

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CMS CEP COR LTD., and CMS CEP COR AMERICAS LLC,
Petitioner,

v.

SANDVIK INTELLECTUAL PROPERTY AB,
Owner.

Patent No. 11,014,090

Inter Partes Review No. IPR2024-01381

FIFTH DECLARATION OF HARRI KYTÖMAA, PH.D.

I, Harri Kytömaa, Ph.D., make this declaration in connection with the proceeding identified above.

I. INTRODUCTION

1. I have been retained by counsel for Patent Owner Sandvik Intellectual Property AB (“Sandvik”) as a technical expert in connection with the proceeding identified above. I submit this declaration in support of Patent Owner’s Reply to Petitioner’s Opposition to Patent Owner’s Revised Contingent Motion to Amend U.S. Patent No. 11,014,090 (“the ’090 patent”).

2. Exponent is being paid at an hourly rate for my work on this matter. I have no personal or financial stake or interest in the outcome of the present proceeding.

II. QUALIFICATIONS

3. In my initial declaration and accompanying appendix (“Kytömaa I”), I summarized my educational background, experience, career history, publications, and other relevant qualifications. (*See* Ex. 2001, ¶¶ 3–14.) Unless otherwise noted below, I will not repeat them here. My updated testimony record for the last four years is attached as Appendix A.

I. MATERIALS CONSIDERED

4. In preparing this declaration, I have reviewed, among other things, the following materials:

- The '090 patent (Ex. 1001);
- The Petition for *Inter Partes* Review of the '090 patent to which my declaration related (“Petition”) and Exhibits thereto, with particular attention to the Exhibits set forth below;
- The prosecution history of the '090 patent (Ex. 1001-1, “’090 prosecution history”);
- The Expert Declaration by David G. Smith that accompanies the Petition (Ex. 1002, “Smith”);
- Excerpts from Richard G. Budynas & J. Keith Nisbett, *Shigley’s Mechanical Engineering Design*, Ninth Edition (2011) (Ex. 2003);
- Excerpts from Andrew W. Batchelor & Gwidon W. Stachowiak, *Engineering Tribology*, Second Edition (2001) (Ex. 2004);
- Excerpts from Robert C. Juvinall & Kurt M. Marshek, *Fundamentals of Machine Component Design*, 3rd Edition (2000) (Ex. 2005);
- Excerpts from Oscar J. Horger, *Metals Engineering Design*, First Edition (1953) (Ex. 2006);
- U.S. Patent No. 4,410,143 issued to Polinski (Ex. 1017, “Polinski”);
- U.S. Patent No. 6,270,026 issued to Piepho (Ex. 1018, “Piepho”);
- U.S. Patent No. 2,840,399 issued to Harless (Ex. 1033, “Harless”);
- U.S. Patent No. 8,302,754 issued to Yagi (Ex. 1040, “Yagi”);

- My previous declarations (Kytömaa I, Ex. 2001; Kytömaa II, Ex. 2007; Kytömaa III, Ex. 2010; Kytömaa IV, Ex. 2020) in this proceeding;
- The Decision on Institution (“Institution Decision”) dated March 18, 2025;
- EP Application No. 13192402.9 (Ex. 2008);
- U.S. Application No. 15/035,774 (Ex. 2009);
- Deposition Transcript of David Smith dated June 11, 2025 (Ex. 2011);
- Merriam-Webster’s Collegiate Dictionary, 11th ed. (2012) (definition of “end”) (Ex. 2012); and
- The Oxford English Dictionary, 2nd ed. (1989) (definition of “indented”) (Ex. 2013)
- Richard G. Budynas & J. Keith Nisbett, *Shigley’s Mechanical Engineering Design*, Ninth Edition (2011) (Ex. 2015);
- John H. Bickford, *An Introduction to the Design and Behavior of Bolted Joints*, 3rd ed. (1995) (Ex. 2016); and
- Robert C. Juvinall & Kurt M. Marshek, *Fundamentals of Machine Component Design*, 3rd Edition (2000) (Ex. 2017).
- Preliminary Guidance on Patent Owner’s Motion to Amend (Paper 24), dated October 16, 2025;

