

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

ROBERT BOSCH LLC, and
MERCEDES-BENZ USA, LLC,

Petitioner,

v.

WESTPORT FUEL SYSTEMS CANADA INC.,

Patent Owner.

Case No. IPR2023-00293
U.S. Patent No. 6,298,138

PETITIONER'S REPLY

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	ARGUMENT	3
A.	The Translation of Klügl Is Not “Inaccurate”	3
B.	Patent Owner Misinterprets Klügl.....	6
C.	Patent Owner Mischaracterizes Dr. Quinlan’s Testimony	12
D.	Petitioner’s Claim Construction Positions Are Not “Inconsistent”	13
E.	<i>Ground 1:</i> Wirbeleit and Klügl Render the Claims Obvious	14
1.	Independent Claims.....	14
2.	Claims 2, 3	18
3.	Claims 6 and 13.....	18
4.	Claim 17	19
5.	Claim 19.....	20
6.	Claim 41	20
7.	Motivation to Combine	21
F.	<i>Ground 2:</i> Wirbeleit, Klügl, and Newcomb Render the Claims Obvious.....	23
G.	<i>Grounds 3 and 4:</i> Klügl and Hayes (and Newcomb) Render the Claims Obvious	23
H.	Dr. Quinlan Is Qualified	25
III.	CONCLUSION.....	25

LISTING OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 6,575,138 B2 to Welch et al.
1002	File History of U.S. Patent No. 6,575,138 B2 to Welch et al.
1003	Declaration of Dr. Matt Quinlan
1004	U.S. Patent No. 5,479,902 to Wirbeleit et al.
1005	DE 197 08 304 A1 to Klügl
1006	Certified translation of DE 197 08 304 A1 to Klügl and associated translator's declaration
1007	U.S. Patent No. 5,735,240 to Ito et al.
1008	U.S. Patent No. 6,295,969 B1 to Kato et al.
1009	U.S. Patent No. 5,697,554 to Auwaerter et al.
1010	U.S. Patent No. 4,725,002 to Trachte
1011	U.S. Patent No. 5,630,550 to Kurishige et al.
1012	U.S. Patent No. 4,684,067 to Cotter et al.
1013	EP 0 107 894 A2 to Beck et al.
1014	U.S. Patent No. 4,284,263 to Newcomb
1015	GB 2 318 390 A to Roessler et al.
1016	Docket from <i>Westport Fuel Systems Canada Inc. v. Ford Motor Company</i> , No. 2:21-cv-00453 (E.D. Tex.)
1017	Docket from <i>Westport Fuel Systems Canada Inc. v. Mercedes-Benz USA, LLC</i> , No. 2:21-cv-00454 (E.D. Tex.)
1018	Docket from <i>Westport Fuel Systems Canada Inc. v. Nissan North America, Inc.</i> , No. 2:21-cv-00455 (E.D. Tex.)

1019	Docket from <i>Westport Fuel Systems Canada Inc. v. General Motors, LLC</i> , No. 2:21-cv-00456 (E.D. Tex.)
1020	Docket from <i>Westport Fuel Systems Canada Inc. v. FCA USA LLC d/b/a FCA Group US LLC</i> , No. 2:21-cv-00457 (E.D. Tex.)
1021	Docket from <i>Robert Bosch, LLC v. Westport Fuel Systems Canada Inc.</i> , No. 1:22-cv-00370 (E.D. Va.)
1022	Plaintiff Westport Fuel Systems Canada Inc.’s Disclosure of Asserted Claims and Infringement Contentions, <i>Westport Fuel Systems Canada Inc. v. Ford Motor Company</i> , No. 2:21-cv-00453 (E.D. Tex. April 12, 2022)
1023	U.S. Patent No. 6,148,842 to Kappel et al.
1024	U.S. Patent No. 5,779,149 to Hayes, Jr.
1025	Discussion of “Hubübersetzung” on KudoZ
1026	Transcript from the July 16, 2024 deposition of Heike Holthaus
1027	Transcript from the July 19, 2024 deposition of Dr. Christopher Atkinson
1028	Excerpt from Automotive Engineering Dictionary / Kraftfahrzeugtechnik Wörterbuch (1991)
1029	DE 10 2005 009 148 A1 to Magel (annotated)
1030	U.S. Pub. 2008/0099538 A1 to Magel (annotated)
1031	EP 1 590 880 B1 to Kronberger (annotated)
1032	U.S. Pub. 2006/0033405 A1 to Kronberger (annotated)
1033	DE 10 2012 222 509 A1 to Jagani et al. (annotated)
1034	U.S. Pub. 2015/0292462 A1 to Jagani et al. (annotated)
1035	DE 10 2010 040 612 A1 to Bachmaier et al. (annotated)
1036	U.S. Pub. 2023/0269790 A1 to Bachmaier et al. (annotated)

1037	DE 41 19 467 C2 to Schwerdt et al. (annotated)
1038	U.S. Patent No. 5,186,151 to Schwerdt et al. (annotated)
1039	Excerpt from Askeland et al., “The Science and Engineering of Materials” (7th Ed. 2022)
1040	Reply Declaration of Dr. Matt Quinlan

I. INTRODUCTION

Patent Owner's Response (Paper 19, "Response") does not meaningfully address the Petition's strong showing of obviousness. Rather than confronting what the Petition argues, what the prior art teaches, and the actual testimony of Petitioner's expert Dr. Quinlan, Patent Owner crafts its own alternate version of the record. It then uses this to argue—incorrectly—that the Petition's evidence can be discarded or discounted.

