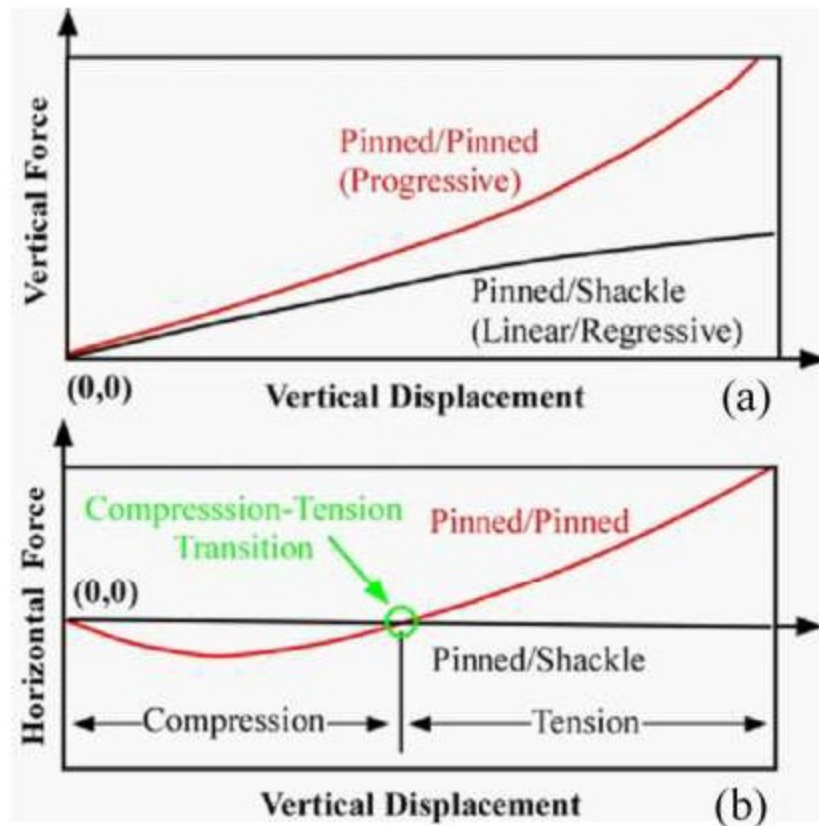
Patent Owner and Mr. Dilling dispute the finite element analysis ("FEA" or "FE" analysis) of Enomoto's leaf spring presented by Dr. Wagoner in this proceeding, and make a number of arguments as to the

sufficiency and veracity of the analysis. PO Resp. 28–39. Patent Owner first contends that Dr. Wagoner did not, himself, perform the FEA analysis of Enomoto, and that the analysis did not properly use the actual dimensions of Enomoto’s leaf spring. *Id.* 29–31, 33–34. Additionally, Patent Owner asserts that Dr. Wagoner did not consider yield and failure points of the leaf spring, disregarded the pivot connections and did not perform a travel study. *Id.* 34–36. We address these, and other related arguments in turn below.

Before addressing Patent Owner’s arguments, we initially summarize Dr. Wagoner’s FE analysis presented with the Petition.

ii. Dr. Wagoner’s FE analysis of a simple arc leaf spring

Dr. Wagoner testifies that a person of ordinary skill in the art understands that “[a]ny leaf spring with non-displaceable ends will, when deflected sufficiently, be subjected to increasingly tensile loading [], so any prior art leaf spring with non-displaceable ends would read on this claim element.” Ex 1002 ¶ 183 (citing *id.* ¶¶ 106–113). Dr. Wagoner explains that for a leaf spring with pinned ends “[a]t some critical deflection point, the horizontal reaction forces would become zero. Thereafter, for increased upward displacement of the spring center, the horizontal reaction forces would become pointed outward, i.e. tensile. *Id.* ¶ 105 (citing *id.* Fig. 15(b)). Dr. Wagoner illustrates this deflection point with the “compression-tension transition” point illustrated in the following graphs.



Id. ¶ 105. Figures 15(a)-(b) above from Dr. Wagoner’s declaration illustrate conceptual development of loading forces with vertical displacement for the simple arc leaf spring pinned at one end and shackled at another, “pinned/shackled,” in comparison to a simple arc leaf spring pinned at both ends, “pinned/pinned.” *Id.* Dr. Wagoner explains for the pinned/pinned scenario that with sufficient vertical displacement “the horizontal reaction forces would be expected to become zero when the unconstrained spring attains its initial length. This is shown in green on Figure 15(b) and is labelled the Compression-Tension Transition point. Thereafter, tensile loads (pointed outward) increase. Figure 15(b) [above] shows this behavior schematically.” *Id.*

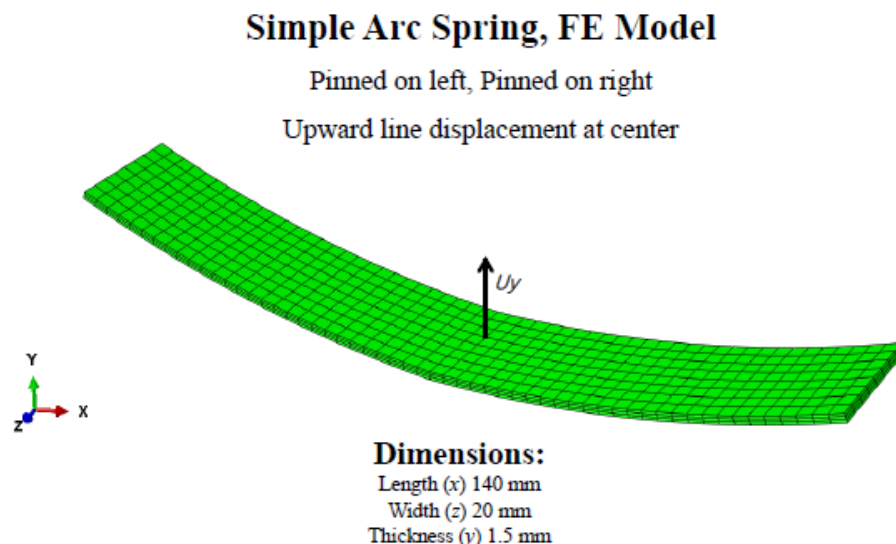
Dr. Wagoner presents, and refers to, his FE analyses of several variations of leaf springs illustrating an increasing vertical load being

applied, and the resultant horizontal force (in Newtons) compared to displacement of the leaf spring by the vertical load. Ex. 1002 App'x D–I. As shown in the figures below, an FE analysis divides a large 3-dimensional model into smaller simpler parts for mathematical solution by providing a finite element mesh. Dr. Wagoner explains that his FE analyses

starts with simulation of a leaf spring with simple arc shape initially (as above) to see how the simple conceptual picture agrees with or varies from the actual case. Then, it continues with simulation of a few examples of new progressive leaf spring designs that are shaped and contoured. This reveals the principles of leaf spring operation for these more general configurations. The finite element simulation technique used for the three-dimensional simulation of arbitrary shapes and attachment strategies to understand their roles and deviations from the simple semi-elliptical, uniform cross-section, mono-leaf case.

Ex. 1002 ¶ 106.

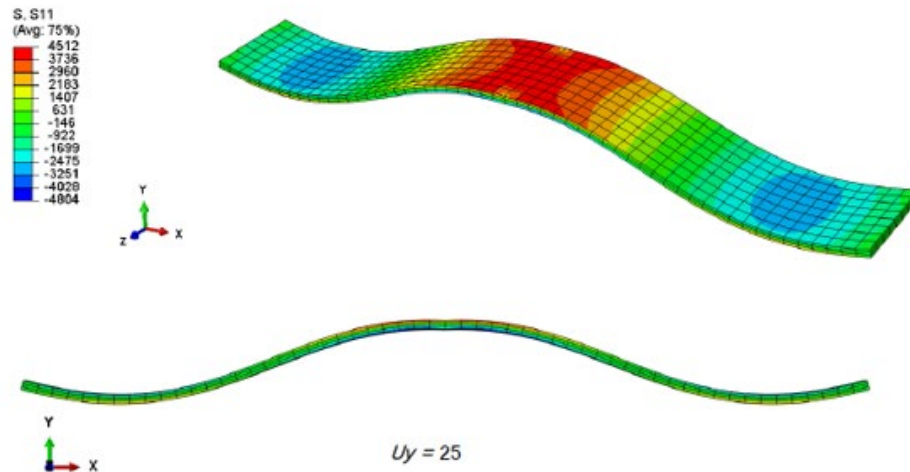
For example, portions of the FE analysis for a simple semi-elliptical (arc) leaf spring with both ends pinned, i.e., fixed, are reproduced below.



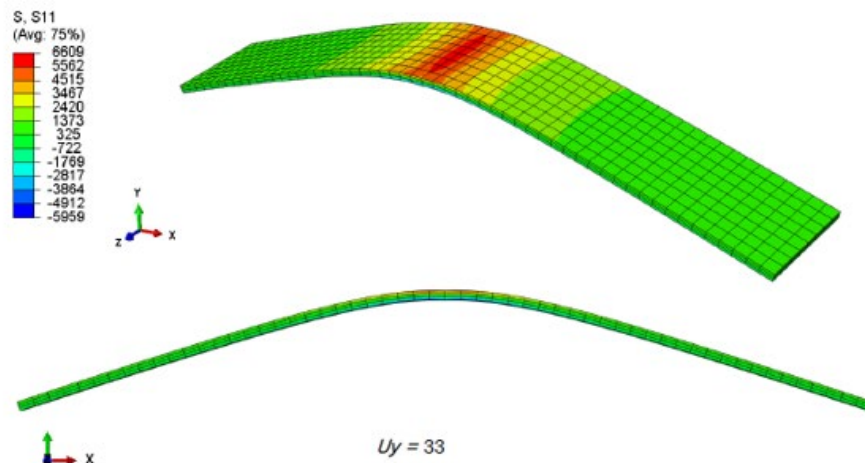
The figure above depicts an arc leaf spring (the green, curved rectangle), pinned at both ends, with no vertical load applied and no displacement.

Ex. 1002, Appx. E. U_y is the vertical displacement in mm (here 0 mm).

The figures below show the FEA modeling results of a simple arc spring, pinned on the left and right, for certain displacements.



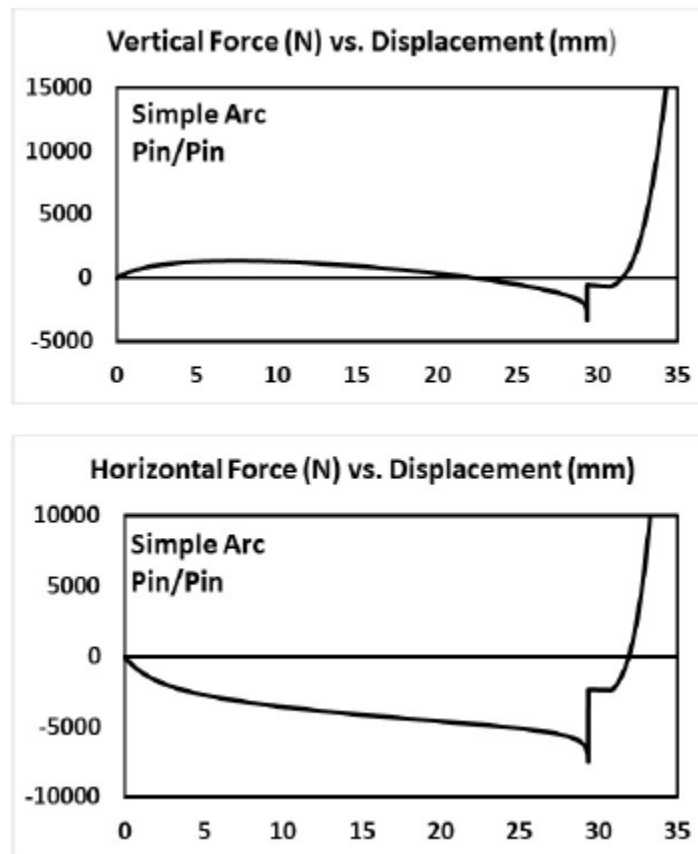
The figure above depicts an arc leaf spring (multicolored, curved rectangle), pinned at both ends, with a vertical load applied and $U_y = 25$ mm displacement. *Id.*



The figure above depicts an arc leaf spring (multicolored, curved rectangle), pinned at both ends, with a vertical load applied and 33 mm displacement.

Id. For the simple arc leaf spring, Dr. Wagoner testifies that the FE analysis confirms the understanding of a person of ordinary skill in the art, that is “[f]or pin/pin simple springs there is an initial range of displacement where compression grows, a second region where they decrease, and a third region where they start at zero and grow rapidly in tension.” Ex. 1002 ¶ 113, *see also id.* ¶ 112 Fig. 19 (Graphs representing “comparison of finite element results for the mechanical behavior of a simple leaf spring with pin/shackle mounting (black lines) versus pin/pin mounting (pin/fix lines)”).

Reproduced below are Dr. Wagoner’s vertical and horizontal force graphs showing force in Newtons versus displacement U_y for the simple arc leaf spring.



Id. ¶ 111. The FE analysis graphs above represent “[f]inite element results for the mechanical behavior of a simple leaf spring with pin/pin mounting.”