- Second Declaration of David Smith (Ex. 1044);
- Richard G. Budynas & J. Keith Nisbett, *Shigley's Mechanical Engineering Design*, Ninth Edition (Ex. 1049);
- Second Deposition Transcript of David Smith, Dated October 24, 2025 (Ex. 2019);
- Third Deposition Transcript of David Smith dated December 3, 2025 (Ex. 2021);
- U.S. Patent No. 4,034,922 to Coxhill ("Coxhill '922") (Ex. 2023);
- Innovative Combustion Technologies, Inc., "Optimum Operation and Maintenance of EL Pulverizers" (Ex. 2024);
- Sandvik CH440 Webpage at <https://www.rockprocessing.sandvik/en/products/stationary-crushers/stationary-cone-crushers/ch440-cone-crusher/> (accessed on Dec. 15, 2025) (Ex. 2025);
- Sandvik CH440 Crusher Maintenance Instructions (Ex. 2026); and
- A YouTube video entitled Sandvik Parts Evolution (<https://www.youtube.com/watch?v=P-6xpGLxv2U>) (Ex. 2027);
- U.S. Patent No. 4,027,825 ("Coxhill '825") (Ex. 2028).

II. DEFINITIONS AND STANDARDS

5. I have been informed and understand that claims are construed from the perspective of one of ordinary skill in the art at the time of the claimed invention, and that during *inter partes* review, claims are to be construed using the same standard applied in district court as I discussed in Kytömaa I, Ex. 2001, ¶ 17.

6. I have also been informed and understand that the subject matter of a patent claim is obvious if the differences between the subject matter of the claim 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 the subject matter pertains as I discussed in Kytömaa I, Ex. 2001, ¶¶ 18-19.

III. LEVEL OF ORDINARY SKILL IN THE ART

7. Mr. Smith states that “a person having ordinary skill in the art would be a person who has a bachelor’s degree in mechanical engineering or a related field and at least two years of experience with industrial equipment design and development. A POSITA may also have a combination of more formal education and less work experience or a combination of less/different formal education and more work experience.” (Ex. 1002, ¶ 30.) For the purposes of this Declaration, I do not object to Mr. Smith’s position on the level of skill in the art. I meet and

exceed the defined level of skill of a person of ordinary skill for the reasons set forth in my third declaration (Kytömaa III). (*See* Ex. 2010, ¶¶ 13–30.)

IV. THE SUBSTITUTE CLAIMS ARE SUPPORTED BY THE ORIGINAL DISCLOSURES AND DO NOT INTRODUCE NEW MATTER

8. In my previous declaration and accompanying appendix (“Kytömaa IV”), I provided my analysis in terms of written description support and patentability for a set of substitute claims. Unless otherwise noted below, I will not repeat that analysis here.

V. CLAIM CONSTRUCTION OF “INDENTED AT THE EXTERNAL SURFACE”

9. In my previous declaration and accompanying appendix (“Kytömaa IV”), I provided my analysis in terms of claim construction for “indented at the external surface.” Unless otherwise noted below, I will not repeat that analysis here.

VI. THE NEW GROUNDS RELY ON NON-ANALOGOUS ART

10. I understand that a prerequisite in an obviousness determination under Section 103 is determining the “prior art.” I further understand that the prior art must pertain to the claimed invention, which is sometimes referred to the art being “analogous” or not. I further understand that two tests have been developed for defining whether a prior art reference is analogous to the claimed invention: (1) whether the art is from the same field of endeavor, regardless of the problem

addressed, and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

11. I understand that in determining whether a reference is “from the same field of endeavor” courts have considered explanations of the invention's subject matter in the patent, including the embodiments, function, and structure of the claimed invention.

