

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WIRTGEN AMERICA, INC.
Petitioner

v.

CATERPILLAR INC.
Patent Owner

Case IPR2022-01397
U.S. Patent 9,975,538

**PETITIONER WIRTGEN AMERICA, INC.'S
REPLY TO PATENT OWNER'S RESPONSE**

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EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 9,975,538
1002	U.S. Patent No. 9,975,538 file history
1003	Declaration of Jeffrey L. Stein, Ph.D., P.E.
1004	Curriculum Vitae of Jeffrey Stein
1005	U.S. Patent Application Pub. No. US 2010/0014917 A1 to Willis <i>et al.</i> (“Willis”)
1006	U.S. Patent No. 9,656,656 to Xing <i>et al.</i> (“Xing”)
1007	N. Beachley, A. Frank, <i>Continuously Variable Transmissions Theory and Practice</i> , (Lawrence Livermore Laboratory Report UCRL-15037, 1979)
1008	US Patent No. 8,622,871 to Hoff (“Hoff”)
1009	rotor, The Concise Oxford Dictionary of Current English, 9th Ed., 1995
1010	E. Orshansky, W Weseloh, <i>Characteristics of Multiple Range Hydromechanical Transmissions</i> , SAE International, SAE Transactions, (1972), Vol. 81
1011	A. Rosetti and A. Macor, <i>Multi-objective optimization of hydro-mechanical power split transmissions</i> , Mechanism and Machine Theory 62 (2013)
1012	U.S. Patent No. 9,864,347 to Laux <i>et al.</i> (“Laux”);
1013	U.S. Patent No. 8,465,105 to Parker <i>et al.</i> (“Parker”)
1014	U.S. Patent No. 8,781,694 to Sheidler <i>et al.</i> (“Sheidler”)
1015	U.S. Patent Pub. No. 2009/0118912 to Hugenroth <i>et al.</i> (“Hugenroth”)
1016	U.S. Patent Pub 2015/0091363 to Reuter <i>et al.</i> (“Schomaker”)
1017	U.S. Patent No. 8,167,378 to Busely <i>et al.</i> (“Busely”)
1018	William Ross, <i>Designing a Hydromechanical Transmission for Heavy Duty Trucks</i> , Society of Automotive Engineers paper 72075 (1972)

1019	Director Vidal Memorandum, “Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation,” June 21, 2022
1020	Dkt. 33, Amended Complaint, C.A. No. 17-770-RGA (Sept. 2, 2021)
1021	Dkt. 43, Answer to Amended Complaint and Counterclaims, C.A. No. 17-770-RGA-MPT (Oct. 14, 2021)
1022	Caterpillar Inc. v. Wirtgen Am., Inc., IPR2022-01264, Petition (P.T.A.B., July 22, 2022)
1023	Dkt. 92, Wirtgen Am., Inc. v. Caterpillar Inc., C.A. No. 17-770-RGA, Court’s Order Setting Claim Construction Hearing
1024	Dkt. 88, Stipulation Extending Fact Discovery Cutoff (Apr. 4, 2022)
1025	Federal Court Management Statistics (Mar. 31, 2022)
1026	Dkt. 56, <i>Wirtgen America, Inc. v. Caterpillar Inc.</i> , C.A. No. 17-770-RGA, (D. Del. Nov. 4, 2021) (“Motion to Sever and Transfer”)
1027	Dkt. 57, <i>Wirtgen America, Inc. v. Caterpillar Inc.</i> , C.A. No. 17-770-RGA, (D. Del. Nov. 4, 2021) (“Opening Brief in Support of Motion to Sever and Transfer”)
1028	Dr. Abid Kemal Deposition Transcript - September 12, 2023

I. Introduction

Caterpillar’s response centers on the claimed “adjusting the engine speed” step, focusing on undisclosed and overly narrow claim constructions. Yet, to avoid acknowledging its improper attempt to narrow the claim scope, Caterpillar asserts that no construction is necessary and that each term should be given its plain and ordinary meaning. POR, 7–8. The “adjusting engine speed” step merely states that the output (engine speed) is “based on” two inputs (engine load and predefined efficiency points). However, many of Caterpillar’s arguments import new limitations into this step, and Caterpillar does so without identifying the necessary supporting evidence for the limitations it now seeks to apply. Caterpillar cannot, on the one hand, assert the plain and ordinary meaning and, on the other hand, import new claim limitations to circumvent the prior art. Caterpillar must articulate particular claim constructions and cite specific supporting evidence to afford the Board and Wirtgen the opportunity to analyze and address its arguments. Caterpillar’s applied construction remains unclear. But Caterpillar’s analysis suggests its construction incorrectly requires an ordered algorithm utilizing a particular equation that directly connects engine load and engine speed to determine the most optimum engine speed.

For Claim 13, Caterpillar attacks Wirtgen’s references individually rather than evaluating the proposed combination and whether a person of ordinary skill in the art (POSITA) would have been motivated to combine the references. Caterpillar

focuses on the functionality of Laux’s hydraulic pump and associated auxiliary drive—which are *not* included in the proposed combination—to argue against motivation to combine. Caterpillar never addresses Laux’s shift clutch *as implemented in the proposed combination*. The Board has previously rejected such an analysis; the Board should do so again. *Caterpillar Inc. v. Wirtgen Am., Inc.*, IPR2022-01278, Paper 12, at 33–34 (Feb. 7, 2023) (quoting *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986)) (“Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references.”). Caterpillar further rejects the teachings of Xing by requiring more clutch functionality than the Claims require and ignoring Xing’s description of the Power Take Off clutch’s functionality.