Id. ¶ 112. Dr. Wagoner explains that with both ends pinned, these graphs reveal

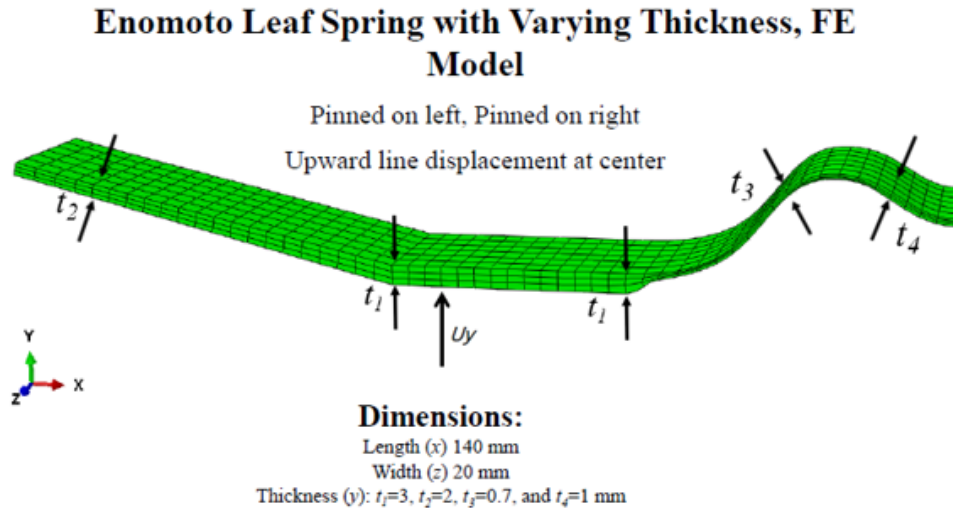
dramatic spring progression once the deformation becomes tensile starting at vertical displacements of 32mm. The pin/pin mounting introduces horizontal reaction forces that are compressive/inward during the first range of motion. For this pin/pin configuration, the horizontal forces increase up to approximately 30 mm of displacement, then decrease to zero at a displacement around 32mm and increase rapidly in the tensile/outward direction thereafter. The transition of horizontal reaction forces from compression to tension occurs at approximately 32mm of vertical displacement.

Ex. 1002 ¶ 112.

Thus, as discussed above, it is Dr. Wagoner’s conclusion that a simple leaf spring, fixed at both ends, will inevitably experience both compression and transition to tension forces when subjected to sufficient forces.

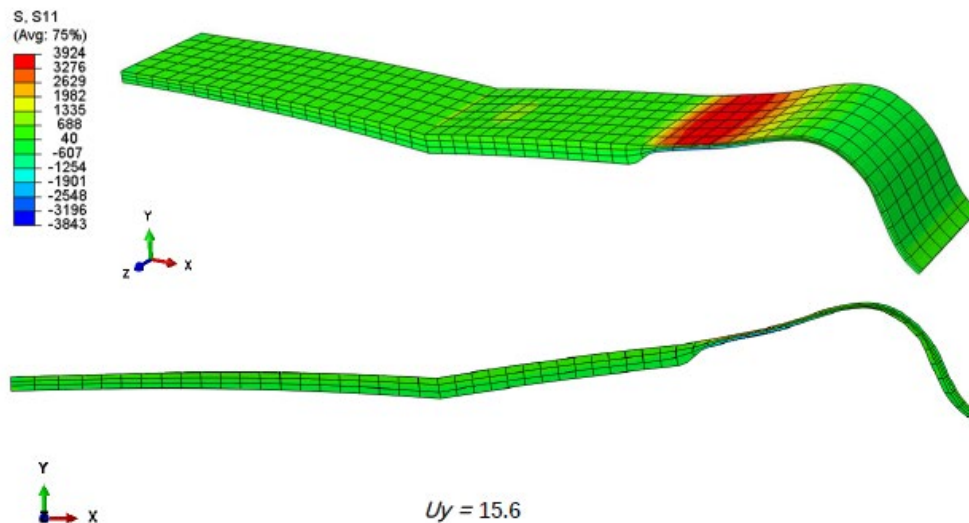
iii. Dr. Wagoner’s FE analysis of Enomoto’s leaf spring

By way of another example, portions of the FE analysis of Enomoto’s leaf spring also with both ends pinned (as Enomoto teaches) are reproduced below.

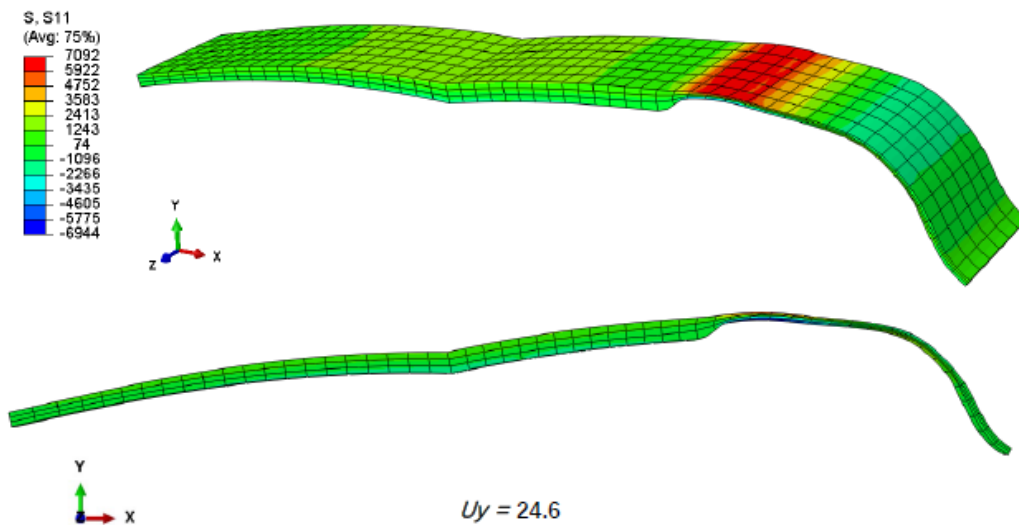


The figure above depicts Enomoto's leaf spring (green colored shape), pinned at both ends, with no vertical load applied and no displacement. Ex. 1002, Appx. E. U_y is the vertical displacement in mm.

The figures below show the FEA results for Enomoto's leaf spring, pinned on the left and right, for certain displacements.

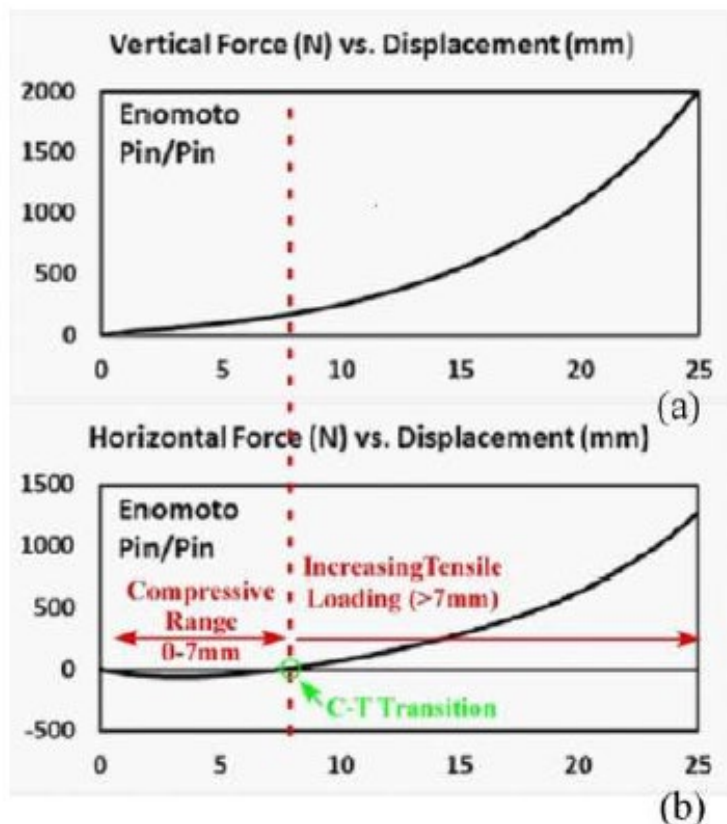


The figure above depicts Enomoto's leaf spring, pinned at both ends, from a side view and from a perspective view, with a vertical load applied and 15.6 mm displacement.



The figure above depicts Enomoto's leaf spring, pinned at both ends, again from a side view and from a perspective view, with a vertical load applied and 24 mm displacement. For Enomoto's leaf spring, Dr. Wagoner testifies that the FE analysis confirms the understanding of a person of ordinary skill in the art, that is "the Enomoto leaf spring, by virtue of its pinned connection at both ends, will be increasingly subjected to tensile loading when deflected upward sufficiently by vertical forces." *Id.* ¶ 185 (citing *id.* ¶ 144–145).

Reproduced below are the vertical and horizontal force vs. displacement graphs, including Dr. Wagoner's annotations illustrating compressive and tensile ranges, showing force in Newtons versus displacement U_y for Enomoto's leaf spring.



Id. ¶ 186. The FE analysis graphs and Dr. Wagoner’s annotations represent that “[u]p to 7mm of deflection, the loading is compressive. At 7mm deflection, it is neutral and is labelled the “C-T Transition” on Figure 33 for the transition from compressive loading to tensile loading.” *Id.* Dr. Wagoner explains further, based on his analysis and graphs that “[f]or deflections larger than 7mm the loading is tensile and increasing.” *Id.*

Thus, it is Dr. Wagoner’s conclusion that a leaf spring, fixed at both ends, as taught by Enomoto, also will inevitably experience both compression and tension forces, the first transitioning to the second, when subjected to sufficient forces.

iv. Dr. Wagoner's FE analysis as undertaken with assistance from Dr. Zhou and Dr. Taghipour

Patent Owner argues that Dr. Wagoner did not, himself, actually perform the FE analysis, and instead had a colleague, Dr. Guowei Zhou, perform the FE analysis under a license for the Abaqus FE analysis program. PO Resp. 31 (citing Ex. 2011, 72:2–24). Dr. Wagoner explained during his deposition that he asked Dr. Zhou to do the FE analysis because he (Dr. Wagoner) did not have “have a license to do these things, so I didn’t do it myself.” Ex. 2011, 75:16–17. Also, Dr. Wagoner explained that a post-doctoral student at Ohio State University, Dr. Ehsan Taghipour, assisted with the CAD models for the analysis. *Id.* at 76:19–77:6.

Patent Owner argues that because Dr. Wagoner did not himself perform the FE analysis, we should ascribe “little or no value” to his report. PO Resp. 30. However, it appears from the record, that Mr. Dilling also did not have license to perform an FE analysis, yet presented results from such an analysis. *See* Ex. 2009 ¶ 110 (Mr. Dilling explaining that “since I do not have an active license of Ansys currently, I needed someone to create, solve, and postprocess the Ansys FEA models in my declaration.”). Patent Owner’s FEA models produced by the Ansys program, according to Mr. Dilling were conducted by a company called “SimuTech Group, Inc., in Rochester, NY.” *Id.* Mr. Dilling explained that he “supervised the creation and postprocessing of each of the Ansys FEA models that are part of my declaration.” *Id.* Similarly, in his deposition Dr. Wagoner confirmed that he provided the parameters for his FEA models to Dr. Zhou. *See* Ex. 2011, 81:14–19. (Dr. Wagoner explaining that “I told [Dr. Zhou] what I wanted done on these simulations, and I went over the

parameters and what to use, and then I asked him to run the program. So he did it, but I set up how I wanted it to be done.”).

Patent Owner argues that Dr. Wagoner was unaware of what specific kind of user-license Dr. Zhou had for the Abaqus program which Dr. Zhou used to produce the FEA models. PO Resp. 30–31 (citing Ex. 2011, 72:2–24). For instance, whether or not it was an “academic license” or was otherwise limited by the licensee. Patent Owner also argues that Dr. Zhou did this work as a favor for Dr. Wagoner, and Dr. Wagoner did not know how much time Dr. Zhou spent doing the analysis. *Id.* at 31 (citing Ex. 2011, 76:12–13). In this way, Patent Owner alleges that Dr. Wagoner’s FE analysis may have been limited and incomplete in some way. However, neither Patent Owner nor Mr. Dilling describe the substantive difference between an academic license and, say, a professional license for FEA software such as Abaqus and Ansys. This appears to be mainly attorney argument, because the evidence to which Patent Owner refers, Mr. Dilling’s declaration, Ex. 2009 ¶ 110, and Dr. Wagoner’s deposition, Ex. 2011, 74:19–21, do not provide compelling or supporting testimony opining on any particular differences. *See* PO Resp. 31. We appreciate that there may be differences between the application capabilities depending on the level of the license held by the user, but this allegation does not explain with any particularity any such differences or show how differences would significantly impact the outcome of Wagoner’s FEA models. We acknowledge that there may be differences in the declarants’ analyses. But, as Mr. Dilling states “[a]ny model will be, even at its best, an approximation of the actual physical system.” Ex. 2009 ¶ 97 (quoting Ex. 2016).

With respect to the apparent lack of financial compensation to Dr. Zhou and the amount of time spent doing the analysis, based on these

questions alone as posed to Dr. Wagoner during his deposition, (Ex. 2011 71–76), we do not have sufficient evidence before us to evaluate whether or not there was a lack of care or attention or time on the part of Dr. Zhou, as Patent Owner’s argument insinuates. Based on the facts and evidence with respect to the implementation of Petitioner’s and Dr. Wagoner’s FE analysis, we do not find that Dr. Zhou’s and Dr. Taghipour’s involvement in performing the CAD modeling and FE analysis impacts our consideration of Dr. Wagoner’s testimony in any detrimental way.

v. *Whether Dr. Wagoner’s FE analysis fulfills the requirements of 37 C.F.R. § 42.65(a) and (b)*

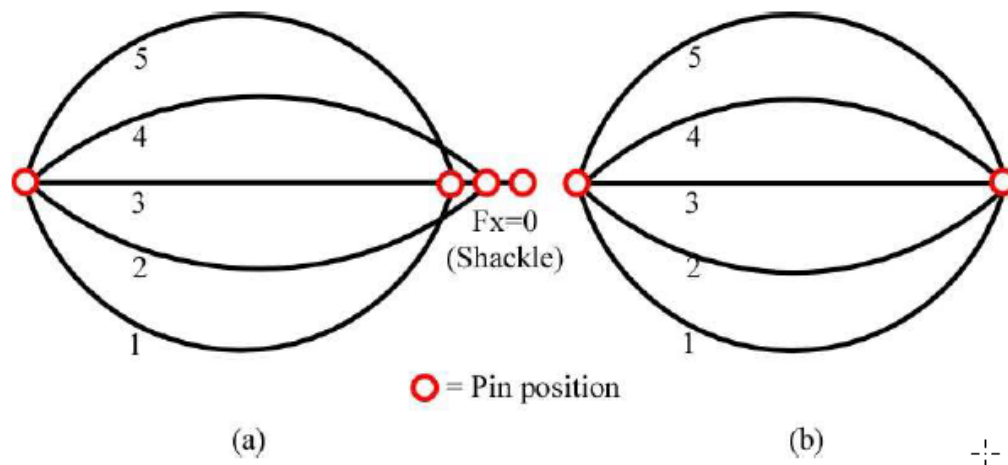
37 C.F.R. § 42.65(a) states in part:

- (a) Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight . . .
- (b) If a party relies on a technical test or data from such a test, the party must provide an affidavit explaining:
 - (1) Why the test or data is being used;
 - (2) How the test was performed and the data was generated;
 - (3) How the data is used to determine a value;
 - (4) How the test is regarded in the relevant art; and
 - (5) Any other information necessary for the Board to evaluate the test and data.