12. I understand that in determining whether a reference is “reasonably pertinent to the particular problem” looks at the problems of the claimed invention and the prior art reference at issue.

13. All of Petitioner's new grounds combine Coxhill (Ex. 1053) with Piepho (Ex. 1018). Both the '090 patent and Coxhill relate to gyratory crushers, but Piepho is directed to a coal pulverizer. In my opinion, a coal pulverizer differs so much in function and structure from a gyratory crusher that no POSITA would consider Piepho as pertinent art. Thus, for the reasons I discuss below, a POSITA would not consider Piepho to be analogous art to the '090 Patent. It does not qualify as analogous art under either test.

A. Field Of Endeavor

14. The '090 patent and Piepho are directed to different subject matter. The field of invention for the '090 patent is a gyratory crusher. The '090 patent is

entitled a “Gyratory Crusher Main Shaft And Assembly,” and its “Field of Invention” is directed to a “gyratory crusher main shaft and main shaft assembly for positioning within a gyratory crusher.” (Ex. 1001, 1:1–20.) The purpose of the invention is to enable “convenient mounting and dismounting of the protective sleeve at the upper end of the shaft” (Ex. 1001, 1:65–67). Every reference cited there is a gyratory crusher patent. For its invention description, the ’090 patent describes and illustrates a gyratory crusher having a tapered main shaft fit with a tapered sleeve, oil grooves, and an internal oil path. (*See, e.g.*, Ex. 1001, 2:31–45, FIG. 1). During prosecution, the Examiner only cited gyratory crusher art. (Ex. 1001-1, References Cited (September 25, 2018).)

15. In contrast, Piepho is not directed to a gyratory crusher at all. Piepho describes a purported improvement to the main shaft for B&W Type E and EL pulverizers. (Ex. 1018, 1:5-8.) Moreover, its purported invention is not a sleeve. Rather, the purported invention disclosed by Piepho is a coating applied to the main shaft of a coal pulverizer with the purpose of reducing fretting wear on the shaft. “The present invention comprises an intervening layer of a material such as a thermal sprayed ceramic coating or a thermal setting dry film lubricant between the main shaft and the mating bore in the yoke for reducing local stresses in the shaft within the joint by reducing the relative movement.” (Ex. 1018, 2:20–25)

16. The '090 patent discloses a particular geometric design of gyratory crusher components, specifically providing a tapered main shaft and associated tapered main shaft sleeve, to facilitate attachment and detachment of the sleeve to the shaft. (Ex. 1001, 2:4–9). Piepho, meanwhile, describes a ceramic coating applied to a region of a coal pulverizer main shaft. The shaft in Piepho can be tapered or cylindrical. The purported invention in Piepho does not relate to the design of the tapered or cylindrical portion of the shaft. In fact, one of the advantages described for the purported invention of Piepho is that “the existing shaft and yoke geometries need not be changed.” (Ex. 1018, 4:25–26). Moreover, Piepho does not address the frequency of replacement of the yoke bushing nor does it address the ease of replacement of the yoke bushing. A POSITA, therefore, would not look to Piepho when considering the geometric design of a shaft sleeve and associated shaft for a gyratory crusher, since Piepho does not address the geometric design of such components.

17. A coal pulverizer and a gyratory crusher are very different machines. The embodiments, functions, and structure of the coal pulverizer described in Piepho are not analogous to the embodiments, functions and structure of the gyratory crusher as described in the '090 patent. For example, the size of the coal supplied to a B&W Type EL coal pulverizer, the type described in Piepho, should