II. Analysis

A. The Prior Art Shows That Using a CVT to Improve Fuel Efficiency Was Known.

Caterpillar incorrectly concludes that Willis combined with Xing fails to “adjust an engine speed based on the engine load and one or more predefined efficiency points” as claimed in the ’538 Patent. Caterpillar argues that Xing relies on a load power requirement (P_{load}) as the starting point for identifying efficiency points and adjusting engine speed and that P_{load} is distinct from the recited “engine load.” POR 9–10. But, as conceded by Caterpillar’s expert, Dr. Kemal, Xing unambiguously discloses that its P_{load} is the *current measured engine load* minus the

estimated current internal power losses. EX1028, 84:17–87:7. Thus, by Dr. Kemal’s own admission, P_{load} is “based on the engine load.” Xing unambiguously adjusts the engine to the most fuel-efficient candidate speed identified from points on a fuel efficiency map (“predefined efficiency points”). Each point corresponds to different candidate engine loads, which Xing calculates from the estimated P_{load} plus the estimated power losses at the corresponding candidate speeds. Thus, Xing adjusts an engine speed of the engine *based on* the engine load and *based on* one or more predefined efficiency points.

Dr. Kemal acknowledged that Xing discloses a machine that measures the current engine power, or load, and uses the measured engine load to estimate the useful work the machine currently outputs. Xing’s machine measures **current** engine power (P_{engine}) and estimates the machine’s internal power losses (P_{loss}) at the **current** engine speed to calculate the amount of useful work (P_{load}) the machine currently outputs. EX1028, 84:17–87:7, 98:13–102:12. Xing’s P_{load} is nothing more than $P_{engine} - P_{loss}$. EX1028, 98:13–102:12. Given the useful work Xing’s machine currently outputs (P_{load}), Xing then estimates **candidate** power losses and **candidate** engine powers needed for the machine to output the same amount of useful work (P_{load}) at different candidate engine speeds. EX1028, 105:15-106:15. The candidate engine power values are each calculated by adding the estimated system power losses at each candidate engine speed to the load power requirement (P_{load} or

$(P_{engine} - P_{loss})$).

Dr. Kemal admitted that Xing converts each candidate engine power into a candidate engine torque and uses Figure 11 to obtain the engine fuel consumption and engine efficiency corresponding to the candidate engine power and speed. EX1028, 106:16–108:20. He further admitted that Xing adjusts engine speed to the candidate engine speed and engine torque pair that is closest to the point at which the engine’s fuel efficiency is maximized. Kemal Decl. ¶50. Thus, irrespective of which candidate engine speed and engine torque Xing’s controller uses for engine speed adjustment, Xing discloses an adjusted speed based on P_{load} calculated from $P_{engine} - P_{loss}$, where P_{engine} is the measured current engine load. This is all that is required to meet the claim term.

B. Dr. Kemal and Caterpillar’s Analysis Includes Several Flaws and Undisclosed Claim Constructions that Render the Analysis Ineffective to Rebut the Evidence Provided by Dr. Stein and Wirtgen.

Dr. Kemal and Caterpillar identify certain alleged flaws in Dr. Stein and the Petition’s analysis. But those critiques are not tied to the claim language or the prior art. Despite asserting that the plain and ordinary meaning applied (at 7–8), Caterpillar appears to rely on unarticulated claim constructions (mostly of the “adjusting engine speed” step) importing new limitations to distinguish the Claims from Xing.

1. Caterpillar’s improper claim constructions read preferred embodiments into claim limitations that merely require adjusting engine speed “based on” two inputs.

Caterpillar alleges that Xing does not disclose adjusting an engine speed based on engine load and predefined efficiency points by impermissibly reading limitations from preferred embodiments into Claims 1 and 6 without demonstrating why the plain and customary meaning of “based on” should be narrowed. POR, 9. According to Caterpillar, adjusting the engine speed “based on” requires that: (1) the identified parameters (engine load and predefined efficiency points) must be explicitly recited in the calculation that returns the recited output (engine speed), (2) the limitation requires a specific sequence of underlying steps that precludes using hypothetical sets of parameters, and (3) the engine speed must be optimized. The Court should reject this implicit and unsupported claim construction. POR, 14–15. Claims 1 and 6 only require adjusting an engine speed “based on the engine load and one or more predefined efficiency points at least partially based on predetermined fuel consumption rates and providing optimum engine speeds for different engine loads.” Caterpillar has failed to point to any claim language supporting its belated claim constructions. The Court should reject Caterpillar’s faulty invalidity analysis that

incorporates these narrow constructions.¹

a. Caterpillar is wrong to construe “based on” as requiring explicit, direct use of a parameter.