Patent Owner argues that “the Board should give little weight to Wagoner’s data because he has not ‘disclose[d] the underlying facts or data on which the opinion is based.’” PO Resp. 33 (citing 37 C.F.R. § 42.65(a)). We disagree. Dr. Wagoner explained that a person of ordinary skill in the art would have understood

that progressive leaf spring action arises inherently from having non-displaceable ends. That is, by constraining the distance between the ends (instead of having one freely displacing end from a shackle installation), at some critical deflection, further deflection requires longitudinal stretching of the spring, which is inherently many, many times stiffer than bending.

Ex. 1002 ¶ 87. Dr. Wagoner testifies that a person of ordinary skill in the art would have understood the basics of leaf spring design, including the configurations represented below illustrating conceptualized deformation of two variations of semi-elliptical leaf springs.



Shown above in Figure (a) is Dr. Wagoner's conceptualized deformation of a leaf spring restrained by a pin on one end and a shackle on the other (so the spring maintains a constant length). Figure (b) illustrates a conceptualized deformation of a leaf spring restrained by a pin on both ends. Different from Figure (a), Dr. Wagoner explains for Figure (b) that where both ends are pinned, that "there will be a reaction force at the ends required *to compress or elongate* the spring length to maintain a common distance between the end points as the center is displaced upward." *Id.* ¶ 95 (emphasis added). Dr. Wagoner additionally testifies that as upward displacement forces the Figure (b) pinned/pinned spring through states 4 and 5 "[a]t some critical deflection point, the horizontal reaction forces would become zero.

Thereafter, for increased upward displacement of the spring center, the horizontal reaction forces would become pointed outward, i.e. tensile.” *Id.* ¶ 101, *see also* Ex. 1030, 1:40–2:6 (“When the axle is deflected upward the main part 16 of the spring takes up a curved form which corresponds to the loaded form of a conventional leaf spring. This spring deflection is accompanied by a shortening of the main part of the spring which in turn tends to straighten out the bend 17 of the spring and applies a longitudinal tensile load in the spring.”).

If this were the extent of Dr. Wagoner’s testimony, Patent Owner might have a point, considering § 42.65(a). But, as we have discussed above, besides explaining in detail, for example in Figures (a) and (b) above, what a person of ordinary skill in the art would generally understand with respect to the functional characteristics of pinned and unpinned leaf springs, Dr. Wagoner provides several examples of FE analysis performed on different springs to confirm this understanding. Ex. 1002, App’x. D–G. Therefore, in our opinion Dr. Wagoner has presented evidence and data that is unrebutted in the record to support his testimony with respect to the level of ordinary skill in the art and the commensurate technical understanding and knowledge of basic leaf spring operation.

Considering § 42.65(b), as to *why* the data and test results are being used, Dr. Wagoner explained that the “finite-element simulation results . . . show precisely what happens in real leaf springs whether simple or complex. It starts with simulation of a leaf spring with simple arc shape initially (as above) to see how the simple conceptual picture agrees with or varies from the actual case.” Ex. 1002 ¶ 106. Dr. Wagoner explains how the simulations were done and data obtained by “specify[ing] dimensions of 150mm-200mm and 110mm-130mm, respectively, for lengths shown on

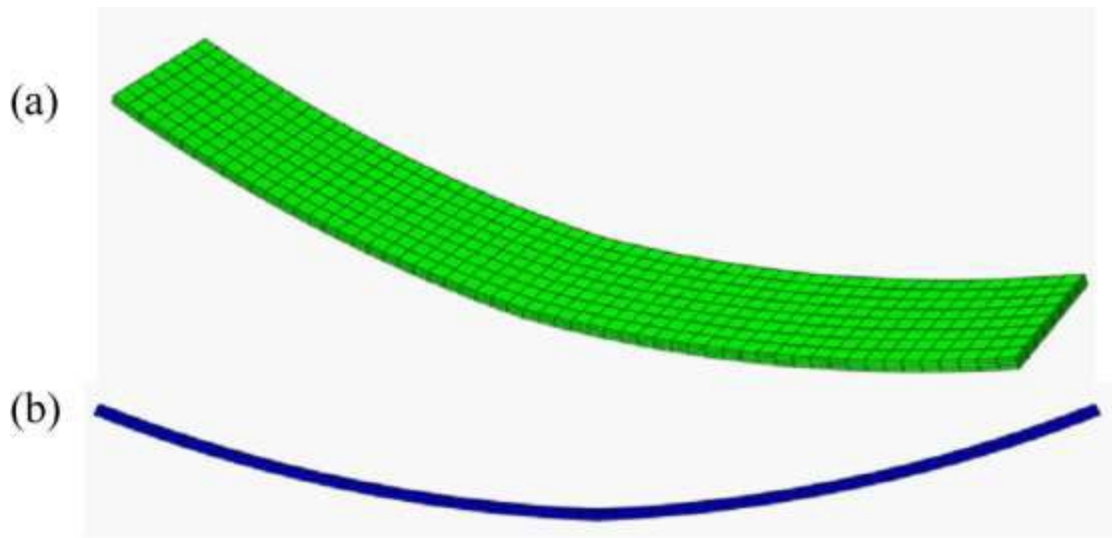
corresponding figures. Common material properties were used for each elastic simulation: Young's modulus = 210 GPa, Poisson's ratio = 0.3.” *Id.* ¶ 107. And, Dr. Wagoner explains that the “simulations were conducted using Abaqus Standard, Version 6.14 with C3D8R reduced integration brick elements. The mesh sizes varied slightly with the particular case, as shown in Table 1.” *Id.* ¶ 108. Table 1 referred to by Dr. Wagoner is reproduced below.

Table 1 - Finite element mesh size by simulation group.

FE Model	Total number of nodes	Total number of elements	Number of elements in length, width, and thickness directions	Element type
Hahn	2700	1888	59, 8, 4	C3D8R
Enomoto	5628	990	55, 6, 3	C3D20R
Greco	7693	1392	58, 8, 3	C3D20R
Simple Arc	7431	1344	56, 8, 3	C3D20R

Dr. Wagoner's Table 1 illustrates mesh sizes used in the FE analysis for each of the prior art leaf spring described in Hahn, Enomoto, Greco and for a simple arc leaf spring.

Dr. Wagoner further explained *how* the test was performed and the data generated, as well as how the data is used to determine a value. Dr. Wagoner, for example, testifies that “[a] simple leaf spring with initial arc shape, similar to the one treated conceptually in the previous section, was first simulated. The FE mesh for a uniform, rectangular cross-section, mono-leaf configuration in a relaxed state with concave-up circular shape is shown in Figure 16.” *Id.* ¶ 109. We reproduce Dr. Wagoner's Figure 16 below.



The caption for Figure 16 describes:

Figure 16 - Finite element mesh of a simple leaf spring with constant rectangular cross-section in the relaxed state (vertical displacement $U_y=0$): (a) perspective view, (b) side view. The spring length is taken to be a common 140mm for comparison with other configurations.

Id. Dr. Wagoner further provides the results, i.e. calculated values for force v. displacement, of the FE analysis, for example for the simple leaf spring, illustrated above in a pin/pin configuration. These results are illustrated in Dr. Wagoner's Figure 18 reproduced below.

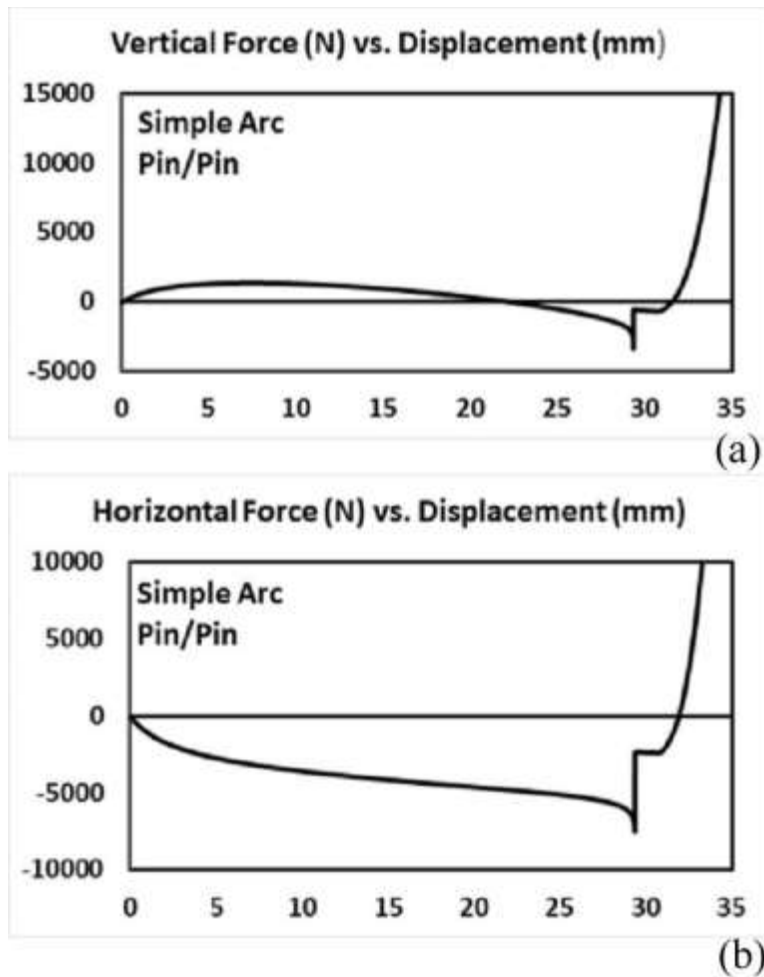


Figure 18 depicts graph 18(a) showing vertical force v. displacement, for a pin/pin leaf spring configuration and graph 18(b) showing horizontal force v. displacement. The caption for Figure 18 states:

Figure 18 - Finite element results for the mechanical behavior of a simple leaf spring with pin/pin mounting: (a) vertical center force vs. displacement (upward force is positive), (b) horizontal reaction force (right side) vs. displacement (showing tensile/outward reaction force as positive, compressive/inward force as negative).

Id. ¶ 111. On its face, we do not discern in the Petition or in Dr. Wagoner's own cited evidence, analysis and testimony, any specific lack of data, explanation, or information implicating § 42.65(b).

Patent Owner argues that in comparison, Mr. “Dilling’s analysis satisfies the requirements of §42.65(b).” PO Resp. 33 (citing Ex. 2009 Sections X-XIII). Patent Owner argues further that “Dilling’s criticism of Wagoner’s FEA demonstrates why Wagoner’s FEA should be given little weight under §42.65(b).” *Id.* (citing Ex. 2009 at ¶¶102–107). We address these criticisms below.

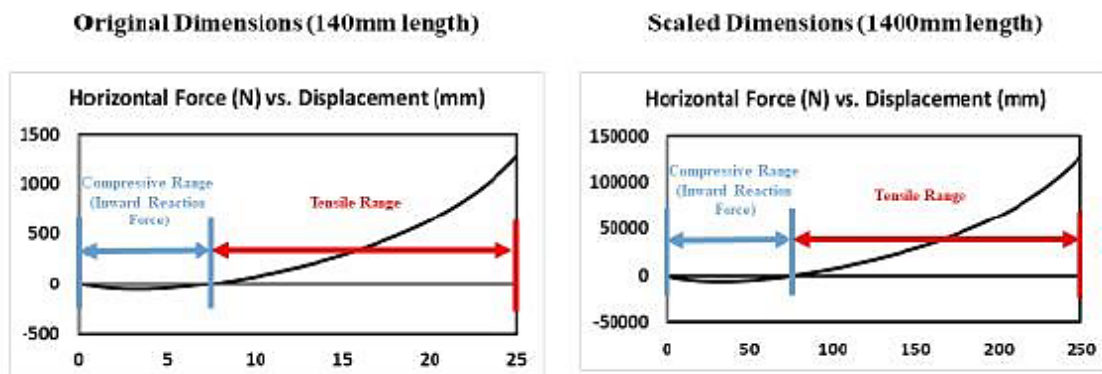
vi. Whether Wagoner’s leaf spring dimensions used in FEA modeling are sufficient

Patent Owner argues that the dimensions relied on by Dr. Wagoner for his FE analysis are flawed. PO Resp. 33. Specifically, Patent Owner argues that “Wagoner did not select 140mm by first measuring a real leaf spring, nor did Dr. Wagoner use any industry standard . . . Instead, he took a ruler and measured the printed page of Enomoto (or Hahn, he wasn’t certain) and measured it to be about 140mm.” *Id.* at 34 (citing Ex. 2011 at 86:23–25, 87:22–23, 139:13–16). Mr. Dilling testifies that “[t]he first major flaw is that the models contained in the Wagoner Declaration are not dimensionally to the proper scale.” Ex. 2009 ¶ 104. Mr. Dilling testifies that “[a]ctual leaf springs have an overall length of about 1250mm (or about 49 inches). That means that the models represented in the Wagoner Declaration are about 1/9th the actual size in overall length.” *Id.*

Mr. Dilling’s ratio of 1/9, is reasonably commensurate with Dr. Wagoner’s ratio of 1/10. Dr. Wagoner explained in his deposition that he measured the patent drawing in Enomoto at approximately 140mm, and “looked at one in a Ford truck, a big pickup truck, and it was about 1400 milli[me]ters long, so its roughly a 10-to-1 scaling. And that’s how those dimensions were set.” Ex. 2011, 87:3–6. We acknowledge, as Patent Owner and Mr. Dilling point out, that Dr. Wagoner did not use in his FEA

models the actual length (1400mm) and dimensions of a full-size leaf spring. PO Resp. 33–34, Ex. 2009 ¶ 104. What Patent Owner and Dr. Dilling have not persuasively explained is why scaling is such a significant flaw or drawback for FEA modeling in this case. Dr. Wagoner scaled the leaf spring, by about 1/10, using a length of 140mm for the FE analysis. *See, e.g.,* Ex. 1002 ¶ 107 (“A common leaf spring with scaled length of 140 mm was adopted for the comparisons.”). In his rebuttal declaration Dr. Wagoner explained that a person of ordinary skill in the automotive field would have understood that “[n]o matter the actual scaling, whether it is 10:1, 12:1, 1:1 or 1:12, the relative position where the C-T transition occurs is the same.” Ex. 1033 ¶ 63.