The most glaring example of this is Patent Owner's discussion of the Petition's translation of Klügl. According to Patent Owner, the translation is "fundamentally inaccurate." But Patent Owner submitted no translation of its own. Even worse, it relies exclusively on the testimony of a translator who apparently did not know what "Hubübersetzung"—the supposedly inaccurately translated term—meant before submitting her declaration. So, the translator went to an Internet forum for professional translators seeking assistance. In response, she was told that the term "Hubübersetzung" can be translated exactly in way the Petition translated it: to refer to the application of translation, a ratio, or amplification to a fuel injector's stroke. Unsurprisingly, both dictionaries and numerous other patents use the term in this very same way.

Patent Owner's discussion of how a POSITA would understand the fuel injector component shown in Figure 1 of Klügl operates is no better. It simply

repeats the argument that the Board already addressed and rejected in its institution decision. As the Petition explained, this embodiment of Klügl operates without stroke translation (*i.e.*, it does not apply a stroke ratio). This means the embodiment's version of the claimed "hydraulic link"—the fluid held in chamber 5 of Klügl's transmission module 2 by membrane 6—must have a "substantially constant" "thickness" during injector actuation as the '138 patent's claims require. Patent Owner incorrectly arrives at the opposite conclusion—that because Klügl uses the word "flexible," membrane 6 must not only flex, but flex to such a degree that the thickness of Klügl's "hydraulic link" substantially changes. Once again, this is directly at odds with and negates Klügl's teaching that this injector embodiment operates without stroke translation. It also finds no support in the rest of Klügl's disclosure. Moreover, it is contradicted by numerous other prior art references—including references that Patent Owner relies on—that discuss Klügl and confirm that it operates in exactly the way discussed in the Petition.

The rest of Patent Owner's response is simply more of the same. Again and again, it misstates the teachings of the prior art, the Petition, and Dr. Quinlan's opinions. The record here says what it says. Patent Owner's efforts to change it should not be countenanced.

II. ARGUMENT

A. The Translation of Klügl Is Not “Inaccurate”

Patent Owner characterizes the translation of Klügl that accompanied the petition as “fundamentally inaccurate” because it used a few English language synonyms in place of the German term “Hubübersetzung.” *E.g.*, Response, 2, 26-28.

This amounts to nothing more than non-substantive quibbling over word usage. Patent Owner did not depose Petitioner’s translator. Nor did it submit a translation of its own. Indeed, Patent Owner does not even appear to take a position regarding what “Hubübersetzung” means. Instead, its translator—Ms. Heike Holthaus—simply opines that the “best practice” when translating is to translate same word the same way throughout a document. Ex. 2026, ¶ 6. Ms. Holthaus goes on to note that translating “Hubübersetzung” to alternatively mean “stroke translation,” “stroke ratio,” and “stroke transmission”—as Petitioner’s translation does—runs afoul of this “practice” and thus constituted a “translation error.” *Id.*, ¶¶ 7-8; Ex. 1026, 12:14-13:4, 15:2-16:10 (no translation or opinion offered by translator on “Hubübersetzung”).

These, however, are all accepted translations of “Hubübersetzung.” And each means substantively the same thing. Indeed, before signing her declaration, Ms. Holthaus submitted a question to a translators’ Internet forum seeking insight into

the meaning of “Hubübersetzung.” Ex. 1025; *see also* Ex. 1026, 17:18-20:9, 21:18-22:16, 25:13-21. In response, she was told that “Hubübersetzung” can be translated to mean “amplification/amplified actuation,” “stroke transformation,” “amplification ratio,” or “stroke transmission or transfer.” Ex. 1025, Ex. 1026, 22:17-23:18, 25:22-31:20. Not only does this undermine the credibility of Patent Owner’s arguments—they are all premised on the testimony of a translator who apparently had no independent, pre-existing knowledge of what “Hubübersetzung” means—but it verifies that there was no translation “error” here. Far from showing inaccuracy, Patent Owner’s own evidence confirms that different English words can properly be used to translate “Hubübersetzung.”

Moreover, the record here shows that, whatever words are used to translate “Hubübersetzung,” the term would have been understood by a POSITA to refer to the amplification or application of a ratio to a fuel injector stroke. To begin, the very same automotive technical dictionary on which Patent Owner itself relies—Response, 39 (citing Ex. 2027)—defines the German term “hub” as “stroke,” and the term “übersetzung” as “gear ratio, gearing, transmission.” Ex. 1028, pp. 293, 364. Thus, “Hubübersetzung” refers to a “stroke” “ratio,” “stroke “gearing,” or “transmission” for a “stroke.” *Id.* Likewise, industry players such as Robert Bosch, Siemens, and Continental, and Daimler have all also previously translated “Hubübersetzung” in substantively similar ways:

- “stroke boost” (*compare* Ex. 1029, [0025] *with* Ex. 1030, [0025]);
- “stroke step-up” (*compare* Ex. 1031, [0006] *with* Ex. 1032, [0006]);
- “stroke boosting action” (*compare* Ex. 1033, [0008] *with* Ex. 1034, [0022]);
- “stroke transmission ratio” (*compare* Ex. 1035, [0006] *with* Ex. 1036, [0007]); and
- “stepping up or transmitting ... strokes” (*compare* Ex. 1037, Title *with* Ex. 1038, Title).

While synonyms are used, “Hubübersetzung” consistently refers to the same concept: application of a ratio or amplification to a fuel injector stroke.