Caterpillar’s first improper limitation requires the engine load to be explicit in the calculation that returns the determined engine speed. The Claim, however, simply recites “adjusting an **engine speed** of the engine **based on the engine load** and **one or more predefined efficiency points** at least partially based on predetermined fuel consumption rates and providing optimum engine speeds for different engine loads.” (emphasis added). Caterpillar’s argument that Xing does not meet the claim because Xing’s calculation expressly uses P_{load} to adjust engine speed rather than P_{engine} evidences a departure from the plain and ordinary meaning of “based on.” POR, 13–14, 17. Specifically, Caterpillar argues:

Petitioner therefore relies on Xing’s disclosure where the load power requirement (P_{load}) is calculated indirectly (rather than measured directly). Xing teaches this is accomplished through the measurement of a current engine speed and a current engine torque at the engine’s output to calculate the current “engine power (P_{engine}),” which is the product of the measured engine speed and the measured engine torque. This, in turn, is used to calculate the load power requirement (P_{load}) by

¹ Caterpillar has not identified the scope of “based on” in the underlying district court litigation or provided any reason for importing limitations or restricting the meaning of the term and, therefore, provides no justification for narrowing the meaning for purposes of this IPR.

subtracting the estimated current power loss (P_{loss}) from the current engine power (P_{engine}).

POR, 13 (internal citation omitted).

Expressed mathematically, Caterpillar appears to construe “based on” as requiring a calculation similar to:²

$$a = b \% c$$

Essentially, a is “based on” b and c because they are recited explicitly in the equation. However, Caterpillar would not consider a above to be based on x under the following relationship:

$$b = x \% y$$

Under Caterpillar’s construction, because b is derived from x and y , a is not “based on” x or y .

The POR does not articulate this construction of “based on” or provide any supporting analysis. The ’538 Patent’s disclosures regarding “based on” repeat the same “output based on inputs” structure as the claims or generically state “based on algorithms,” thereby failing to provide additional information. *See, e.g.*, ’538 Patent, 4:31–34, 4:37–41. These disclosures do not suggest the narrow scope ascribed by

² The % is used as a generic placeholder for any mathematical function (e.g., addition, subtraction, multiplication, etc.).

Caterpillar. Nor has Caterpillar asserted any extrinsic evidence (e.g., expert testimony) to support such a construction.

Caterpillar's improperly narrow construction's is apparent in Caterpillar's rejection of Xing's algorithm. Caterpillar argues that Xing fails to teach the "adjusting engine speed" step because Xing's algorithm expressly recites P_{load} . POR, 13. Caterpillar asserts that "to the extent Xing describes determining an engine load, it is in service of calculating the load power requirement," which is in turn used to determine the engine speed, and that this does not disclose the "adjusting engine speed" step. POR, 13. Expressed mathematically, Caterpillar asserts that Xing discloses the following algorithm:

$$Engine\ Speed = P_{load} \% efficiency\ points$$

Where:

$$P_{load} = P_{engine} - P_{loss}$$

Caterpillar has argued that this algorithm of calculations does not meet the Claims of the '538 Patent but is incorrect because P_{load} is derived from P_{engine} . POR, 13–14.

This analysis and the underlying unarticulated claim construction are not supported or proper. Although the plain and ordinary meaning of "based on" may include some limit to the number of layers between the calculation returning the output (engine speed) and the recited input (engine load), one layer of separation cannot be seen as defeating the "based on" requirement. This is particularly true

where, as in Xing, the explicit parameter (P_{load}) is used to refine the engine load to provide a more meaningful input to the calculation. '538 Patent, 1:36–50. A more data-rich load parameter for the system (e.g., P_{load}) must still use the determined engine load (P_{engine}) as a starting point.

Dr. Kemal and Caterpillar argue that Xing's engine load (P_{engine}) is irrelevant to P_{load} because Xing discusses alternative embodiments that directly measures P_{load} without relying on the determined engine load (P_{engine}). For example, Dr. Kemal's declaration stated that Xing's P_{load} (not P_{engine}), is the basis for determining the most fuel-efficient engine operating parameters, relying on Xing's disclosure of other methods for calculating the load power requirement that do not explicitly utilize P_{engine} for support. EX2001, ¶45, 51-53. Similarly, Dr. Kemal testified at his deposition that "Xing describes a direct method and then an indirect method, but it both leads to the--the--what is needed in Xing's method, which is a load power requirement. In other words, any measurement of the load at the engine can be bypassed entirely by directly measuring the variable of interest, P_{load} , at the source, where the useful work is occurring." EX1028, 110:14-111:4; *see also, e.g.*, 82:11–88:13, 103:4–112:4, 117:5–122:21.

Dr. Kemal misunderstands the role of embodiments in a patent specification, particularly in light of his admission that Xing's Fig. 5 teaches using a current load power requirement. EX1028, 122:6–21. The obviousness analysis only requires that

Xing disclose using the current engine load, even if only in one embodiment. Petition, 47–49. Although some embodiments may not rely on the engine load, some embodiments disclose the algorithm relying on the engine load to determine the engine speed. '538 Patent, 4:64–5:17. That is all that obviousness requires.

Moreover, although P_{load} can be measured directly, there is no dispute that Xing teaches that P_{load} is derived from engine load (P_{engine}). Of course, the Claims require that engine load be expressly determined by the controller, which Xing discloses as one embodiment. But to argue that P_{load} is not affected by engine load is nonsensical. The fact there are ways to bypass explicitly determining the engine load in some embodiments does not make P_{load} any less rooted in the engine load.