Further, after considering Mr. Dilling’s criticism of scaling, Dr. Wagoner provided a comparison in Figure 7 of his rebuttal declaration using the scaled dimension at 140mm, as compared to a 1400mm leaf spring, which we reproduce below.



Dr. Wagoner’s Figure 7 compares force v. displacement for 140mm and 1400 mm. *Id.* ¶ 64. The caption reads “[c]omparison of Wagoner FE simulations of Enomoto: Left: original simulation results with scaled length of 140mm, Right: simulation of 10X larger leaf spring. The C-T transition scales precisely with model length.” *Id.* Dr. Wagoner states that “[n]otably,

Dilling does not express anything contrary to this simple well-known principle that any mechanical engineer should understand. This simple scaling would be known to anyone familiar with FE analysis or simple mechanics, including any expert in mechanical engineering.” *Id.*

Patent Owner and Mr. Dilling criticize the scaling, but neither ever persuasively explains *why* scaling in this case is a flawed technique, or states that a person of ordinary skill in the art would not perform uniform scaling of an article or design for FE analysis. During oral argument we questioned Petitioner’s counsel about why Dr. Wagoner used scaling. Petitioner’s counsel responded that “[p]eople doing FEA scale things down for processing cost and as he testified in his deposition, everything’s elastic. If you changed the dimensions, all it’s going to do, it’s not going to change, you know, the C to T transition.” Tr. 23:5–8.

Dr. Wagoner has been consistent in his testimony—that it was within the level of ordinary skill in the art to scale FEA models, often for purposes of processing costs, and obtain comparative results as to deflection for horizontal compression and tension forces acting on the leaf spring. *See* Ex. 1033 ¶ 59 (Dr. Wagoner testifying that “scaling of dimensions for FE analysis has no effect on the analysis in my Declaration, as would be known to one of ordinary skill or an expert.”). Patent Owner has provided no persuasive evidence or argument that rebuts Dr. Wagoner’s testimony as to scaling in this proceeding. During his deposition Dr. Wagoner was asked if the vertical *forces* for creating the deflection also scaled up similar to deflection values, and if they were accounted for in his FEA modeling. Ex. 2034, 78:12–25. Dr. Wagoner responded that “[t]hey do not.” *Id.* Dr. Wagoner explained that for the vertical forces creating the deflections do not scale up commensurate with the 1/10 ratio, and that “[y]ou could get

forces, but I didn't and I didn't have [to]—I didn't base any conclusions on anything to do with the actual force magnitudes.” *Id.*

Without sufficient evidence to the contrary in this case, we discern no reason why Dr. Wagoner's scaled FE analysis at a 1/10 size leaf spring are flawed or improper. We are persuaded that the issue and magnitude value of vertical force for causing deflection, as Patent Owner argues, does not resolve any issue of the compression versus tension transition point. There are no specific vertical forces described in the '330 patent nor recited as limitations in the challenged claims as to when the C-T transition occurs. Dr. Wagoner's FE analysis focuses on the pertinent characteristics and values of horizontal compression and transition to tension forces, during deflection of the leaf springs. The relevant question is whether a person of ordinary skill in the art understood that a leaf spring, longitudinally fixed at both ends, will transition at some point from compression to tension, not the particular magnitude of causal vertical force at which it will occur.

Overall, we credit and find persuasive Dr. Wagoner's testimony and FE analyses confirming that “[t]he finite element simulation results for both traditional arc designs and modern, shaped, progressive designs conform qualitatively to the conceptual understanding that a POSITA would have.” Ex. 1002 ¶ 119.

vii. Whether Dr. Wagoner improperly ignored stress and yield strength in his FE analyses

Patent Owner argues that “Wagoner admitted that he used a linear model, and he ignored stress and potential failure.” PO Resp. 34 (citing Ex. 2011 at 142:23-143:20; 165:9-11. Patent Owner contends that in FEA modeling a person of ordinary skill in the art “would understand that yield and failure cannot be discarded.” *Id.* (citing Ex. 2009 ¶

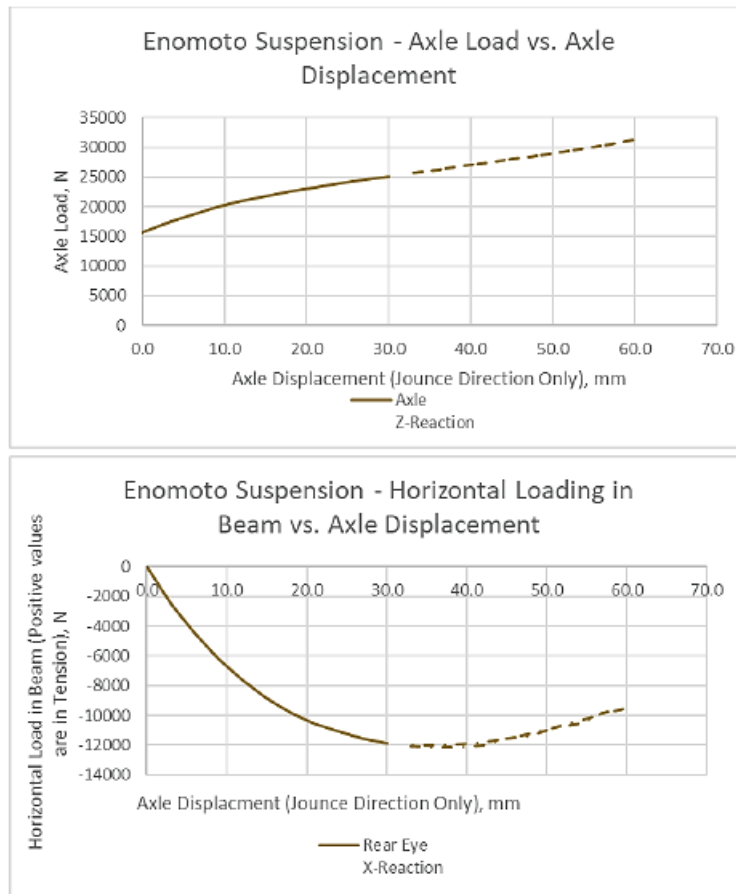
100). Patent Owner points to Dr. Wagoner's testimony arguing that even he testified that "FEA is used as a cost-effective alternative to real-world experimentation during the design and development of a component, because FEA allows a designer to simulate real-world forces to approximate failure limits, namely loads, i.e., stresses and strains." *Id.* at 35 (citing Ex. 2011, 70:2–71:9). According to Patent Owner, despite this, "Wagoner admitted that the forces and stresses in his declaration did not have anything to do with his decision-making process in this case." *Id.* (citing Ex. 2011, 113:15–19). Patent Owner sums up their position in this way, "Wagoner did not evaluate whether the stresses are below the yield values of the materials and thus his analysis is unreliable." *Id.* at 35–36 (citing Ex. 2011, 142:23–143:20; 165:9–11).

Dr. Wagoner uses a linear material analysis, and as Mr. Dilling points out "[i]n a linear material type, the material is assumed to be perfectly elastic, meaning that it will never yield nor break." Ex. 2009 ¶ 87. In other words, according to Mr. Dilling, Dr. Wagoner failed to consider the failure point of the leaf springs in his FEA modeling. Ex. 2011, 106:13–107:15. Dr. Wagoner essentially agreed, explaining that he didn't care about the stress values and failure point because "the simulation would give the same answer. We assume it's linear elastic and that's what we use." *Id.* at 113:17–19

Patent Owner's point is that while Dr. Wagoner's theoretical linear models may show that a leaf spring has a C-T transition point, it may be that in reality, in use, a given leaf spring design could fail prior to the C-T transition point. We acknowledge also that Mr. Dilling provides an FE analysis of Enomoto including a travel study "show[ing] that the axle *should have* approximately 70 mm (263-193 mm) of jounce and 80 mm (342-263

mm) of rebound.” Ex. 2009 ¶ 158 (emphasis added). However, Mr. Dilling acknowledged that the study did not account for the stress level in the rear portion of the leaf spring. *Id.* This is because “[t]he stresses in the beam show that the jounce travel needs to be restrained to 30 mm of vertical travel to prevent yielding of the rear portion of the beam.” *Id.* ¶ 162.⁸ Mr. Dilling testifies that “[i]n the case of Enomoto, we will see that the rear portion of the beam does in fact restrain the beam from reaching either the full jounce or the full rebound due to stress levels in the rear leaf spring beam portion (refer to the stress results for more details on the rear portion of the leaf spring beam portion).” *Id.* ¶ 158. Mr. Dilling’s stress results are shown in the graphs of Figure 82 from his declaration for the Enomoto suspension and are reproduced below.

⁸ “Jounce” is the upward movement of a leaf spring when a vertical force is applied, and “rebound” is the subsequent downward movement. Pet. Reply n.4.



The graphs for Mr. Dilling’s Enomoto FE analysis show the reaction load in the vertical direction at the axle location and horizontal load in the beam, both as a function of vertical axle displacement and that the “[d]ashed line in the above graphs indicate that the material strength has been exceeded.” *Id.* ¶ 182. Mr. Dilling further testifies that stress failure is shown above 30 mm of displacement and that “[t]he beam remains in compression throughout the suspension travel.”

To be clear, Mr. Dilling’s FE analysis of Enomoto’s leaf spring indicates that the leaf spring fails if it exceeds 30 mm of displacement, which is about 1.2 inches, while it would remain in compression “even well beyond 60 mm of jounce if that were permitted by the material strength of the beam, which it is not.” *Id.* ¶ 181. In other words, Mr. Dilling’s

conclusion based on his FE analysis is that Enomoto's leaf spring would never reach a point where the leaf spring is in tension—due to failure. *Id.*

Besides the leaf spring itself, Mr. Dilling's FE analysis of Enomoto also includes air spring 4 and shock absorber as it is shown in Enomoto's Figure 1 and described by Enomoto. *See* Ex. 1007 ¶ 48 (Enomoto describing that "[i]n the suspension structure in FIG. 1 provided with the leaf spring 25, when a vertical load acts on the vehicle, the leaf spring 25 and the air spring 4 flex, absorbing the load."). Mr. Dilling constructed a CAD model using Enomoto's Figure 1, as shown in Figure 66 of Mr. Dilling's declaration reproduced below.

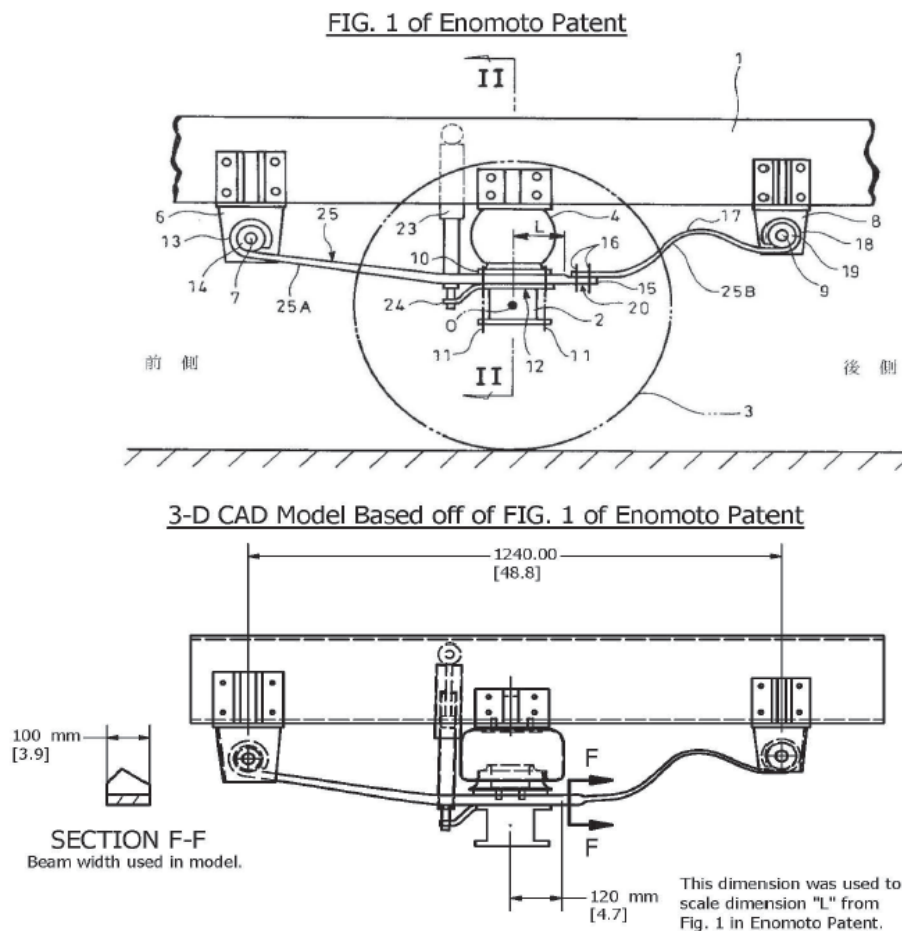


Figure 66

Figure 66 from Mr. Dilling's declaration illustrates for comparison purposes Figure 1 of Enomoto above the "3-D CAC Model Based off FIG. 1 of Enomoto Patent." Ex. 2009 ¶ 151. Mr. Dilling's CAD model includes not only leaf spring 25, but also air spring 4 and shock absorber 23. *See id.* ¶ 156 ("In my opinion, the CAD model I created for Enomoto fairly represents the teachings of the Enomoto reference."). Mr. Dilling testifies further that in addition to the stress levels (failure) in Enomoto's leaf spring, "the air spring restrains the leaf spring beam in jounce direction and the shock absorber restrains the leaf spring in rebound direction."). *Id.* ¶ 158. Mr. Dilling notes for the thinner rear portion of Enomoto's leaf spring is that "no matter how flexible the rear portion of the beam of Enomoto is made, the full jounce travel is still restrained by the air spring minimum height and the full rebound is still restrained by the shock absorber maximum extended length." *Id.* ¶ 183.