If this were not enough, Dr. Quinlan testified during his deposition that “taken on a whole,” the translation of Klügl makes sense and is “accurate.” Ex. 2025, 13:23-14:6. Per Dr. Quinlan, Klügl plainly refers to the “relationship between” the motion on opposing sides of its “hydraulic link[,]” and whether that motion “is the same or different.” *Id.*, 17:22-18:3. And he repeatedly testified that the precise words used by Klügl—and formal definition applied to those words—do not matter. *Id.*, 21:9-14 (meaning of “stroke translation” understandable from rest of Klügl); 23:12-24:1 (“stroke transmission” and “stroke translation” in Klügl both refer to the same general concept: application of a “stroke ratio”); 26:6-17 (particular definition of “stroke translation” and “stroke ratio” not pertinent); *see also* 27:17-28:2, 28:22-29:12, 29:24-30:5, 31:3-16, 37:11-20.

B. Patent Owner Misinterprets Klügl

Patent Owner is also wrong when it argues that Klügl’s “hydraulic link” (the thickness of hydraulic fluid in chamber 5) cannot have a “substantially constant” “thickness” because membrane 6 allegedly “must flex” during injector actuation. Response, 32, *et seq.* This argument—much like Patent Owner’s arguments regarding the term “Hubübersetzung”—improperly fixates on a single word in Klügl: “flexible.” But the mere fact that Klügl sometimes labels its “membrane 6” as “flexible” does not end the analysis. When Klügl’s teachings are considered in their entirety, it is apparent that in the injector of Figure 1, membrane 6 does not substantially flex during actuation. It follows that Klügl’s “hydraulic link” maintains a substantially constant thickness as the claims here require.

As explained in the Petition, Klügl says as much. According to Klügl, Figure 1’s injector operates “***without stroke translation.***” Klügl, 1:41-42 (emphasis added). Petitioner’s expert Dr. Quinlan testified that this means that “the movement of the actuator results in the same amount of movement of the piston without amplification.” Ex. 1003, ¶ 208. This, however, is not the limit of Klügl’s teachings. It also discusses the injector in more detail. Klügl explains that in Figure 1, when “the piezoelectric actuator 1” is actuated it “presses the entire transmission module 2 ... in the direction of the drive piston 3, so that pressure is exerted on the drive piston 3 via the first membrane 6 and the transmission medium located in the

pressure chamber 5....” Wirbeleit, 3:23-28. This in turn “moves the drive piston 3” to open the valve. *Id.*, 3:30-32. Klügl also explains that “transmission medium” does not “flow” during this process to avoid “impair[ing]” “activation of the drive piston.” *Id.*, 4:11-15. So, the actuator actuates, the transmission module moves, the fluid in the transmission module does not flow, and the piston is pushed by the transmission module such that it moves by the same amount as the actuator. There is no “stroke translation.”

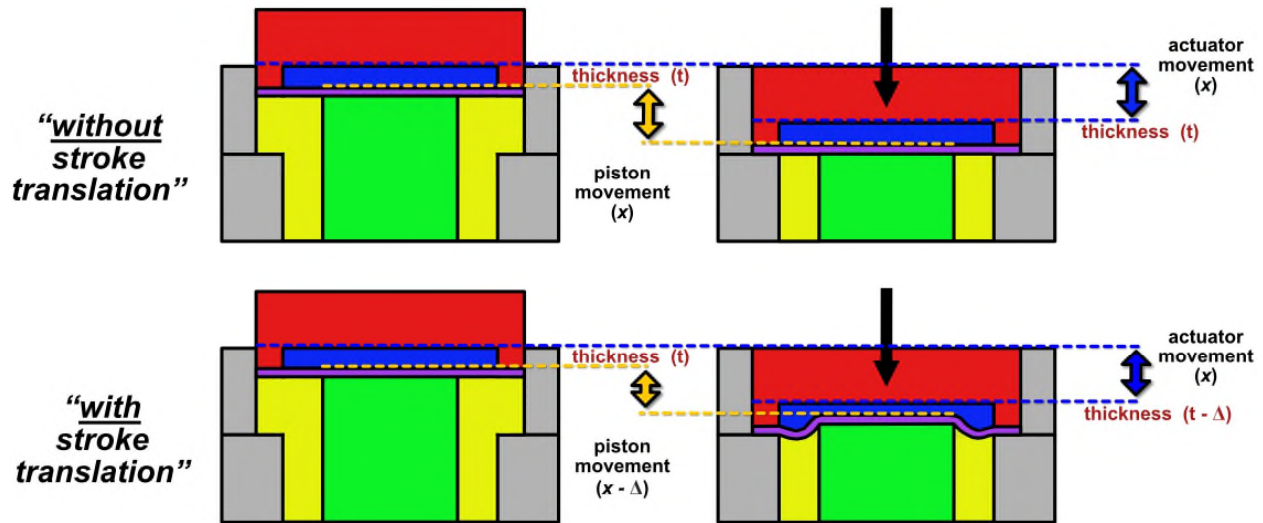
Klügl contrasts Figure 1’s injector with that of Figure 3. Figure 3’s injector operates “***with stroke translation.***” *Id.*, 1:45-46 (emphasis added). The injector employs a “first pressure chamber 5” (formed by membrane 6) associated with piston 3 and a “second pressure chamber 28” (formed by a membrane 26) associated with die 29. *Id.*, 5:9-15. Fluid can be pumped from the second chamber to the first chamber via “lines 25.” *Id.*, 5:18-23. During actuation, when “third membrane 26” is “pushed downwards by the die 29,” the “transmission medium located in the second pressure chamber 28” is “pushed into the pressure chamber 5 via the line 25” causing “brief pressure increases” in the chamber 5 that in turn cause the “first membrane 6” to “deflect[] ... in the direction of the drive piston 3” to move the piston to open the valve. *Id.*, 5:28-6:6. Then, because “die 29” and “piston 3” are different sizes—and because “membrane 6” and “third membrane 26” are also “different[ly] sized surfaces”—this embodiment “achieve[s] a stroke ratio between

the deflection of the piezoelectric actuator 1 and the deflection of the drive piston 3.” *Id.*, 7:9-20. So here, fluid flows, pressure increases, and a stroke ratio is applied to piston movement. There is “stroke translation.”