Moreover, the Board should credit Dr. Stein's testimony because Dr. Kemal did not evaluate the full teachings of Xing, believing the embodiment disclosing using the current P_{engine} to be irrelevant. EX1028, 110:14-111:4; *see also, e.g.*, 82:11–88:13, 103:4–112:4, 117:5–122:21. Dr. Kemal's opinion is therefore unsupported and should not be given any weight whether Xing's embodiment relying on the engine load satisfies the claim element.

The '538 Patent's Specification does not express any specific calculation to define the “based on” language. One portion of the Specification states that “the estimated fuel consumption rates for a given milling machine 100 and an associated engine 122 may be predetermined for different combinations of engine speed and

engine load” as represented in Fig. 4. ’538 Patent, 4:9–18. At most, the Specification explains that “the controller 130 may retrieve, recall and/or refer to predefined fuel efficiency points 162, or any other predetermined information pertaining to the fuel consumption characteristics of the milling machine 100 stored in memory 132, to determine an optimum engine speed for the given engine load.” ’538 Patent, 5:7–12. The Specification itself cautions that “the solution of any particular problem is not a limitation on the scope of...the attached claims,” an implicit acknowledgment that “based on” does not require the explicit, direct use of engine load to adjust engine speed, as urged by Caterpillar. ’538 Patent, 1:45-48. A single layer of separation does not mean the engine speed is no longer based on the engine load.

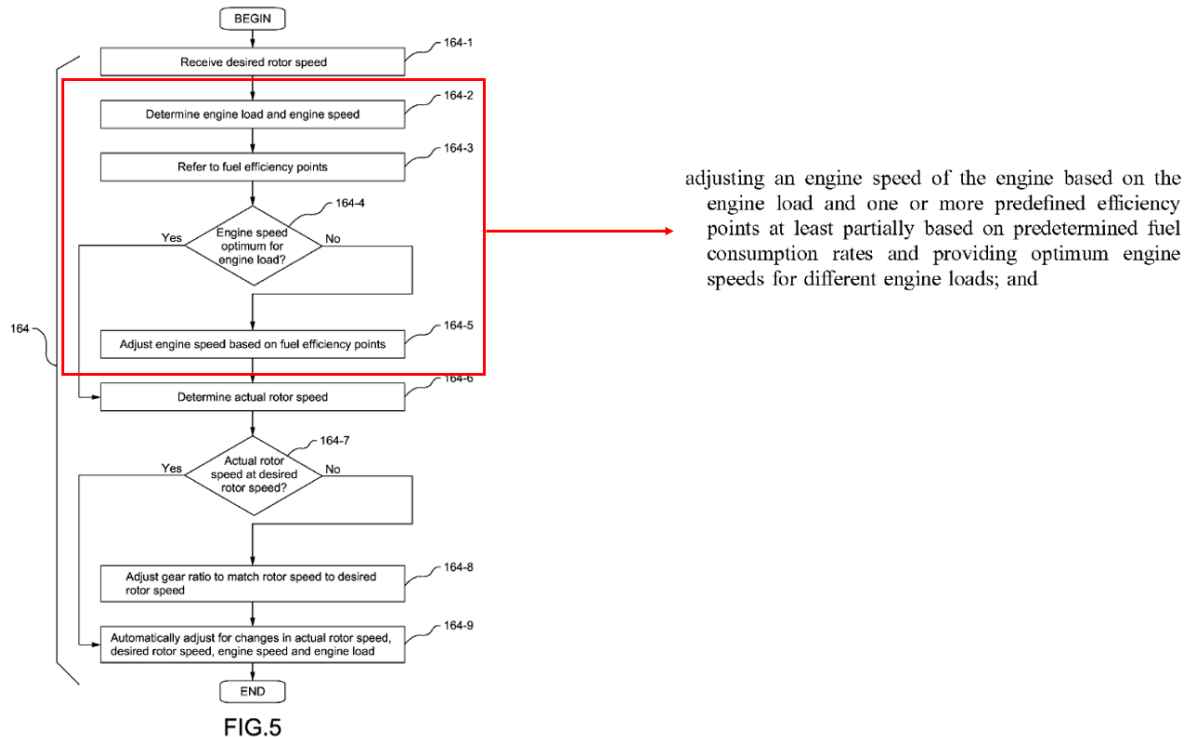
b. Caterpillar incorrectly construes the Claims to exclude Xing using candidate parameters despite Xing’s candidate parameters adjusting engine speed as claimed.

Caterpillar limits the scope of the “adjusting the engine speed” step by arguing that an algorithm utilizing candidate engine parameters does not disclose the claim limitation, departing yet again from plain and ordinary meaning. POR, 22–23. The Claim simply recites an output “based on” two inputs: “adjusting an engine speed of the engine *based on* [1] the engine load and [2] one or more predefined efficiency points at least partially based on predetermined fuel consumption rates and providing optimum engine speeds for different engine loads.” While its exact construction remains unclear, Caterpillar does appear to assert that the claimed algorithm’s single

step actually requires multiple ordered steps, including (1) “a determination of the engine load as a reference point from which predefined efficiency points are retrieved for that given load,” (2) “which then provide optimum engine speeds at which to operate the engine,” (3) “at the determined engine load,” and (4) “to achieve fuel efficiency.” *See, e.g.*, POR 14–15. But Caterpillar has provided no support for this construction.³

Caterpillar provides no support for construing an “output based on two inputs” element to exclusively require a four-step, ordered algorithm. Essentially, Caterpillar seeks to import into the claim limitations corresponding to the following steps from Fig. 5, in the order they are recited:

³ *See supra* n.1.