On one hand, we note that Mr. Dilling's analysis of Enomoto appears to result in an unusable device with only 30mm of displacement before failure. *See* Ex. 1033 ¶ 21 (Dr. Wagoner testifying that "suspension travel of 30mm is completely unrealistic for nearly every type of motor vehicle wheel suspension system."). And, on the other hand, we determine that it is irrelevant whether Enomoto's leaf spring might be designed to fail, or is impeded by an air spring prior to transitioning to tension because the claims are written broadly enough to encompass a leaf spring that is capable of transitioning to tension, whether or not the leaf spring is supporting a wheel carrier and is actually situated on and inclusive in a vehicle's complete suspension system. We do not find that Dr. Wagoner's FE analysis is compromised because it assumed a perfectly elastic beam, and credit Dr. Wagoner's conclusion "that one of ordinary skill in the art would

understand that the Enomoto Fig. 3 invention is capable of progressive spring rate action, including increasing tension. This occurs naturally for the generally concave-up configuration in unloaded states, as would be seen and expected without assistance of numerical calculations such as finite element analysis.” *Id.* ¶ 25.

We determined in our claim construction that the claim “language does not require that the wheel carrier is physically on the leaf spring, or that a load is actively applied to the leaf spring via the wheel carrier, only that the leaf spring is capable of supporting a wheel carrier and receiving forces through the wheel carrier that cause tensile loading.” Section II.C. In other words, where Enomoto has the capability to be deflected in such a way as to transition from compression into tension, then Enomoto’s leaf spring encompasses this limitation regardless of whether or not the function is activated or utilized in any way. *See Silicon Graphics, Inc. v. ATI Techs., Inc.*, 607 F.3d 784, 794 (Fed. Cir. 2010) (The Federal Circuit explaining that whether or not the functional aspects of the claim were “activated or utilized in any way,” a product that included the structure for performing the claimed function can still infringe.). Accordingly, Patent Owner’s contention that Enomoto’s leaf spring *might* fail, or must be considered as installed on a vehicle with an air spring and actively subject to vertical displacement is incorrect from the outset based on the proper claim construction, and in this case, overcome by Petitioner’s persuasive evidence that the structure and capabilities of a leaf spring are well known, regardless of whether the leaf spring is installed with a wheel carrier in a complete vehicle suspension system. *See, e.g.*, Ex. 1030 (British Patent No. 1,077,968 to Oldfield explaining that “[t]his spring deflection is accompanied by a shortening of the main part of the spring which in turn tends to straighten out the bend 17

of the spring and applies a longitudinal tensile load in the spring. This tensile load increases with increasing spring deflection.”).

In this case we credit Dr. Wagoner’s response, who acknowledges that “Enomoto Fig. 3 leaf spring embodiment *could be* designed in a particular way (size, shape, material, strength) and installed into a particular environment (vehicle and suspension) such that it could be prevented from experiencing tension. Examples of such treatments include various means of making the spring too weak or too small for the vehicle, or externally limiting its travel by various vehicle/suspension choices.” Ex. 1033 ¶ 19. Dr. Wagoner points out that in Mr. Dilling’s analysis, Enomoto’s leaf spring has “only 30mm of travel beyond which it would catastrophically break or deform into an unusable form.” *Id.* ¶ 21. Dr. Wagoner testifies that “[l]eaf springs in widely available commercial suspension systems are known to have travel ranges of 4-6 inches, for example and even over 10 inches in trucks.” *Id.*

Dr. Wagoner testifies further that even “without numerical analysis of any kind, one of ordinary skill would understand that Enomoto Fig. 3 leaf spring would transition from compression to tension at approximately halfway through the upper travel range indicated and then would be subjected to increasing tension thereafter.” *Id.* ¶ 29. Dr. Wagoner testifies that “[t]he FE analysis confirmed the visual analysis. The visual analysis identified the C-T transition point as approximately halfway to the limit of the air spring compression whereas the combination of FE analysis of the simulated C-T transition point was 7/16 of the CAD-determined full upward travel point for literal Enomoto Fig. 3.” *Id.* ¶ 31.

As discussed above, Dr. Wagoner and Mr. Dilling provide competing analyses for the range of Enomoto’s leaf spring and its transition from

compression to tension, or not, as in Mr. Dilling's analysis. *Compare* Ex. 1002 ¶¶ 182–192, *with* Ex. 2009 ¶¶ 148–182. The analyses provide differing results at least because different conditions for the leaf spring are assumed by the declarants at the outset of their analyses. There is really no way really to reconcile these analyses because the FE analyses, of course, provide different results based on different initial inputs and assumptions. We can, to an extent, assume that both are correct.

Mr. Dilling's initial assumptions about undertaking the FE analysis of a suspension including failure of the leaf spring as well as an air spring and shock absorber and dimensions may be presumptively correct under the conditions imposed by Mr. Dilling. However, this does not show that Dr. Wagoner's material characteristics and linear analysis of a leaf spring alone are incorrect, improper, or that Enomoto's leaf spring is incapable of going into tension under the conditions imposed by Dr. Wagoner. Even if Mr. Dilling's analysis is correct based on his initial inputs and assumptions including the air spring and shock absorber, given Dr. Wagoner's persuasive testimony and FE analysis, a person of ordinary skill in the art would also understand that in an installed or uninstalled state, Enomoto's leaf spring is capable of transitioning from compression to tension given the appropriate structural dimensions, material characteristics and vertical displacements upon which Dr. Wagoner relies. *See* Ex. 1033 ¶ 66 (Dr. Wagoner testifying that "one [of skill in the art] would know that routine design of dimensions and materials would be performed for each specific application to match intended displacements and loads for that vehicle.").

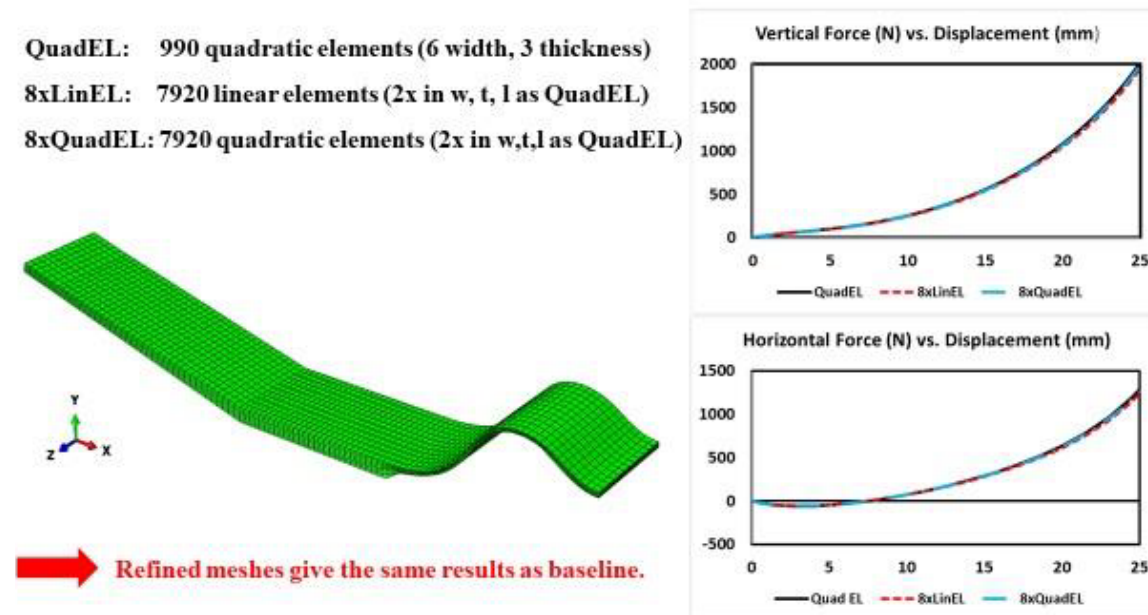
*viii. Whether Dr. Wagoner properly validated his
FE analysis*

Patent Owner argues that unlike Dr. Wagoner, Mr. Dilling “verified the [FEA] process by creating two simple plate FEA models; a flat plate and an arched plate . . . [t]his allowed Dilling to verify model creation, macro creation, and boundary conditions. PO Resp. (citing Ex. 2009, Section X.A, ¶¶ 88, 120, 139). Mr. Dilling explains that validation of his models ensures that “key model dimensions agree with the actual part dimensions,” that “material properties [are] correct and [] properly associated to model regions,” and that “the applied loads and constraints [are] correct,” also that “the deformations and stresses [are] believable.” Ex. 2009 ¶ 139.

Dr. Wagoner responds that he did in fact use a verification process for his FE analysis, explaining that

I used both mesh refinement and a lower-order and higher-order element to confirm that the results were unaffected by refining the resolution of the mesh. The results are shown unequivocally in Figure 8, below. This technique is the gold standard for proving mesh sufficiency for nonlinear problems; it is required by virtually all peer reviewers.

Ex. 1033 ¶ 72. Dr. Wagoner provides a comparison of the results of mesh refinement for his Enomoto model in Figure 8 of his rebuttal declaration, reproduced below.



Id. Figure 8 is described by Dr. Wagoner as a “[c]omparison of Wagoner FE simulations of Enomoto over the displacement range of interest with mesh refinement and lower/higher order elements. The results superimpose with no detectable difference, indicating a sufficient mesh for accuracy.” *Id.*

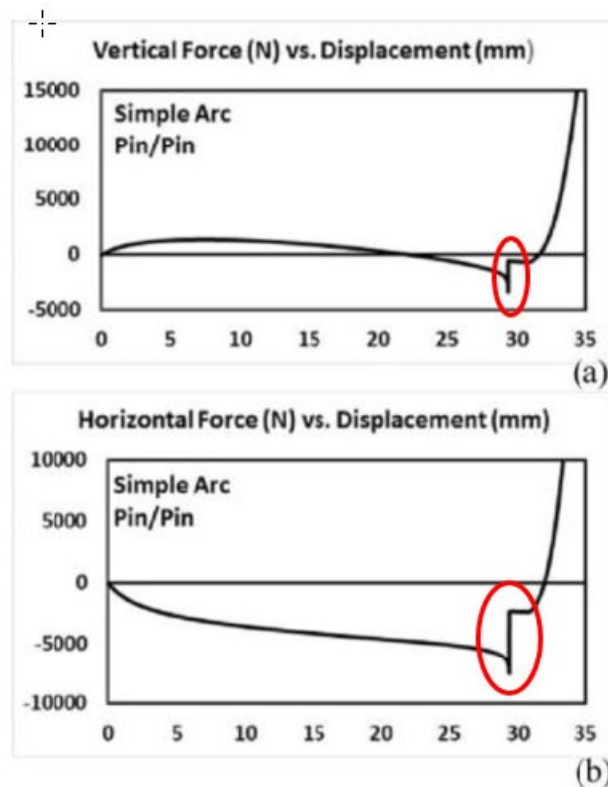
Dr. Wagoner testifies that Dilling’s “‘validation’ was done with small displacements that don’t test the critical handing of geometric nonlinearity. Furthermore, his small displacement range[] didn’t approach the critical snap-through points that are known to exist for his simple test case that he found so objectionable in my simulations.” *Id.* ¶ 73.

Despite the criticism leveled by the declarants at one another’s FE analysis, both declarants provide certain evidence and testimony tending to show they undertook a level of verification and validation to ensure their respective FEA models are accurate. Again, as discussed above, it may be that both models are accurate based on the initial assumptions made by the respective declarants. The fact that Mr. Dilling’s model of Enomoto’s complete suspension system indicates that the leaf spring would fail, or

never achieve tension based on certain assumptions, does not, however, render Dr. Wagoner's testimony and FE analysis inaccurate, which indicates Enomoto's leaf spring is capable of undergoing tension with sufficient displacement.

ix. Patent Owner's criticism of Dr. Wagoner's FEA models exhibiting snap-through

Patent Owner argues that a person of ordinary skill in the art would understand that snap-through, as shown in Dr. Wagoner's Figure 18 reproduced below, as annotated by Patent Owner, is an undesirable condition. PO Resp. 17 (citing Ex. 1002, Fig. 18).



Dr. Wagoner's Figure 18 as annotated by Patent Owner circling in red the graphical representation of snap-through data at approximately 30mm of displacement. *Id.* Patent Owner, supported by testimony from Mr. Dilling, argues that "[a] POSITA would avoid each of these undesirable conditions

and operate in the region of compressive forces. *Id.* at 16 (citing Ex. 2009 ¶ 18).

Petitioner responds, arguing that “[o]ptimizing leaf spring performance to account for material changes as well as to address any negative spring rate or snap through is a routine task well known to a POSA. Pet. Reply (citing Ex. 1033 ¶ 77). Dr. Wagoner testifies in response that

I agree with Dilling’s statement that such behavior is undesirable in leaf springs, but if the characteristic is present, then the FE analysis must be able to show it. Shallow curved plates (such as one that Dilling used for his “validation” trials) exhibit snap-through when properly modeled, that is, at the displacements where the phenomenon occurs).

Ex. 1033 ¶ 75 (citing <https://www.digitalengineering247.com/article/ansys-workbench-19.2/pre-processing-and-meshing>). Dr. Wagoner testifies that “the reason that Dilling’s plate models did not show snap-through or reversal of end loads is that he considered only very small displacements, in the linear range, well before snap-through occurs.” *Id.* ¶ 76. Moreover, Dr. Wagoner explains that “[s]nap-through can be physically eliminated by normal design parameter changes, as one of ordinary skill could readily accomplish.” *Id.* ¶ 77, *see also* Ex. 1027, 149:8–17 (Dr. Wagoner testifying in his deposition that “[w]hether the spring has snap-through or not is going to actually be a combination of . . . the shape, and it can be its configuration.”).