In other words, Klügl not only states that Figure 3 is “with stroke translation” and Figure 1 is “without stroke translation,” but it also explains **why** the differences in structure and operation between these two figures produce these different results. Figure 3’s injector utilizes deflecting membranes and differently sized piston/membrane surfaces leading to fluid flow, temporary pressure increases, and a resultant “stroke ratio” between the actuator’s and piston’s movement. This is why it operates “**with stroke translation.**” In contrast, in Figure 1, the piezoelectric actuator’s movement is simply transferred to the drive piston via the movement of module 2 (and the chamber 5 and membrane 6 that it contains). There is no discussion of fluid flow, pressure increase, membrane deflection, or application of a stroke ratio in this embodiment. *See* Ex. 1027, 33:5-21, 34:8-35:15, 41:12-45:5 (Patent Owner’s expert confirming lack of discussion). Thus, the embodiment in Figure 1 operates “**without stroke translation.**”

As Patent Owner interprets Klügl’s first embodiment, during actuation, “membrane 6” will “bulge on the sides of the piston where it is unsupported by piston 3.” Response, 36. Patent Owner concedes that this deformation of membrane 6 results in a “loss of actuator linear translation, or stroke” (*i.e.*, the piston will move

less than the actuator). Paper 7, 32; Ex. 1027, 28:5-30:21. This is the **opposite** of how Klügl says Figure 1's injector works. This difference is illustrated by the below figures based on an image from Patent Owner's response (Response, 37). The figures are in accordance with those in Petitioner's rehearing request:



Ex. 1040, ¶ 7-29. The top figures show operation "**without stroke translation.**" Here, the membrane (purple) does not materially flex and the thickness (t) of the hydraulic fluid (blue) between the transmission module (red) and the piston (green) remains constant such that the piston and actuator move by the same amount (x). The bottom figures show the effect of Patent Owner's erroneous interpretation on operation. In these figures, the deformation of the membrane creates a different shaped space, causing the thickness of the hydraulic fluid (t) between the transmission module and piston to be reduced by Δ such that it becomes $t - \Delta$. As a

consequence, while the actuator still moves x , the piston movement is reduced to $x - \Delta$, resulting in ***stroke translation***. *Id.*

In addition to being inconsistent with Klügl, Patent Owner's argument that membrane 6 "must" meaningfully "flex" during actuation simply because it is "flexible" (*e.g.*, Response, 32) fails for additional reasons. To begin, this argument does not account for what the '138 patent's claims require. The claims provide only that the thickness of "hydraulic link" stay "***substantially*** constant" during actuation. Ex. 1001, claim 1 (emphasis added). Insubstantial, meaningless changes in link thickness do not matter. Patent Owner does not attempt to quantify how much membrane flexing purportedly occurs when Klügl's injector is actuated. And it offers no explanation of why any such flexing would result in a "substantial" (as opposed to insubstantial) change in the "thickness" of Klügl's hydraulic link.

Further, Dr. Quinlan explained during his deposition that a POSITA would readily be able to design Klügl's injector such that any flexing of membrane 6 is immaterial during actuation. *E.g.*, Ex. 2025, 63:21-64:10. According to Dr. Quinlan, the amount of membrane flexing depends on the force applied, the material the membrane is made from, the membrane's thickness, how the edges of the membrane are supported, the fluid pressure in the chamber 5, and the size of the membrane/piston interface. *Id.*, 62:25-63:8, 64:13-20, 118:14-21 135:3-18, 136:2-20; *see also* Ex. 1039 (membrane displacement decreases exponentially with

increasing thickness and decreasing unsupported length); Ex. 1040, ¶¶ 30-35. So, consistent with Klügl's teachings, flexing can be avoided simply by choosing the right membrane material and dimensioning it appropriately. *E.g.*, Ex. 2025, 99:12-20 (appropriately sizing Klügl's piston/membrane is "normal design procedure"), 119:24-120:11 (similar); *see also* Ex. 1027, 54:16-57:13 (POSITA aware of various "parameters and variables" that impact membrane flexing).

Patent Owner ignores all this. Instead, it looks no further than Klügl's use of the term "flexible" and the dimensions shown in its figures. *E.g.*, Response, 34-35 (Figure 1 depicts "open space" to "accommodate deformation of the flexible membrane"), 36 ("membrane 6" is "unsupported" by the piston). This is not how prior art is assessed. *Janssen Pharms. Inc. v. Teva Pharms. USA, Inc.*, 97 F.4th 915, 930-31 (Fed. Cir. 2024) (prior art not limited to just its "explicit" statements; all that a "reference fairly suggest[s]" to a POSITA must be considered). Moreover, even Klügl itself confirms that Figure 1 is only a "schematic[]" such that no concrete dimensions can be derived from it. Klügl, 1:47.