'538 Patent, Fig. 5 (annotated) & Claim 1 excerpt.

The Specification describing Fig. 5 discloses that “the controller 130 may retrieve, recall and/or refer to predefined fuel efficiency points 162, or any other predetermined information pertaining to the fuel consumption characteristics of the milling machine 100 stored in memory 132, to determine an optimum engine speed for the given engine load.” ’538 Patent, 5:7–12. This passage does not dictate a specific order of operations for determining an engine speed. Nor has Caterpillar identified anything in the Claims or Specification attributing this specific meaning to “based on.”

Caterpillar’s claim construction is thus improper because it is not supported by the Claims, the Specification, or any other evidence proffered by Caterpillar.

Moreover, Caterpillar has not articulated the new construction itself, asserting instead that no terms needed construction. POR, 7–8. Caterpillar should thus not be allowed to depart from the plain and ordinary meaning of the Claims.

Notwithstanding, Caterpillar also incorrectly evaluates Xing against the Claims. Caterpillar argues that candidate parameters do not meet the claim limitations because (1) they use potential loads and (2) they incorrectly evaluate the combination of the engine speed, engine load, and efficiency points. *See, e.g.*, POR, 15–16. Caterpillar further argues that Xing’s use of candidate engine parameters does not satisfy the Claims because P_{load} remains constant while other parameters are varied to consider different “candidates.” POR, 17. According to Caterpillar, Xing’s algorithm therefore does not use the determined engine load to determine the engine speed nor does the algorithm perform the underlying ordered algorithm allegedly required. POR, 14–17. But Caterpillar is incorrect on both points.

To the extent that the Claim requires reliance on current engine load, Xing discloses using the current engine load and projected engine load. Petition, 20–23, 45–49. Xing discloses that, “[i]n one embodiment, the current load power requirement for the work vehicle may be determined indirectly by calculating the current engine power (P_{engine}) and the current power loss (P_{loss}).” EX1006, 9:37–56; EX1028, 85:14–88:4 (admitting that Xing discloses an embodiment relying on current engine load). Xing’s machine measures current engine power (P_{engine}) and

estimates the machine's internal power losses (P_{loss}) at the current engine speed to calculate the amount of useful work (P_{load}) the machine currently outputs. EX1028, 84:17–87:7, 98:13–102:12, 105:15–106:15. The machine then estimates candidate power losses and candidate engine powers needed for the machine to output the same amount of useful work (P_{load}) at different candidate engine speeds. *Id.* Thus, Xing discloses the current engine load as a parameter in the algorithm. *See* Petition, 24, 31, 57–58. Although repeatedly asserting that the Claims required returning the “optimum engine speed for the given engine load,” Dr. Kemal derives this alleged requirement from the Specification. Caterpillar identifies no *claim language* requiring that the engine speed achieves the measured engine load. '538 Patent, Claim 1, 6; *but see* POR, 19 (asserting the opposite); EX2001, ¶¶27-30, 46 (citing the Specification at column 5 for these statements, never the claim language itself).

Although the POR and Dr. Kemal's declaration assert that Xing does not teach using the current engine load, Dr. Kemal admitted at his deposition that Xing discloses that for some embodiments Xing's algorithm uses the current engine load. Dr. Kemal admitted that in these embodiments, the table in Xing Fig. 5 would replace the projected parameters (e.g., P_{load}) with the current parameters (e.g., engine load). EX1028, 122:6-21. This is further supported by Xing itself, specifically stating that “[i]t should be appreciated that, as an alternative...the controller 116 may be configured to utilize the current load power requirement as the basis for determining

the candidate engine speeds.” EX1006, 10:33–41.

Finally, Caterpillar is wrong that candidate parameters fail to satisfy the Claims because those candidates do not explicitly include the engine load in the equation that returns the engine speed. As discussed above, the Claims do not require the calculation returning the engine speed to explicitly recite the engine load. Thus, because the disclosed candidates relied on the engine load to determine the engine speed, the candidate parameters satisfy the claim language.

c. The claims do not require adjusting the engine to the most fuel-efficient speed.

Dr. Kemal and the POR criticize the Petition’s analysis that selecting the optimum engine speed did not satisfy the claim elements “because of Xing’s different approach to efficiency assessment.” POR, 20; EX2001, ¶56. But Caterpillar’s narrow “approach to efficiency assessment” imports limitations into the Claims. Although Caterpillar may now wish the Claims required the controller to optimize the engine speed to the *most* fuel-efficient setting, Caterpillar does not identify any requirement that the engine speed be the most efficient engine speed or specifying what the engine speed should be optimized for. The Claims only state that the engine speed is “based on...one or more predefined efficiency points at least partially based on predetermined fuel consumption rates and providing optimum engine speeds for different engine loads.” Indeed, Caterpillar itself appears to admit that returning multiple engine speeds meets this limitation. POR, 1–2 (explaining

that the claimed method “refers to one or more ‘predefined efficiency points,’ which *each identifies an optimum engine speed*” (emphasis added)).