Dr. Wagoner’s testimony that in actuality, “snap-through,” can be eliminated in a leaf spring by properly choosing material and design characteristics is unrebutted in this record. Therefore, while the declarants agree that “snap-through” is undesirable, we are not persuaded by Patent Owner’s assertions that Dr. Wagoner’s FE analyses are somehow

compromised simply because the data for a simple curved plate exhibit “snap-through.”

x. Patent Owner’s additional arguments

Patent Owner makes several additional arguments. One, that Dr. Wagoner failed to perform a proper travel study of Enomoto. PO Resp. 37. Two, that Dr. Wagoner improperly eliminated the pivot connections. *Id.* at 36. Three, that Dr. Wagoner only considered steel, and not FRP for the material in his FE analyses, and four that Dr. Wagoner’s analysis uses the ’330 patent as a roadmap for the obviousness analysis. We address each of these arguments in turn.

As to a proper travel study, Patent Owner’s argument again improperly relies on the assumption that Enomoto’s leaf spring in this case must be analyzed in combination with an air spring and a shock absorber which limit leaf spring travel. *Id.* at 37. Patent Owner argues that in his deposition “[r]egarding the limits of suspension travel Dr. Wagoner recognized that if tensile loading occurred beyond the limits of suspension travel, then the leaf spring would, in truth, not go into a tensile loading condition.” *Id.* (citing Ex. 2011, 107:5–15). It may be that in designing a complete suspension system for a vehicle a person of ordinary skill in the art would account for the leaf spring, air spring and shock absorber characteristics together in determining the limits of jounce and rebound, but that is not what the claims in this case require. As discussed above, we are persuaded that Enomoto discloses a leaf spring, regardless of design factors that could cause it to fail or not reach a deflection where tension would occur, that *inter alia*, is capable of “with an increasing load due to vertical forces from the wheel carrier, is increasingly subjected to tensile loading.” Ex. 1001, 12:31–33.

Patent Owner further argues that Dr. Wagoner's leaf spring structural assumptions "cut-off" the portion of the beam that formed the eyelets at either end, and asserts that "[s]ince the beam deflections due to vertical load are so vitally important in this analysis, moving the assumed pivot location from the closed end to a cut-off portion of the beam may lead to erroneous results." PO Resp. 36 (citing Ex. 2009 ¶ 106). Mr. Dilling testifies that in view of this "the location of the boundary condition is not at the center of the closed or partially closed ends. Instead, it appears as if the ends were removed from the beam geometry." Ex. 2009 ¶106.

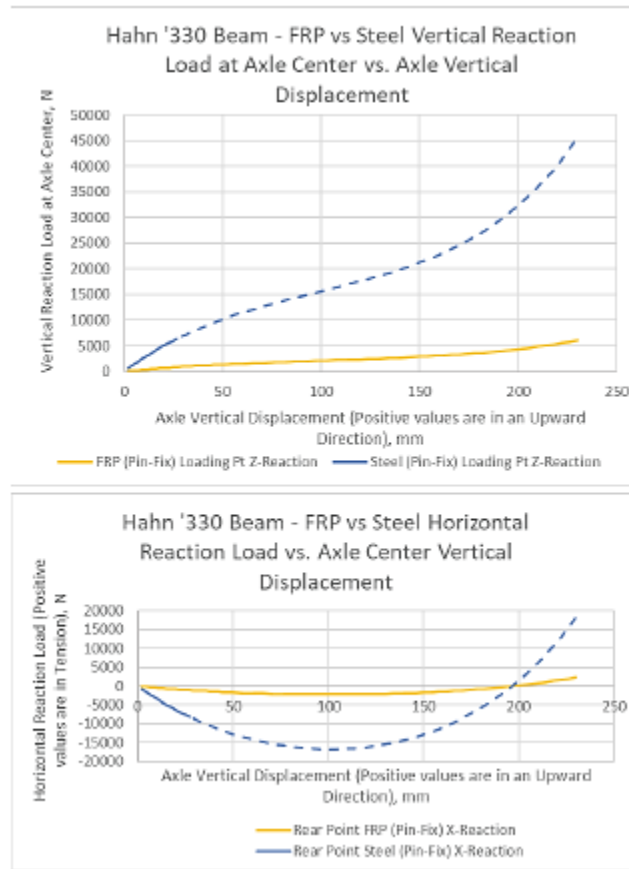
Dr. Wagoner explained during his deposition that to account for the pin/pin rotation "what we did was cut the leaf spring off at the section there, and then we have a surface at the end, and we told that surface that it could rotate freely but could not translate. That's the boundary condition we used for the pin end." Ex. 2011, 187:19–24. We appreciate that the eyelets are removed from Dr. Wagoner's FE analyses, but neither Patent Owner nor Mr. Dilling explain why or how the lack of eyelet modeling specifically compromised Dr. Wagoner's analysis, particularly where the ends of Dr. Wagoner's leaf spring could still rotate as in a pin/pin connection. This argument appears as an effort to cast shade on Dr. Wagoner's analysis, but without sufficient evidence as to why it renders Dr. Wagoner's analysis unusable, we do not find that it undermines his credibility or FE analysis in any way.

Considering Patent Owner's assertion that Dr. Wagoner only used steel as a material in his modeling and not FRP, this fact also does not affect our decision. We credit Dr. Wagoner who explains persuasively that

[t]he choice of material is moot from a purely technical standpoint because the displacement to the C-T transition (the

only FE result of interest in Issue 6) is independent of the values of the elastic constants used. Therefore, FRP or steel, or any other linear elastic material, would give the same result.

Ex. 1033 ¶ 56. As shown below, Dr. Wagoner reproduces in Figure 5 of his Rebuttal Declaration Mr. Dilling's Figure 64, comparing FRP and steel as the material for the FE analysis. *Id.* ¶ 57.



Dilling's Figure 64, referred to by Dr. Wagoner, showing in the lower graph for horizontal reaction load vs. displacement that the C-T transition point is the same for steel and FRP. Mr. Dilling testifies that analyzing only steel is a flaw because "a POSITA in the art of suspensions would anticipate a large difference between the beam stiffnesses and loads, due to the large differences between Young's Modulus for both materials." Ex. 2009 ¶ 146. Dr. Wagoner responds, explaining that "substituting FRP for steel makes no

difference in the C-T transition displacement, as an expert in mechanical engineering should know without any simulation needed. The only difference in each of the results is the magnitudes of forces, which are proportional to the modulus values.” *Id.* ¶ 57. Neither Petitioner nor Mr. Dilling explain sufficiently why the different Young’s moduli for FRP and steel and resultant proportional beam stiffness and load impacts the C-T transition point showing that both beams are capable of transitioning from compression to tension. Dr. Wagoner’s testimony that the C-T transition is the same no matter which material is analyzed is unrebutted on this record and, in fact confirmed by Mr. Dilling’s comparison.

Patent Owner argues also that “Wagoner’s statements regarding a POSITA’s motivation to modify Enomoto’s componentry are untethered to any supporting evidence, other than the disclosures of the ‘330 patent. PO Resp. 51. Weighing the evidence, as we have above, Petitioner has not drawn particularly on the teachings of ’330 patent, nor used the patent as a template for its own reconstruction. Petitioner has, in our opinion, set forth challenges based on the state of the art at the time of filing of the application which became the ’330 patent—specifically Enomoto, and the person of ordinary skill in the art who understood the function and structure of leaf springs and how FE analysis is used to determine leaf spring characteristics such as C-T transition points, all of which was well-known in the art. *See In re McLaughlin*, 443 F.2d 1392, 1313–1314 (C.C.P.A. 1971) (“Any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made and does not include knowledge gleaned only from applicant’s disclosure, such a reconstruction is proper.”).

As discussed above, for claim 1, the particular characteristic of a progressive spring rate and the transition of a leaf spring from compression to tension is specifically discussed in British Patent No. 1,077,968 to Oldfield explaining that “[t]his spring deflection is accompanied by a shortening of the main part of the spring which in turn tends to straighten out the bend 17 of the spring and applies a longitudinal tensile load in the spring. This tensile load increases with increasing spring deflection.”). Ex. 1030. Dr. Wagoner’s testimony and explanations regarding progressive spring rate characteristics are consistent with the prior art, for example Dr. Wagoner testifies that for a leaf spring with pinned ends “there will be a reaction force at the ends required to compress or elongate the spring length to maintain a common distance between the end points as the center is displaced upward.” Ex. 1002 ¶ 94.

Additionally, Patent Owner argues that “Petitioner uses hindsight to substitute FRP for steel in Enomoto. While FRP was known to be used in leaf springs it was also known to be more expensive compared to steel as well as much more flexible than steel.” PO Resp. 5 (citing Ex. 2009 ¶ 199). Patent Owner also argues that Petitioner’s reasoning that Enomoto’s joint is a point of failure and would benefit from a single piece FRP leaf spring, is incorrect because “Enomoto’s joint is not a point of failure . . . [i]ndeed Enomoto indicates that its two piece design was made in response to a prior one piece design of the same shape.” *Id.* (citing Ex. 1025, 5–6).

Petitioner responds, pointing out that “Dr. Wagoner accurately noted any joint as a potential point of weakness (stress riser), the primary motivation for substituting a single-leaf FRP spring for a multiple section leaf spring is reduction in parts and elimination of fasteners, thereby reducing cost and manufacturing complexity. Pet. Reply 26 (citing

Ex. 1002, ¶ 153). We note that besides this point of failure argument, Dr. Wagoner testifies that

[f]irst, FRP eliminates the need for any heat treatment, a goal of Enomoto. Second, the ability to shape FRP readily into a wide range of designs also allows integration of the two leaves of Enomoto into a single, leaf spring, thus reducing the number of parts, eliminating fasteners, reducing costs and simplifying manufacturing, all through the simple substitution of one well known material for the only other well-known material. Thus, adopting FRP for the Enomoto design would be known to a POSITA as a win-win change motivated by the teachings and objectives of Enomoto: eliminate manufacturing steps, simplify the manufacturing, and reduce overall costs while increasing reliability.

Ex. 1002 ¶ 153. It is unrebutted on this record that FRP and steel are the two primary materials used for vehicle leaf springs. Clearly the prior art to the '330 patent contemplates the use of FRP as a known material for progressive leaf springs. *See* Ex. 1001, Abstract (Greco describing “[a] fiberglass composite monoleaf bow spring for use in a vehicle chassis system.”), *see also In re Leshin*, 277 F.2d 197, 199 (CCPA 1960) (the selection of a known material based upon its suitability for the intended use is a design consideration within the skill of the art).

Despite the higher cost of FRP compared to steel, we find Dr. Wagoner’s testimony persuasive that “[a] POSITA would understand that the shaping/contouring approach is practical with either steel [Enomoto] or FRP [Greco, Schurmann] leaf springs. The primary difference governing the choice is the higher cost of FRP but with weight saving and better flexibility in manufacturing of highly contoured and shaped configurations.” Ex. 1002 ¶ 87, *see also KSR*, 550 U.S. at 416 ([W]hen a patent claims a structure already known in the prior art that is altered by the mere

substitution of one element for another known in the field, the combination must do more than yield a predictable result . . . [W]hen a patent simply arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is obvious.”).

Patent Owner has not presented any persuasive evidence or pointed us to compelling testimony from Mr. Dilling that a person of ordinary skill in the art would have found replacing a steel leaf spring with an FRP leaf spring particularly difficult or beyond the level of ordinary skill in the art. In fact, evidence appears to show that substituting plastics and polymer composites for steel in the automotive industry has increased significantly since 1960. Ex. 1002 ¶ 68 (Dr. Wagoner referring to data from American Chemical Council 2019), *see also id.* ¶ 76 (Dr. Wagoner testifying that “[b]y 2015, 1.3 million FRP leaf springs had been installed in Daimler vehicles, reportedly with ‘zero rejection rate and no customer complaints[,]’ and by 2019 more than 1 million FRP leaf springs had been installed in Volvo cars.”) (citing <https://www.compositesworld.com/news/sgl-carbon-delivers-millionth-composite-leaf-spring-to-volvo>).

We do not find Petitioner’s arguments, nor Dr. Wagoner’s testimony as to Enomoto’s teaching and the knowledge of a person of ordinary skill in the art with respect to substitution of FRP for steel leaf springs, and all of which relies on explicit prior art teachings and supporting evidence, to be based on improper hindsight.

(c) Conclusion as to Patent Owner’s arguments that a person of ordinary skill in the art would not have

understood Enomoto's leaf spring to transition from compression to tensile loading with increasing load.

We are persuaded that Petitioner and Dr. Wagoner have shown that a person of ordinary skill in the art would have understood Enomoto's leaf spring as it constrained by a pinned/pinned connection at each end to be configured to transition from compression to tension "due to vertical forces introduced from the wheel carrier" as recited in independent claim 1.

We reproduce below a comparison of Figure 6(c) from the '330 patent with Enomoto's Figure 3.