If all this were not enough, Patent Owner itself relies on prior art references that discuss Klügl and confirm that it operates exactly in the manner described in the Petition. For instance, one such reference explains that "[w]hen the actuator" in Klügl "is actuated, the deflection ... is transmitted via the transmission element ***essentially unchanged*** to the drive plunger...." Ex. 2012, 1:70-2:6 (emphasis

added). Another repeats this same characterization and then further explains that in Klügl, “deflection of the actuator is transmitted to the drive plunger of the servo valve **virtually undamped**....” Ex. 2010, ¶¶ [0004], [0005] (emphasis added). Indeed, even Klügl offered a similar explanation in later patent filings, noting that “when the piezo actuator is actuated electrically, ... movement ... is transmitted via the transmission module **virtually unchanged** to the drive plunger....” Ex. 2008, 1:48-57 (emphasis added).

So, in sum, Patent Owner interprets Klügl in a way (1) that negates its teaching that the injector of Figure 1 is “without stroke translation,” (2) is inconsistent with the rest of Klügl’s discussion of its embodiments, (3) ignores that membrane material and dimensions substantially limit any flexing, and (4) is contradicted by numerous prior art characterizations of Klügl. This is all “plainly inconsistent with the record” and cannot show non-obviousness. *Homeland Housewares, LLC v. Whirlpool Corp.*, 865 F.3d 1372, 1378 (Fed. Cir. 2017).

C. Patent Owner Mischaracterizes Dr. Quinlan’s Testimony

In addition to misinterpreting the prior art, Patent Owner also repeatedly mischaracterizes Dr. Quinlan’s deposition testimony. Patent Owner accuses Dr. Quinlan of being “evasive” and “simply ... not answer[ing]” many questions. Response, 32-33. Dr. Quinlan **did** answer the **relevant** questions asked during his deposition. Patent Owner simply does not like what he said. Dr. Quinlan did explain

that he has not formulated formal opinions regarding the meaning of “flexible,” “diaphragm,” and “membrane” in the abstract and separate from the functionality of prior art at issue here. Ex. 2025, 47:11-48:13. He was abundantly clear regarding his understanding of Klügl. He repeatedly explained that in Figure 1, “displacement would essentially be the same” on opposing sides of the “hydraulic link.” *Id.*, 38:21-39:14. He also elaborated that the injector of Figure 1 is specifically designed without stroke translation which implies that membrane 6 does not substantially flex during actuation. *Id.*, 63:21-64:10. Because of this, Dr. Quinlan explained that the specific terminology used is irrelevant. Whether one refers to membrane 6 as a “diaphragm,” “flexible membrane,” or just “membrane” is nothing more than a matter of “semantics” that would not change a POSITA’s view of Klügl’s operation. *Id.*, 61:22-62:20.

D. Petitioner’s Claim Construction Positions Are Not “Inconsistent”

Next, nothing in the Petition is “inconsistent” with Petitioner’s positions elsewhere. Response, 5-6. Petitioner did propose more specific constructions of the terms “valve needle,” “lift,” “interior chamber,” and “fluid passage” in district court. *See generally id.*, 7. But these were necessitated by Patent Owner’s overbroad and erroneous infringement allegations. And the constructions are simply an elaboration of the terms’ plain and ordinary meaning. Petition, 15-17. They do not bear on—or have any pertinence to—Grounds 1 and 2. Indeed, Patent Owner points to no

limitation that would not be satisfied when the constructions are applied. Grounds 3 and 4 raise different issues: they apply Patent Owner’s overbroad, district court claim interpretations. *Id.* The Petition recognizes that the art in those grounds do not teach what the claims require when afforded their proper scope. Petition, 15-18, 55-56.

E. Ground 1: Wirbeleit and Klügl Render the Claims Obvious

1. Independent Claims

a) “Opening”/“closing” “force[]” “transmi[ssion]”

Patent Owner argues that there is purportedly “no discussion” in the Petition “of how closing forces are transmitted through a hydraulic fluid thickness.” Response, 45. This is not the case. Per the Petition, Wirbeleit’s injector includes an intermediate “hydraulic transmission element 22” through which both opening and closing forces are transmitted. Petition, 31-32. “[D]uring valve opening, force is exerted from the actuator through the hydraulic transmission element to the needle.” *Id.* Then, “[d]uring valve closing, force is exerted from the spring, to the needle, and back through the hydraulic transmission element until a rest position is reached.” *Id.* The Petition then went on to explain why it would have been obvious to employ Klügl’s “transmission module 2” when implementing Wirbeleit’s “hydraulic transmission element 22.” *Id.*, 32-37. It also included a graphical depiction of the combination. *Id.*, 37. Because Klügl’s transmission module 2 simply replaces Wirbeleit’s hydraulic transmission element 22, it will continue to operate in the same

way. Opening forces exerted by the actuator will continue to pass through module 2 (and the hydraulic fluid it contains) to the needle. And closing forces exerted by the spring will likewise continue to pass from the needle, through the module 2 (and its hydraulic fluid), and back to the actuator. *Id.*, 32-34 (analogizing Wirbeleit’s and Klügl’s structures); 47 (explaining that Wirbeleit’s and Klügl’s injectors are “structurally and functionally analogous” opening and closing valves in the same way); *see also* Ex. 1003, ¶ 351 (similar); Ex. 2025, 107:9-108:8.