Indeed, when Wirtgen asked Dr. Kemal to explain the basis for this position during his deposition, Dr. Kemal was unable to support the analysis. EX1028, 49:10–22, 51:14–54:4. Rather, Dr. Kemal simply read back the entire “adjusting the engine speed” step when asked for the basis of his statement that the claims required the engine speed to be optimized. EX1028, 49:10–22. When Wirtgen asked Dr. Kemal again to identify the specific part of the Claim that required an optimum engine speed, Dr. Kemal responded repeatedly by reading the claim limitation over again. EX1028, 51:14–54:4. Dr. Kemal could not (or would not) identify a basis for his position that the Claims require selecting the most optimum engine speed. This is because the Claims include no such limitation and instead recites plural “optimum engine speeds.”

Xing discloses an algorithm that determines the engine speed using the engine load and the efficiency points, and states that “the controller 116 may select the candidate engine speed/torque pair that maximizes fuel efficiency (i.e., the pair intersecting closest to the optimal fuel efficiency point 30) as the target engine speed and target engine torque for producing the engine power necessary to achieve the lower power requirement.” EX1006, 12:58–63. Xing specifically states that the controller selects the engine speed/torque pair *that maximizes fuel efficiency*, and

then clarifies which pair that would be—the one that intersects closest to the optimal fuel efficiency point 30. Thus, it is unclear how Xing does not select an engine speed “based on...one or more predefined efficiency points at least partially based on predetermined fuel consumption rates and providing optimum engine speeds for different engine loads.”

Dr. Stein opines that Xing’s algorithm meets this limitation, stating that, using Xing Fig. 11 (the engine map):

The controller then selects the candidate engine speed/torque pair that minimizes fuel consumption (i.e., the pair intersecting closest to the optimal fuel efficiency point) as the target engine speed and target engine torque. Xing, 12:58-63. The controller may then set the engine to operate based on the target engine speed.

EX1003, ¶80. Dr. Kemal, on the other hand, utilizes Caterpillar’s unsupported claim construction to conclude that:

Xing does not indicate that the candidate speeds associated with each of these pairings represent the optimum speed of the paired candidate engine torque; instead, Xing seeks to identify the most efficient combination of candidate engine speed-torque by comparing each of the pairings to an associated efficiency value.

EX2001, ¶58–61. Because Dr. Kemal did not render an opinion under the full scope of the Claims, his opinion is not probative of whether Xing discloses the claim limitation. Dr. Stein’s opinion under the proper claim construction stands unrebutted.

2. Caterpillar misreads Xing and Laux’s disclosures of the clutch and overly narrows the scope of “disengage.”

Caterpillar asserts that neither Xing nor Laux discloses the clutch

configuration, ignoring Wirtgen’s asserted proposed combination and misapplying the teachings of both references. Concerning Xing, Caterpillar dismisses Wirtgen and Dr. Stein’s discussion of Xing’s clutches and Power Take Off (PTO). Concerning Laux, Caterpillar attacks Laux individually rather than addressing Laux as part of Wirtgen’s proposed combination. The Board has previously rejected such an analysis and should do so again. *Caterpillar*, IPR2022-01278, Paper 12, at 33–34 (citing *Merck*, 800 F.2d at 1097).

a. Xing’s forward/reverse clutches disengage the rotor from the engine.

Caterpillar improperly interprets Claim 13 to require the clutch to disengage all power, not just the power flowing through the clutches, from the engine. But Caterpillar’s analysis neglects to consider that Claim 13 depends from Claim 6, which recites “[a] machine, **comprising**: an engine; a variable transmission operatively coupled to an output of the engine; [and] a rotor operatively coupled to an output of the variable transmission...” ’538 Patent, 6:49–54 In requiring a machine “comprising” various elements, Claim 6 does not exclude the presence of other drivetrain elements such as Xing’s pump 36 and motor 40 and Laux’s electric motors, driven by engine powered electrical generators, or hydraulic systems (EX1006, 4:54-63; EX1017, 3:15–27, 5:13–24), that can drive the rotor using power from engine. See *Solvay S.A. v. Honeywell Int’l Inc.*, 742 F.3d 998, 1005 (Fed. Cir. 2014). As Claim 13 includes the limitations of Claim 6, it does not exclude other

methods of powering the rotor using the engine even after the drivetrain's clutch disengages the engine from the rotor. Caterpillar's improper interpretation of "disengage" should be rejected as a naked attempt to read the limitations of a preferred embodiment—'538 Patent Fig. 2—into Claim 13. See POR, 29, n.2.

Caterpillar does not dispute that Xing's transmission can transmit power from the engine through a mechanical branch and a hydrostatic branch. POR, 26–28. Caterpillar concedes that Xing's directional clutches 52, 54 direct whether the mechanical branch receives power output from the engine. POR, 28. Thus, there is no dispute that by disengaging both directional clutches 52, 54, Xing's controller can disengage the power from the engine that flows through the transmission's mechanical branch. POR, 28.