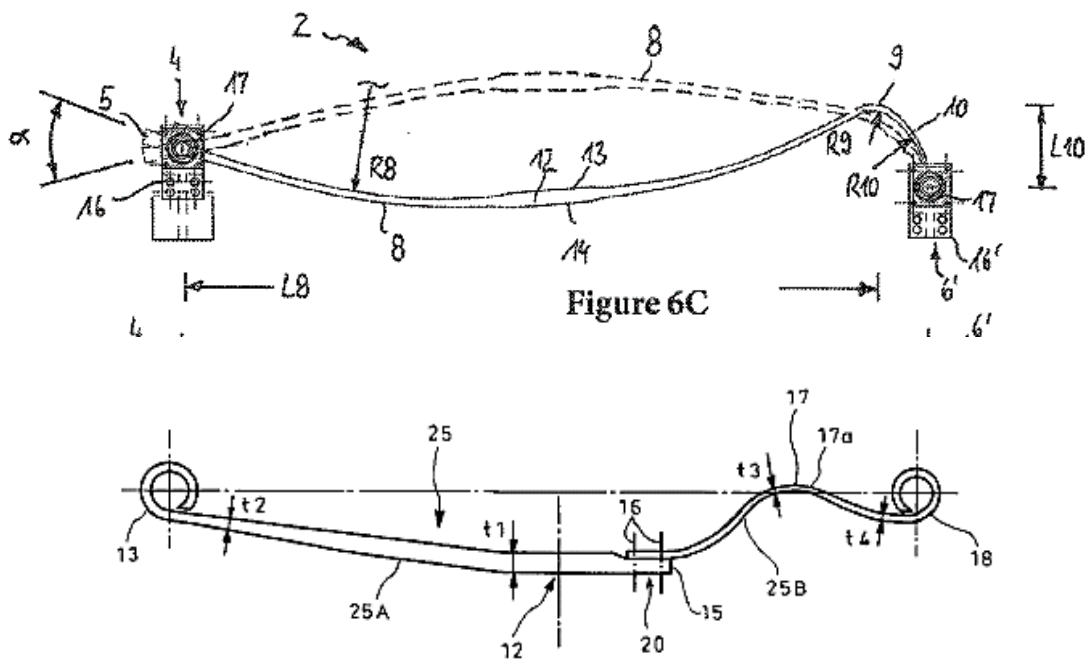


Figure 6C (above-top) from the '330 patent depicting leaf spring 8 is shown in direct comparison to leaf spring 25 illustrated in Enomoto's Figure 3 (above-bottom). As an initial matter, in comparing the above figures, we are compelled to credit Dr. Wagoner's testimony that is a person of ordinary skill in the art would have understood the concept of progressive leaf spring

operation, for example as shown by Dr. Wagoner's reference to Figure 39 of SAE Manual 1944 reproduced below.

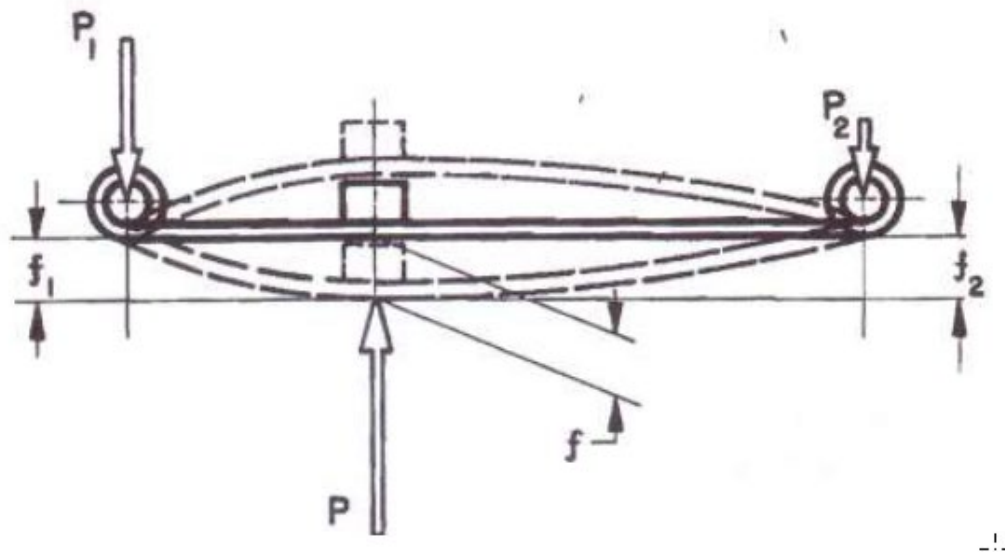


Figure 39 of SAE Manual 1944 is shown illustrating deflecting force P moving the leaf spring between three exemplary spring states, a lower unloaded state, a generally flat, deflected middle state, and an upwardly bowed larger deflected state. Considering the SAE Manual 1944 and referring to his Figure 13(a)-(b), Dr. Wagoner testifies, persuasively, that “the principles of the three main spring states 1, 3, and 5 [unloaded, flat, and upwardly bowed] are long-established and would be understood by anyone with ordinary skill in the leaf spring art, as exemplified for example by a sketch in an early leaf spring design manual [SAE Manual 1944].”

We credit Dr. Wagoner's testimony and explanations, because, as discussed above, they are consistent with the prior art and known progressive spring rate characteristics and the transition of a leaf spring from compression to tension as specifically discussed, for example, in British Patent No. 1,077,968 to Oldfield explaining that “[t]his spring deflection is accompanied by a shortening of the main part of the spring which in turn tends to straighten out the bend 17 of the spring and applies a longitudinal

tensile load in the spring. This tensile load increases with increasing spring deflection.”). Ex. 1030. We do not credit Mr. Dilling’s testimony in this case at least because it relies upon Patent Owner’s incorrect assumption that “the tensile loading must flow from the leaf spring in the installed state” and because that “installed state” supposedly defines failure of the leaf spring, as well as an air spring in Mr. Dilling’s analysis. PO Resp. 49. We determined in our claim construction that statements of intended use, like “in the installed state” in an apparatus claim do not distinguish the claim over the prior art apparatus, and that Petitioner and Dr. Wagoner have shown persuasively that Enomoto is capable of transitioning from the compressive to the tensile state either on its own, or in an installed state. *In re Sinex*, 309 F.2d 488, 492 (CCPA 1962).

(d) Conclusion as to independent claim 1

Based on the complete record before us and for the reasons expressed above, we are persuaded that Petitioner has shown a preponderance of evidence that claim 1 would have been obvious in view of Enomoto.

3. Dependent claims 2–5, 8, 10–14 and 17

Petitioner argues that dependent claims 2–5, 8, 10–14 and 17 would have been unpatentable in view of Enomoto. Pet. 42–63. Petitioner has shown, on an element-by-element basis, how Enomoto teaches the subject matter of each dependent claim. *Id.*

Patent Owner argues that “[c]laims 2–5, 8, 10–14 and 17 all depend from claim 1. The patentability of claim 1 should be confirmed for the reasons stated above.” PO Resp. 55.

We have considered, and on the complete record in the proceeding, find persuasive Petitioner’s arguments and evidence set forth at pages 42–63 of the Petition. Accordingly, we determine that Petitioner has shown

preponderant evidence that claims 2–5, 8, 10–14 and 17 would have been obvious in view of Enomoto.

(a) Dependent claim 8

Patent Owner argues for claim 8 that “the entirety of Wagoner’s analysis of claim 8 is unreliable because it is premised on 5deg of travel and as Dilling points out, Hahn’s pin/fixed embodiment has a possible rotation of 27deg in Wagoner’s own Figure.” *Id.*

Claim 8 recites in part “the associated end portion to be pivotable by at least one of a minimum of up to 10° and a maximum of up to 60° around the pivot axis.” Ex. 1001, 13:7–9. Regardless of Dr. Wagoner’s discussion in his declaration of “a total unfettered rotation angle of 5°,” (Ex. 1002 ¶ 222) as Mr. Dilling points out, Wagoner’s Figure 36 appears to show rotation of the ’330 patent’s leaf spring on the left side at 27 (i.e., 16+11) degrees. Ex. 2009 ¶ 204. 27 degrees falls within the claimed range of 10 to 60 degrees.⁹ Moreover, where there is no evidence or argument that the rotations are some type of critical or novel range, we credit Dr. Wagoner’s testimony, that is unrebutted on this record that “[t]he baseline pivotable mounting, known to all POSITAs, would allow pivoting over a range of angles limited primarily by the geometry of installation.” Ex. 1002 ¶ 222.

Accordingly, we determine that Petitioner has shown preponderant evidence that claim 8 would have been obvious in view of Enomoto.

⁹ Claim 8 is oddly worded, calling for “. . . a minimum of up to 10°,” whereas the specification describes “a minimum of 10° and/or up to a maximum of 60°.” Ex. 1001, 3:35–39. The parties do not expressly dispute that the range includes 10–60 degrees.

(b) Dependent claim 10

Claim 10 requires that the leaf spring portion is designed such that upon application of vertical forces introduced from the wheel carrier it “is subjected to pressure loading in a first spring travel range and is subjected to tensile loading in a second spring travel range.” Ex. 1001, 13:13–18. Patent Owner argues that “[f]or the reasons noted above Enomoto does not achieve tensile loading at any point during its spring travel. Rather, the leaf spring of Enomoto remains in compression in response to increasing vertical loads throughout that travel.” PO Resp. 56 (citing Ex. 2009 ¶¶191, 208).

As we discussed above, we credit Dr. Wagoner’s FE analysis and testimony over that of Mr. Dilling, and we are persuaded that Enomoto’s leaf spring is capable of transitioning from compression to tension at the C-T transition point. *See, e.g.*, Ex. 1002 ¶¶ 182–186. We have considered, and on the complete record at this point in the proceeding, find persuasive Petitioner’s arguments and evidence set forth at pages 64–68 of the Petition. Accordingly, we determine that Petitioner has shown preponderant evidence that claim 10 would have been obvious in view of Enomoto.

4. Ground 2: Claim 15 – Obviousness over Enomoto and Glover (Ex. 1018)

We determine that claim 15 would have been obvious over Enomoto and Glover for the reasons explained below.

(a) Glover (Ex. 1018)

Glover, titled “Composite Leaf Spring and Method of Making Same,” issued as U.S. Patent 9,765,838 B3 on September 19, 2017, from U.S. Application No. 12/991,999, filed as the U.S. National Stage of PCT/CA 2011/050751 on December 6, 2011; Glover ultimately indicates priority to a

U.S. Provisional application No. 61/420,085, filed on December 6, 2010.
Ex. 1018, codes (10), (45), (21), (22), (30), (54), (60).

Glover discloses a composite leaf spring 10, where, for attachment to a vehicle frame, “[a] pair of eyelets 12 is attached [] one to either end of the composite leaf spring. Eyelets 12 are attached to the composite leaf spring 10 with bolts 15.” *Id.* at 4:44–46. Glover’s Figure 1 is reproduced below.

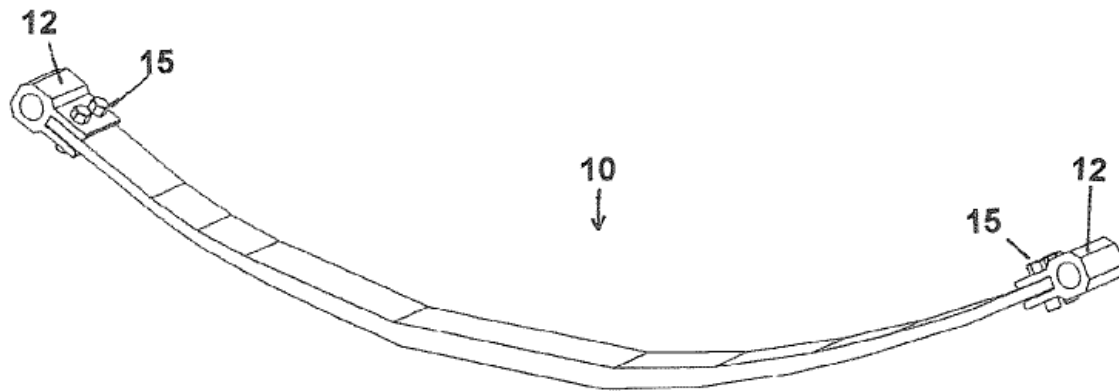


FIG. 1

Glover’s Figure 1, above, illustrates composite leaf spring 10, eyelets 12, and bolts 15.

(b) Dependent Claim 15

Claim 15 depends directly from claim 1 and recites “[t]he leaf spring assembly of claim 1, wherein at least one of the first end portion and the second end portion is unmachined.” Ex. 1001, 14:8–10. Petitioner argues that “[t]he ‘330 Patent describes ‘unmachined’ ends to be ‘bore-free’ In other words, the ends of the leaf spring disclosed by the ‘330 Patent are flat in the ‘unmachined’ claimed embodiment.” Pet. 63 (citing Ex. 1001, 5:13–16). According to Petitioner, “Glover is one example of composite eyelets

that can be utilized and attached to flat ends of a composite material leaf spring that facilitates rotation of the leaf spring in an installed assembly.” *Id.* at 64 (citing Ex. 1018, 2:14–16; 4:44–50). Petitioner contends that a person of ordinary skill in the art “would have been motivated to form separate pivoting eyes and then attach them to the ends of the leaf composite leaf spring of Glover as they would perform the same as integrally formed eyes and would overcome any disadvantages associated with forming eyes from a fiber-reinforced plastic as one piece with the leaf spring.” *Id.* at 64 (citing Ex. 1002 ¶¶ 260–262). Patent Owner does not substantively address claim 15 or Petitioner’s arguments. Prelim. Resp. 56.

As noted, claim 15 requires at least one end portion to be “unmachined.” The parties do not define “unmachined.” Considering Figure 1A, the ’330 patent describes in one embodiment receiving device 4 having bearing means 17 and clamping member 18 for clamping the first end portion of the leaf spring. Ex. 1001, 8:33–38. It further describes that

[t]he first end portion 5 of the leaf spring 3 is wedge-shaped and its thickness increases towards its end. In this way, the end portion 5 is effectively prevented from slipping out of the first receiving device 4, even if the leaf spring is under maximum load.

Id. at 8:38–42. This embodiment, consistent with at least Figures 1A–C, appears to disclose that the end portion 5 is secured only by clamping. Such an embodiment is within the scope covered by claim 15.

Petitioner argues that a person of ordinary skill in the art, when considering using FRP as a leaf spring material, would have considered along with Enomoto “alternative ways to provide eyes on the ends of Enomoto’s spring to maintain pivoting capability of the leaf spring ends. Pet. 64 (citing Ex. 1002 ¶¶ 260–262). And, considering Glover, “[a] POSA

would have been motivated to form separate pivoting eyes and then attach them to the ends of the leaf composite leaf spring of Glover as they would perform the same as integrally formed eyes and would overcome any disadvantages associated with forming eyes from a fiber reinforced plastic as one piece with the leaf spring.” Pet. 64 (citing Ex. 1002 ¶¶260–262). Patent Owner does not offer any arguments with respect to claim 15. *See, generally* PO Resp.