In arguing that this limitation is not satisfied because “Wirbeleit should only be relied on for what it actually discloses, which is nothing” (Response, 46), Patent Owner improperly addresses the prior art in isolation. The Petition argued that the **combination** of Wirbeleit and Klügl—specifically Wirbeleit’s injector implemented using Klügl’s transmission module 2—renders the claims obvious. Thus, whether Wirbeleit itself teaches everything the claims require is of no moment. *In re Mouttet*, 686 F.3d 1322, 1332–33 (Fed. Cir. 2012).

While Klügl does include a separate “disk spring 14” that operates to “pre-stress[]” the “transmission module 2” that does exert force (Klügl, 2:11-21), closing force also passes through the module 2. In particular, when “activation of the ... actuator 1 ends, ... the drive piston 3 is pushed away from the closing element 4 by the spring 15.” *Id.*, 3:49-44. Since Klügl’s “drive piston 3 is always in contact with the first membrane 6” (*id.*, 4:9-10), closing force from spring 15 exerted on the drive

piston is also transmitted through Klügl's chamber 5 and the hydraulic transmission medium it contains.

**b) “Hydraulic fluid” that “acts substantially as a solid”
with a “substantially constant” “thickness”**

Patent Owner next argues that because Klügl's “membrane 6 is flexible,” the fluid within it cannot “act[] substantially as a solid” with a “substantially constant” “thickness” during injector actuation. Response, 47. This, however, is simply a repeat of its prior mischaracterization of Klügl's operation. *Supra* Section II.B.

c) “Adjustable” “hydraulic link”

Patent Owner also argues that while Klügl's injector accounts for some changes in component size due to thermal influences or aging, there are “other changes in the dimensional relationship” that are purportedly not accounted for. Response, 48. The '138 patent's claims, however, require only that “hydraulic link” be “adjustable ... in response *to changes* in the dimensional relationship” to “maintain a desired valve needle lift.” Ex. 1001, claim 1 (annotated). The hydraulic link does not need to account for all possible changes.

Here, Klügl's transmission module 2 (and the fluid in chamber 5) has the required effect. First, “if ... actuator 1 shortens ... due to thermal influences or signs of aging[,]” fluid is pushed into “pressure chamber 5, so that the first membrane 6 is moved in the direction of the drive piston 3” and “drive piston 3” continues to “bear[] against first membrane 6 despite the shortening” of the “actuator.” Klügl, 3:63-4:3.

A POSITA would have recognized this adjustment to be important: if the membrane did not bear against the piston, the piston would move by less during actuation (since the separating space would first need to be cleared before the piston moves). This would in turn reduce needle lift. Ex. 1040, ¶¶ 43-44. Second, “if the distance between the ... actuator 1 and the drive piston 3 is reduced, the first membrane 6 is pushed in by the drive piston 3 so that the transmission medium is pressed through the throttle 10 into the compensation chamber 7.” Klügl, 4:4-10. This adjustment is also important. If it did not occur, closing element 4 would be pushed too far off its seat during actuation resulting in too much needle lift. Ex. 1040, ¶¶ 45-46.

So, while piston 3 itself cannot “lengthen or shorten” (Response, 49), thermal effects **can** cause this piston to be pushed either too little or too much during actuation. The rest of Klügl operates to avoid this and ensure that a consistent amount of lift is provided even if components change size. Ex. 1040, ¶¶ 39-42, 47; Ex. 1027, 83:5-12 (Dr. Atkinson confirms that purported “flaw” relating to piston size changes does not apply to adjustment if actuator shortens/lengthens).

Patent Owner further characterizes the Petition’s arguments as inconsistent. Per Patent Owner, Klügl’s membrane cannot both maintain constant fluid thickness (which purportedly requires a “rigid” membrane) and allow for adjustment (which purportedly requires a “flexible” membrane). Response, 51. But, this is what a POSITA would have understood from Klügl: in Figure 1, fluid **does not** flow (and

the membrane does not deform) during actuation. Klügl, 3:63-4:31. But fluid **does** flow (causing the membrane to be pushed in) during times of rest. *Id.* This is because—according to Klügl—there may be “long lasting pressure differences” during rest that are not present during actuation. *See id.* It is these long-lasting differences that cause the membrane to behave differently during actuation and rest. Ex. 1040, ¶¶ 48-52; *see also* Ex. 2025, 65:17-66:13 (explaining that the membrane 6 performs “different functions” at different times); 100:24-101:2, 101:20-103:18, 121:1-13, 122:8-21 (all similar).

2. Claims 2, 3

Patent Owner repeats its argument that Klügl cannot perform the required adjustments if its membrane is “rigid.” Response, 51-52. This fails for same reason discussed. *Supra* Section II.E.1.c.

3. Claims 6 and 13

Patent Owner argues that claim 6’s “dimensionally responsive” “actuator” is not present because Petitioner purportedly “relies on Klügl’s” non-adjustable “actuator.” Response, 54. The Petition, however, correlated **Wirbeleit’s** controllable actuator with the claimed “actuator assembly.” Petition, 30. It also explained why a POSITA would have “retain[ed] Wirbeleit’s directly actuated and controllable valve design.” *Id.*, 50. Patent Owner addresses none of this.