Caterpillar instead argues that these clutches do not disengage the engine from the rotor because the hydrostatic branch may still transmit power to the rotor, neglecting to consider Xing's full teachings for the hydrostatic branch. POR, 28–29. Xing teaches that the hydrostatic branch only transmits power from the engine at specific times through a hydrostatic unit transmitting power through a variable displacement hydraulic pump. The pump output is controlled by the angle of a swash plate in the pump, which is controlled by the controller to adjust the transmission ratio. EX1006, 4:54–5:8. Xing explains that the hydrostatic power flow can be adjusted to provide zero speed (zero transmission ratio) by adjusting the angle of the

swash plate. At that swash plate angle, no power from the engine is transmitted through the hydrostatic branch.⁴ Thus, when the controller adjusts the hydrostatic unit's swash plate for zero power flow, disengaging both of the directional clutches 52, 54 disengages all power from the engine to the output of Xing's transmission. With the engine isolated from the transmission output and the load, Xing's controller actuates parking brake 70 to hold the load in place. EX1006, 6:15–35. Xing therefore discloses disengaging “the rotor from the engine through control of a clutch.”

b. Xing's controller-operated PTO clutch disengages the rotor from the engine.

As an alternative, the proposed combination modifies Willis's machine to

⁴ Dr. Kemal testified that it is possible some power could still be transmitted when the swash plate is at this angle. EX1028, 81:19-82:1. Dr. Kemal merely speculates that this would be possible and provides no supporting evidence this would occur. An expert baldly testifying something is possible is insufficient to support the asserted facts. *See Sport Dimension, Inc. v. Coleman Co.*, 820 F.3d 1316, 1323 (Fed. Cir. 2016) (holding the tribunals are gatekeepers to ensure expert testimony “does not include unsubstantiated speculation and subjective beliefs”); *Worrell v. Ellior & Frantz*, 799 F. Supp. 2d 343, 349 (D.N.J. 2011) (“[A]n expert opinion based upon speculation, possibilities or contingencies is inadmissible.”).

include Xing's transmission configured to connect Willis's engine to the milling drum via a power take-off (PTO 110). Petition, 73–75, n.4; EX1003, ¶119 & n.4, 151. The PTO “may be coupled to any...suitable load L, such as...a power take-off (PTO)” EX1006, 4:49–53. Connected to Willis's engine in this manner, as Xing describes, Willis's milling drum acts as a load on Willis's engine and is an implement that can be connected to the PTO output shaft 112. EX1006, 6:64–67. The PTO “form[s] part of the transmission 22 and may be configured to be engaged via a PTO clutch 114.” EX1006, 6:67–7:3.

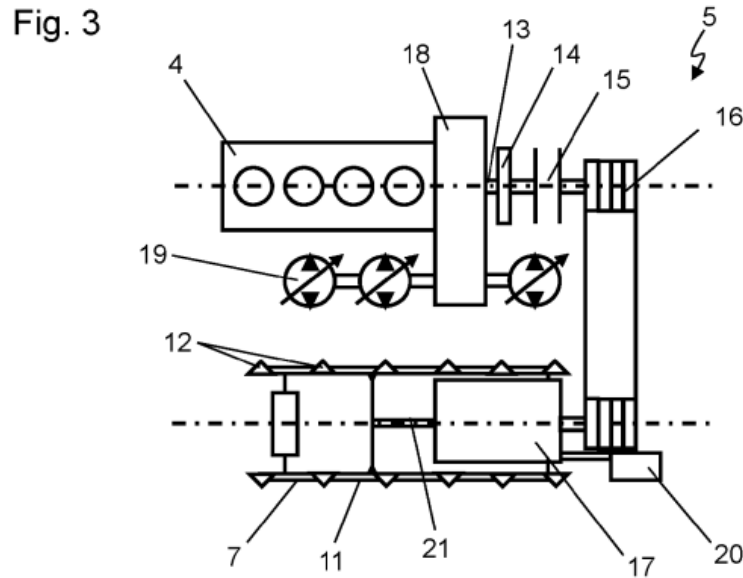
Caterpillar wrongly argues that the Petition does not explain or even allege that clutch 114 is controlled to selectively disengage the rotor from the engine as claimed. POR 32. This is wrong. The Petition explicitly cites Xing to explain that its machine includes a “controller 116 configured to control the operation of one or more components of the work vehicle 10, such as the engine 22 and the transmission 24.” Petition, 75, n.4 (citing EX1006, 7:21–23). Xing's “planetary unit 32 may be configured to be selectively coupled to the load L...under automatic control of the controller 116.” Petition, 73 (citing EX1006, 5:14–17). Notably, Dr. Kemal does not address whether a controller controls clutch 114 or state that Wirtgen or Dr. Stein has incorrectly interpreted these teachings from Xing. EX2001, ¶75–76. Caterpillar thus has no factual evidence to contest that Xing discloses that controller 116 controls clutch 114. Thus, a POSITA would have understood that Xing's controller

can be configured to selectively couple the planetary unit of the transmission to a load (such as a milling drum) connected via the PTO by automatically controlling PTO clutch 114. EX1003, ¶¶69, 71, 119 & n.4, 151.