We find that Petitioner has provided sufficient articulated reasons supported by evidentiary underpinnings to combine Enomoto, the knowledge of one of skill of art regarding FRP as a leaf spring material, and Glover. Glover itself describes a composite leaf spring, and explains for example that for a composite leaf spring to be supported on pinned/pinned connection “[a] pair of eyelets 12 is attached to one to either end of the composite leaf spring . Eyelets 12 are attached to the composite leaf sprint 10 with bolts 15.” Ex. 1018 4:44–46. *See KSR*, 550 U.S. at 415-16 (a “patent for a combination which only unites old elements with no change in their respective functions ... obviously withdraws what already is known into the field of its monopoly and diminishes the resources available to skillful men.”) (*quoting Great Atlantic & Pacific Tea Co. v. Supermarket Equip. Corp.*, 340 U.S. 147, 152-153 (1950)).

We have considered, and on the complete record find persuasive Petitioner’s arguments and evidence set forth at pages 63–65 of the Petition. Accordingly, we determine that Petitioner has shown preponderant evidence that claim 15 would have been obvious in view of Enomoto and Glover.

E. Patent Owner's Motion to Exclude

Patent Owner moves to exclude the following exhibits, or portions thereof: Exhibits 1002, 1027, 1029, 1030, 1032, and 1033. Paper 31. We *deny* Patent Owner's Motion to Exclude for the following reasons.

1. Ex. 1002

Patent Owner moves to exclude paragraphs 77, 104–105, 106–119, and 182–192 of Dr. Wagoner's declaration testimony (Ex. 1002) under FRE 402–403 and 702–703. Paper 31, 2–5.

Patent Owner argues that Dr. Wagoner's declaration paragraph 77 is based on inadmissible hearsay under FRE 703. *Id.* In paragraph 77, item 4, Dr. Wagoner cited to two references at footnotes 9 and 10 for support of his testimony that “there were no fundamental engineering issues remaining with the design, production, or use of FRP leaf springs, and that in fact millions had already been made and sold.” Ex. 1002 ¶ 77.

Considering FRE 703, Patent Owner has not provided any persuasive evidence or argument that the online website references, which are published blog articles, compiling data about FRP leaf spring use in vehicles relied on by Dr. Wagoner are not admissible as exceptions to the hearsay rule as market reports and commercial publications under FRE 803(c)(17) and would not have been reasonably relied upon by an expert in the field. Paper 31, 2–5. Therefore, we find that these references are information that an expert would rely upon, and determine that they are admissible under FRE 703.

Even assuming for the sake of argument they are inadmissible hearsay, leading up to paragraph 77, as Petitioner points out, Dr. Wagoner “provided extensive support for his determination that millions of FRP leaf springs had already been made and sold for vehicles by 2013 in his

discussion leading to the conclusions offered in ¶77.” Paper 33, 3–4.

Dr. Wagoner’s testimony details and cites to relevant patents in the respective time frames along with the development and use of FRP in place of steel leaf springs starting from the 1960’s to the present. Ex. 1002 ¶ 59–69. As discussed above, Dr. Wagoner is undoubtedly a person of more than ordinary skill in the art, he worked at General Motors Research Laboratories, is a member of the Society of Automotive Engineers, and has extensive knowledge and experience in the testing and analysis of automotive components and we find his opinions and conclusions entitled to certain weight based on his extensive expertise and the history of FRP progressive leaf spring development which is probative as to the use of FRP in the automotive industry for leaf springs.

With respect to Dr. Wagoner’s declaration paragraphs 104–105, Patent Owner argues that Dr. Wagoner’s “visualization methodology” and graphs at Figure 15 of his declaration should be excluded under FRE 403, 702. Patent Owner argues specifically that the graphs at Figure 15 conflict with the computer simulation graphs at Dr. Wagoner’s Figure 18 and therefore “the probative value is substantially outweighed by the danger of confusing the issues and misleading the Board.” Paper 31, 4.

We are not persuaded that the differences between graphs in Figures 15(a)–(b) and Figures 18(a)–(b) obfuscate any issues in this case. Dr. Wagoner explained clearly using Figure 15(b) that a person of ordinary skill in the art would understand *conceptually* that, for a pinned/pinned progressive leaf spring, “the horizontal reaction forces would be expected to become zero when the unconstrained spring attains its initial length. This is shown in green on Figure 15(b) and is labelled the Compression-Tension Transition point.” Ex. 1002 ¶ 105. Dr. Wagoner then provides in Figure

18(b) a similar compression-to-tension transition point in the FEA results of a simple leaf spring, including a result consistent with the conceptual figure that “[t]he transition of horizontal reaction forces from compression to tension occurs at approximately 32mm of vertical displacement.” *Id.* ¶ 112.

For paragraphs 106–119 of Dr. Wagoner’s declaration testimony, Patent Owner argues that these paragraphs should also be excluded under FRE 403 and 702. Paper 31, 4–5. Patent Owner argues that “Wagoner does not provide any support to suggest that the testimony in these paragraphs is based on sufficient facts or data, that the testimony is the product of reliable principles and methods.” *Id.* at 4. Patent Owner asserts that Dr. Wagoner failed to examine forces in his FEA and “did not check for stress limits and how close you get to failure.” *Id.*

However, we are persuaded, as Petitioner argues in its response, that

¶¶106–119 of Wagoner I contain a detailed discussion of Wagoner’s computer simulation methodology and summary of results. Specifically, Wagoner modeled and simulated leaf springs with various end fixing configurations. Wagoner has decades of experience with finite element modeling and analysis and has a prolific CV in this regard with numerous honors, awards, grants, publications and work experience.

Paper 32, 5 (citing Ex. 1002). In addition, as discussed above, Patent Owner has not explained why a determination of forces and stress limits was necessary for Dr. Wagoner’s analyses, particularly when such characteristics have no bearing on the claims of the ’330 patent. Patent Owner’s argument may go to the weight of the evidence, but they are not a basis to exclude Dr. Wagoner’s FEA analyses. On the complete record before us, we determine that Wagoner’s FEA methodology and opinions offered in paragraphs 106–119 comply with Rule 702 and therefore we do not exclude them.

Patent Owner argues next that we should exclude Dr. Wagoner's declaration paragraphs 182–192, also under FRE 403 and 702, because they cite to the declaration's paragraphs 106–119. Paper 31, 5. Because we determine, as discussed above, that paragraphs 106–119 are admissible, and because Patent Owner has not asserted any other basis to exclude them, paragraphs 182–192 are also admissible.

Therefore, we *deny* Patent Owner's Motion to Exclude Exhibit 1002.

2. Ex. 1027

Patent Owner argues that we should exclude a portion of Mr. Dilling's testimony from his deposition under FRE 403 because "[t]he question asked by Petitioner is not specific to the air spring and leaf spring of Enomoto, but instead asked Mr. Dilling whether different types of air springs could be used in different suspensions with a leaf spring." Paper 31, 6 (quoting Ex. 1027, 127:19–128:10. Because we do not rely on any part of the questioning or answers provided by Mr. Dilling in this portion of his deposition, the Motion to Exclude Exhibit 1027 is *dismissed* as moot.

3. Exhibit 1029

We do not rely on Exhibit 1029 in our Decision. Accordingly, Patent Owner's Motion to Exclude Exhibit 1029 is *dismissed* as moot.

4. Exhibit 1030

Patent Owner argues that Exhibit 1030 (Oldfield) is irrelevant under FRE 403 because "Petitioner failed to comply with 37 C.F.R. 42.123 by not seeking authorization from the Board to submit supplemental information prior to serving Ex. 1030. Paper 31, 8.

Oldfield is a prior art reference including specific explanations of the concept of a pinned/pinned leaf spring transitioning from compression to tension. *See* Ex. 1030 21:43–2:54. Petitioner submitted Oldfield with its

Petitioner's Reply to Patent Owner's Response. Pet. Reply 9, 14. The Oldfield reference was provided in response to Patent Owner's challenges to Dr. Wagoner's historical and technological explanations that progressive leaf springs transitioning from compression to tension were well known in the art. This reference and citations to Oldfield were in direct response to Patent Owner's assertions that "Wagoner also wrongly claims that *any* pin/pin leaf springs will transition to tensile loading – if deflected a sufficient distance." PO Resp. 4. To this end, the Federal Circuit has explained that evidence presented in a reply that is legitimately responsive to an argument is allowable in *inter partes* review proceedings. *See VidStream LLC v. Twitter, Inc.*, 981 F.3d 1060, 1065 (Fed. Cir. 2020) (The Federal Circuit explaining that the Board has broad discretion to regulate the presentation of evidence and "it was appropriate to permit Twitter to respond to *VidStream*'s challenge by providing additional evidence to establish the Bradford publication date.").

Even if Patent Owner's argument here based on 37 C.F.R. 42.123 can be shoehorned in to a motion to exclude under FRE 403, we determine that Oldfield is relevant to Petitioner's arguments and Dr. Wagoner's testimony that leaf spring were known to transition from compression to tensile forces upon sufficient deflection, And, Patent Owner was given the opportunity to respond to Oldfield in its Sur-Reply, which it did. Paper 30, 24. *See VidStream*, 981 F.3d at 1065 (The Court explaining that "we conclude that the Board acted appropriately, for the Board permitted both sides to provide evidence concerning the reference date of the Bradford book, in pursuit of the correct answer.").

Therefore, we *deny* Patent Owner's Motion to Exclude Exhibit 1030.

5. *Ex. 1032*

We do not substantively rely on Exhibit 1032 in our Decision. Accordingly, Patent Owner’s Motion to Exclude Exhibit 1032 is *dismissed* as moot.

6. *Ex. 1033*

In our Decision, we refer to three of Dr. Wagoner’s paragraphs, paragraphs 21, 75, and 77 from Exhibit 1033, which Patent Owner contends should be excluded under at least one of FRE 402–403, 702–703, and 802. Paper 31, 9–14. Considering Patent Owner’s arguments as to paragraph 21, namely that Dr. Wagoner “has not testified that he was made aware of or personally observed that suspension systems have such travel ranges,” again, Dr. Wagoner is experienced in automotive component analysis, and materials testing and we accord his testimony certain weight. Ex. 1002 ¶¶ 5–17. That Patent Owner does not agree with Dr. Wagoner’s testimony based on his experience, expertise, and technical knowledge of leaf springs and suspension systems and leaf spring travel distances, is not a sufficient reason to exclude it. To the extent that the webpage which Dr. Wagoner refers to in paragraph 21 is admissible or not, the information is helpful in evaluating Dr. Wagoner’s testimony as to the level, skill, and knowledge of those of ordinary skill in the art and substantially outweighs any prejudicial effect to Patent Owner.

With respect to paragraphs 75 and 77, we do not rely on these paragraphs as disparagement of Mr. Dilling’s analysis in any manner, but mainly for the agreement between Mr. Dilling and Dr. Wagoner that “snap-through” exists under certain circumstances in leaf spring deformation. See Section D.2.(b).ix (“while the declarants agree that “snap-through” is undesirable, we are not persuaded by Patent Owner’s assertions that

Dr. Wagoner's FE analyses are somehow compromised simply because the data for a simple curved plate exhibit "snap-through."). Again, Patent Owner's arguments go to the weight to be accorded to the evidence. The Board is capable of determining and assigning the appropriate weight to the evidence and is not, in this case, a persuasive reason to exclude it.

For these reasons, we *deny* Patent Owner's Motion to Exclude Exhibit 1033.

F. Patent Owner's Motion to Strike

Patent Owner also filed a Motion to Strike Exhibits 1029, 1030, 1032, 1033 and related arguments in Petitioner's Reply as improper under 37 C.F.R. §§ 42.23 and 42.123. Paper 26. Petitioner filed an Opposition to Petitioner's Motion to Strike. Paper 27. We did not rely on Exhibits 1029 and 1032 and, thus, the Motion to Strike with respect to these exhibits is *dismissed* as moot.

For Exhibit 1030, as discussed above with respect to the Motion to Dismiss we do not find Oldfield untimely or a new basis for invalidity as it was provided by Petitioner in response to Patent Owner's contentions as to leaf spring compression to tension transition points. As for Exhibit 1033, and relevant paragraphs to which we refer, these paragraphs were also legitimately provided as rebuttal testimony in response to Patent Owner's arguments and Mr. Dilling's testimony in the Patent Owner Response and are therefore not new arguments or bases for invalidity. Overall, we agree with, and accept Petitioner's responses in this case, as proper responses under 37 C.F.R. §§ 42.23 to Patent Owner's arguments. Specifically, we agree that Petitioner's responses, as set forth in Petitioner's table at pages 4–5 of Petitioner's Opposition to Patent Owner's Motion to Strike, are

appropriate responses to Patent Owner's juxtaposed arguments in the table. Paper 27, 4–5.

For these reasons, we *deny* Patent Owner's Motion to Strike Exhibits 1030 and 1033.

III. CONCLUSION¹⁰

For the reasons discussed above, we determine Petitioner meets its burden of establishing, by a preponderance of the evidence, that the challenged claims are unpatentable, as summarized in the following table:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–5, 8, 10–14, 17	103(a)	Enomoto	1–5, 8, 10–14, 17	
15	103(a)	Enomoto, Glover	15	
Overall Outcome			1–5, 8, 10–15, 17	

¹⁰ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

For the reasons given, it is

ORDERED that, based on a preponderance of the evidence, claims 1–5, 8, 10–15, and 17 of U.S. Patent 9,868,330 B2 have been shown to be unpatentable;

FURTHER ORDERED, that Patent Owner’s Motion to Exclude is denied in-part and dismissed in-part;

FURTHER ORDERED, that Patent Owner’s Motion to Strike is denied in-part and dismissed in-part; and

FURTHER ORDERED that, because this is a Final Written Decision, any party to the proceeding seeking judicial review of this Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2022-00278
Patent 9,868,330 B2

For PETITIONER:

John Artz
Paul A. Rodriguez
DICKINSON WRIGHT PLLC
jsartz@dickinsonwright.com
prodriguez@dickinsonwright.com

For PATENT OWNER:

Thomas E. Bejin
Charles A. Bieneman
William K. Broman
BEJIN BIENEMAN PLC
bejin@b2iplaw.com
bieneman@b2iplaw.com
broman@b2iplaw.com