Next, with respect to claim 13, Patent Owner argues that a POSITA would not have considered using a “piezoelectric” actuator with Wirbeleit and Klügl. Response, 54. Wirbeleit does state that “magnetostrictive” actuators are “particularly advantageous.” *Id.* But it also teaches that “a piezo actuator may be utilized” “instead.” Wirbeleit, 2:64-66. This type of actuator was also known, available, and considered an interchangeable option. *E.g.*, Ex. 2025, 91:21-92:9; *see also* Ex. 1001, 2:62-63 (admitting both piezoelectric and magnetostrictive actuators known). Again, the totality of the prior art’s teachings must be considered. Both magnetostrictive and piezoelectric actuators are taught.

4. Claim 17

This claim requires that the “actuator” be able to “maintain ... lift to between 10 and 100 percent of maximum lift.” Wirbeleit teaches a lift controlling actuator. Ex 1004, 1:59-63, 2:1-12, 3:5-7, 3:13-14. Patent Owner discounts this because Wirbeleit “does not disclose any specific range.” Response, 54. As explained in the Petition, however, it does not need to: claims that simply include an “optimum or workable range[]” identified “by routine experimentation” are obvious over prior art teaching “the general conditions of [the] claim.” *EI DuPont de Nemours & Co. v. Synvina C.V.*, 904 F.3d 996, 1006 (Fed. Cir. 2018). This is what Wirbeleit does here.

5. Claim 19

Patent Owner's claim 19 arguments are also deficient. Here, it improperly argues that the art should be limited to just Klügl's "preferred" actuation time range. Response, 55. Again, the totality of the art's teachings must be considered. *Janssen Pharms.*, 97 F.4th at 930-31. Klügl also teaches a range of "fast actuation times" that overlap the claimed range. Klügl, 4:24. In an effort to show that Klügl contemplates slower actuation, Patent Owner points to Klügl teaching that "adjustment across compensation chamber 7 occurs 'from one second to minutes.'" Response, 56. This has nothing to do with actuation speed. Instead, it is simply meant to show that Klügl's injector is dimensioned such that fluid only flows into/out of chamber 5 only during long periods of rest (and not short actuation periods). Klügl, 4:11-25.

6. Claim 41

Patent Owner mis-reads claim 41. It argues that the claimed "cylinder head" must be part of the "hydraulic cylinder." Response, 57. But the "head" is not required to be part of any particular component. The claim simply provides that there be a layer of "hydraulic fluid" between the "piston" and "a cylinder head" (a different element). Ex. 1001, claim 41. There is such a layer (the fluid in chamber 5) between element 45 of transmission module 2 (the "piston") and membrane 6 at the end of guide sleeve 11 (the "cylinder head"). See Petition, 20-21, 32-36, 45-46.

Next, Patent Owner argues that Klügl’s “hydraulic cylinder” must “interface ... with hydraulic fluid.” Response, 57. The claim requires that the hydraulic cylinder be “filled with a hydraulic fluid.” There is hydraulic fluid within Klügl’s housing /guide sleeve (*i.e.*, fluid-filled chambers 5 and 7 in transmission module 2). Petition, 45-46. This fluid also moves from one “side” of the piston to the other (between chambers 5 and 7). *Id.*, 46.

7. Motivation to Combine

Patent Owner concludes its discussion of Ground 1 by disputing that a POSITA would have been motivated to apply Klügl to Wirbeleit.

It begins by arguing that “[a] POSITA would not be motivated to ... correct a problem that Wirbeleit purportedly solved.” Response, 58. But as Patent Owner itself repeatedly points out, Wirbeleit does not detail how its hydraulic link operates and is structured. *Id.*, 15. Thus, a POSITA would out of necessity need to consult another reference—like Klügl—when implementing Wirbeleit. Petition, 46. Further, while Wirbeleit does allow for control of valve lift, it does not itself “solve” problems like component misalignment resulting from aging and thermal effects: Klügl’s transmission module 2 does solve that. *Id.*, 47-52.

Patent Owner is also wrong when it argues that Wirbeleit and Klügl would not be combined because they are structurally “different.” Response, 58. Both are fuel injectors (or components thereof). Both transmit opening/closing force through a

hydraulic element. And both teach outwardly opening valves. *E.g.*, Wirbeleit, Fig.; Klügl, Fig. 1; Ex. 1027, 94:7-96:17. A POSITA would not understand Klügl to add “needless complexity” to Wirbeleit. Response, 59. Once again, Wirbeleit requires additional, structural supplementation. Klügl’s more structurally complete transmission element is necessary, not needless. Moreover, Patent Owner’s critique of the combination of Wirbeleit and Klügl appears to take the two references’ drawings literally. According to Patent Owner, “visual inspection” “reveals” the structure is not “compact.” Response, 59-60. And it purportedly has the potential to “[i]ntroduce[] fluid” in way that could cause “hydro-lock.” *Id.* These figures are only “schematic[s].” *E.g.*, Wirbeleit, 1:47. A POSITA would of course be able to tailor the dimensions of the combined structure to optimize the size and operation of the combined valve.

Next, Patent Owner argues that “disadvantages with flexible membranes” would purportedly weigh against combination. Response, 60. The decisive fact is that Klügl fills a gap in Wirbeleit’s disclosure. And it does so in a way that is not only consistent with Wirbeleit’s injector but improves it by providing the ability to adjust for aging and thermal effects. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004) (mere teaching of alternatives does not render claims non-obvious).