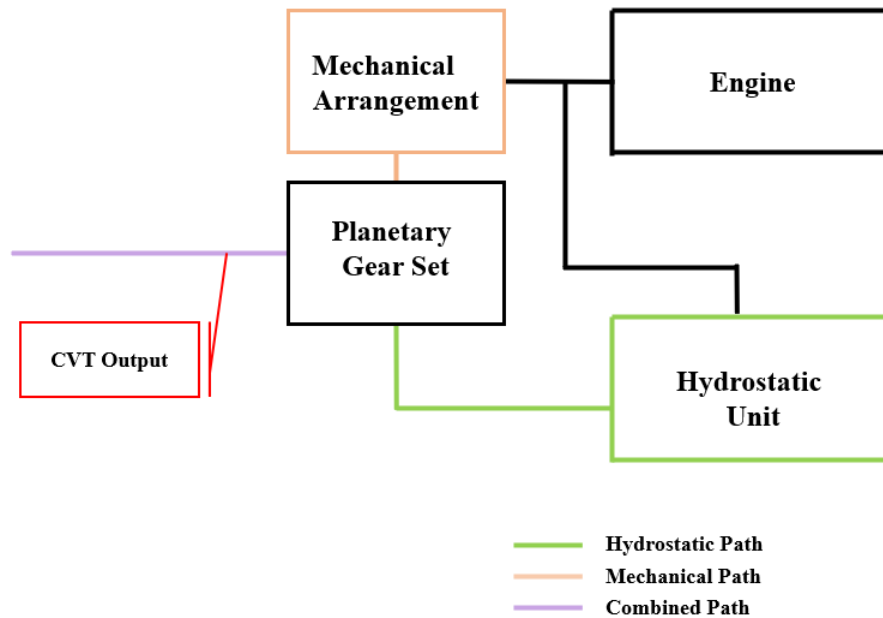
c. Willis modified by Xing and Laux would have included a controller-operated clutch for disengaging the rotor from the engine.

Caterpillar is also wrong to suggest that the alternative proposed combination of Willis, Xing, and Laux fails to disclose a clutch that “selectively disengage[s]” a rotor from an engine. Caterpillar’s criticism here focuses primarily on Laux as an independent reference rather than how it is used as part of the proposed combination. Such attacks on references individually fail. *Caterpillar*, IPR2022-01278, Paper 12, at 33–34 (citing *Merck*, 800 F.2d at 1097).

In this case, Laux discloses that a shift clutch 15 in a milling machine drive train can be located as the last drive train element immediately adjacent the belt drive 16 in part of the drive train between engine 4 and belt drive 16. Petition, 59–64, 78–79 (citing EX1012, 9:3–10). When implemented in the proposed combination, Laux’s shift clutch 15 would have been located as the last drive train element between Xing’s transmission and adjacent Willis’s drive pulley “belt-and-pulley system” at the output of Xing’s transmission. Petition, 11 (citing EX1005, ¶[0020].)



EX1012, Fig. 3



Representation of EX1006, Fig. 2

In Laux Fig. 3, Laux's clutch 15 disengages engine 4 from belt drive 16 and the load imposed by its milling drum (rotor 7). EX1012, 9:3–10. Xing teaches that

its transmission's "planetary unit 32 may be configured to be selectively coupled to the load L...under automatic control of the controller 116." EX1006, 5:14–17; Petition, 73. Thus, Xing teaches that the drive train element specifically designed to disengage its transmission and engine from the load should be controlled by Xing's controller. Xing's teaching would therefore apply to Laux's clutch 15 implemented in Willis's machine modified by Xing. Contrary to Caterpillar's arguments, Willis combined with Xing and Laux discloses a clutch that "selectively disengage[s]" a rotor from an engine.

Caterpillar further contends that a POSITA would not have viewed Laux's clutch as a safety feature for disengaging the milling drum from the engine when replacing milling drum tools. POR, 38. According to Caterpillar, the "assertion that a POSA would have understood Laux's clutch as a conventional safety feature used to disengage milling drum from the engine during tool replacement is unsupported by the reference itself." POR, 38. Caterpillar is incorrect. Although Laux's machine includes a hydraulically powered motor that can drive the rotor when clutch 15 mechanically disengages the engine from the rotor, the proposed combination only alleges implementing Laux's clutch 15. Neither party has alleged that the additional hydraulically powered motor would also be implemented as part of the proposed combination. Caterpillar's criticism therefore focuses on Laux in isolation.

As the Petition explains, a POSITA would have modified Willis to include

Laux's clutch between the output of Xing's transmission and Willis's drive pulley, utilizing the clutch in the standard manner as described in Busely. Petition, 79–80 (citing EX1017, 1:34–47, 3:66–67, Fig. 2); EX1003, ¶157–158. Disengaging Laux's clutch would have disengaged all power from Xing's transmission (both the hydrostatic and mechanical branches) from Willis's drive pulley and its rotor.

III. Conclusion

For the foregoing reasons, the Board should find all challenged Claims unpatentable.

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CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITS

The undersigned hereby certifies that this PETITIONER WIRTGEN AMERICA, INC.'S REPLY TO PATENT OWNER'S RESPONSE contains 5,464 words in the applicable sections according to 37 C.F.R. § 42.24 and is in compliance with that section's 5,600-word requirement.

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CERTIFICATE OF SERVICE (37 C.F.R. § 42.6(e))

The undersigned hereby certifies that the foregoing **PETITIONER WIRTGEN AMERICA, INC.’S REPLY TO PATENT OWNER’S RESPONSE** was served in its entirety electronically via e-mail on October 3, 2023, on the following counsel of record for Patent Owner:

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