F. Ground 2: Wirbeleit, Klügl, and Newcomb Renders the Claims Obvious

Patent Owner moves on to discount Ground 2 because it purportedly provides a “mere recitation of common generic elements.” Response, 61. The Petition did more: it began by highlighting Newcomb’s teaching of injectors made from materials with matching thermal expansion coefficients. Petition, 53-54. Newcomb also expresses various benefits deriving from this (*e.g.*, it reduces the impact thermal expansion has on valve stroke). *Id.*, 54. Then, the Petition explained why a POSITA would have been motivated to apply Newcomb’s teachings to Wirbeleit/Klügl. *Id.*, 54-55. Patent Owner responds with a bald denial. This type of “[c]onclusory assertion[]” is “not persuasive....” *Coalition for Affordable Drugs VII LLC v. Pozen Inc.*, Case IPR2015-01680, Paper 18 at 15 (Feb. 11, 2016).

G. Grounds 3 and 4: Klügl and Hayes (and Newcomb) Render the Claims Obvious

Here, Patent Owner begins by identifying a handful of required claim limitations that are not, in its view, taught by Klügl. This includes the claimed “fuel inlet port,” “interior chamber,” and “valve member.” *Id.*, 62-64. But Grounds 3 and 4 noted that these elements are taught by Klügl and Hayes *together*. And Hayes does teach—at least when Patent Owner’s erroneous interpretation of its claims is applied—these limitations. *E.g.*, Petition, 57-64.

Patent Owner next argues that a “POSITA would not consider” Klügl’s piston 3, control needle 32, and ball 4 to “together ... constitute the claimed valve member.” Response, 63. But Patent Owner offers no explanation why and ignores the Petition’s argument. Petition, 61-62.

Patent Owner continues this portion of its response by again contesting the accuracy of the translation of Klügl and pointing to the “flexibility” of Klügl’s membrane 6. *E.g.*, Response, 64-66. Patent Owner also re-makes many of the same dependent and claim 41 arguments from Grounds 1 and 2. *See id.*, 66-68. These arguments are addressed above. *Supra* Sections II.A-E.

Patent Owner concludes by arguing that “Petitioners’ Klügl/Hayes combination” is “inoperable” because “no pressure differential exists” around the injector needle preventing the injector from opening/closing. Response, 68-69. This is wrong. Dr. Quinlan included a demonstrative showing how a fuel supply line results in high pressure (yellow), while a throttle/neck and vent result in intermediate (green) and low (blue) pressures at appropriate times allowing the valve to open and close. Ex. 1003, ¶ 418. Patent Owner appears to ignore the effect of the throttle/neck and vent. Finally, Patent Owner’s argument that a POSITA would not have been motivated to replace Hayes’ “hydraulic amplifier” with Klügl’s transmission element is irrelevant. Response, 71. This gets the Petition’s argument backwards. The Petition pointed to Hayes as an example of how a POSITA would have understood

the lower portion of Klügl's injector to be structured. *E.g.*, Petition, 57. It did not argue that a POSITA would have bodily grafted Klügl into Hayes.

H. Dr. Quinlan Is Qualified

Patent Owner is also wrong that the Board should discount Dr. Quinlan's testimony because he was not a POSITA as of 1999. "[W]hether" an expert "was an ordinarily skilled artisan as of" the patent-at-issue's "critical date ... is irrelevant." *Apple Inc. v. Zipit Wireless, Inc.*, IPR2021-01130, Paper 30, pp. 41-42 (Dec. 20, 2022). An expert only must be "qualified in the pertinent art." See Nov. 2019 Trial Practice Guide, p. 34. Here, in view of his advanced degree and years of experience researching and working with fuel injectors, Dr. Quinlan undeniably possesses the technical expertise needed to offer meaningful opinions. Ex. 1003, ¶¶ 5-15.

III. CONCLUSION

In conclusion, in instituting IPR the Board rejected Patent Owner's "incorrect reading" of the prior art. Paper 10 at 8. Patent Owner's response does not overcome this finding. Petitioner's translation of Klügl is accurate and Klügl's membrane in the embodiment without stroke translation does not flex during actuation. As a result, the record continues to mandate obviousness over the prior art.

Respectfully submitted,

ORRICK, HERRINGTON & SUTCLIFFE LLP

Dated: July 26, 2024

/K. Patrick Herman/

K. Patrick Herman, Reg. No. 75,018
Orrick, Herrington & Sutcliffe LLP
51 West 52nd Street
New York, NY 10019
Telephone: (212) 506-3596
Email: P52PTABDocket@orrick.com

Counsel for Petitioners

CERTIFICATE OF WORD COUNT

The undersigned certifies that the foregoing paper complies with the type-volume limitation in 37 C.F.R. § 42.24. According to the utilized word-processing system's word count, the paper contains 5,566 words.

Dated: July 26, 2024

By: /K. Patrick Herman/

K. Patrick Herman, Reg. No. 75,018
Orrick, Herrington & Sutcliffe LLP
51 West 52nd Street
New York, NY 10019
Telephone: (212) 506-3596
Email: P52PTABDocket@orrick.com

Counsel for Petitioners

CERTIFICATE OF SERVICE

The undersigned hereby confirms that the foregoing paper was caused to be served on July 26, 2024 via email upon the following counsel of record for Patent Owner:

David W. Higer (dhiger@winstead.com)
Miranda Y. Jones (mjones@winstead.com)
Phillip B. Philbin (pphilbin@winstead.com)
Jamie H. McDole (jmcdoles@winstead.com)
WINSTEAD PC

/K. Patrick Herman/

K. Patrick Herman, Reg. No. 75,018
Orrick, Herrington & Sutcliffe LLP
51 West 52nd Street
New York, NY 10019
Telephone: (212) 506-3596
Email: P52PTABDocket@orrick.com