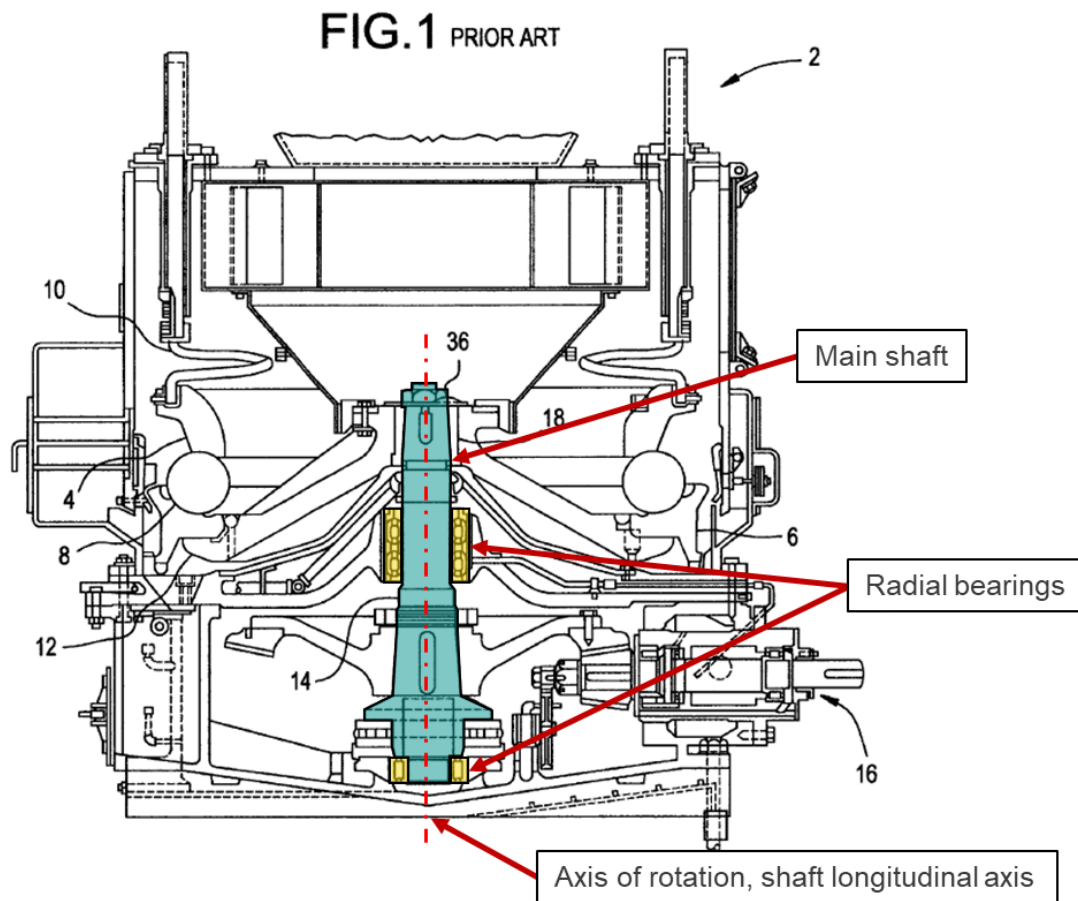
ideally be 0.75 to 1 inch and the output pulverized coal particle sizes should be 0.003-0.012 inches. (*See* Ex. 2024.)

18. Ex. 2024 is a technical specification published by Innovative Combustion Technologies, Inc., which describes features of the Babcock & Wilcox Company coal pulverizer of a type EL. I understand that Piepho is assigned to Babcock & Wilcox Company, and Piepho also references a type EL coal pulverizer. I note that Ex. 2024 has what appears to be a date at the bottom left of 2/10, that is, February 2010. In my experience, such technical specifications are usually dated in this manner, and I have no reason to believe that this was not published in February 2010.

19. Turning back to the size of the pulverized coal, it is so small that it can be entrained in air flow and removed out the top of the coal pulverizer. A Sandvik CH440 cone crusher accepts rock up to 9.8 inches wide and has an adjustable output size of 0.3 to 1.8 inches. (*See* Ex. 2025.) It must handle much larger input material with a wide range of sizes. The coal pulverizer requires a relatively small range of input sizes and coal itself is relatively soft compared to rocks such as granite. Below, I set forth additional significant distinctions between a coal pulverizer, as described in Piepho, and a gyratory crusher.

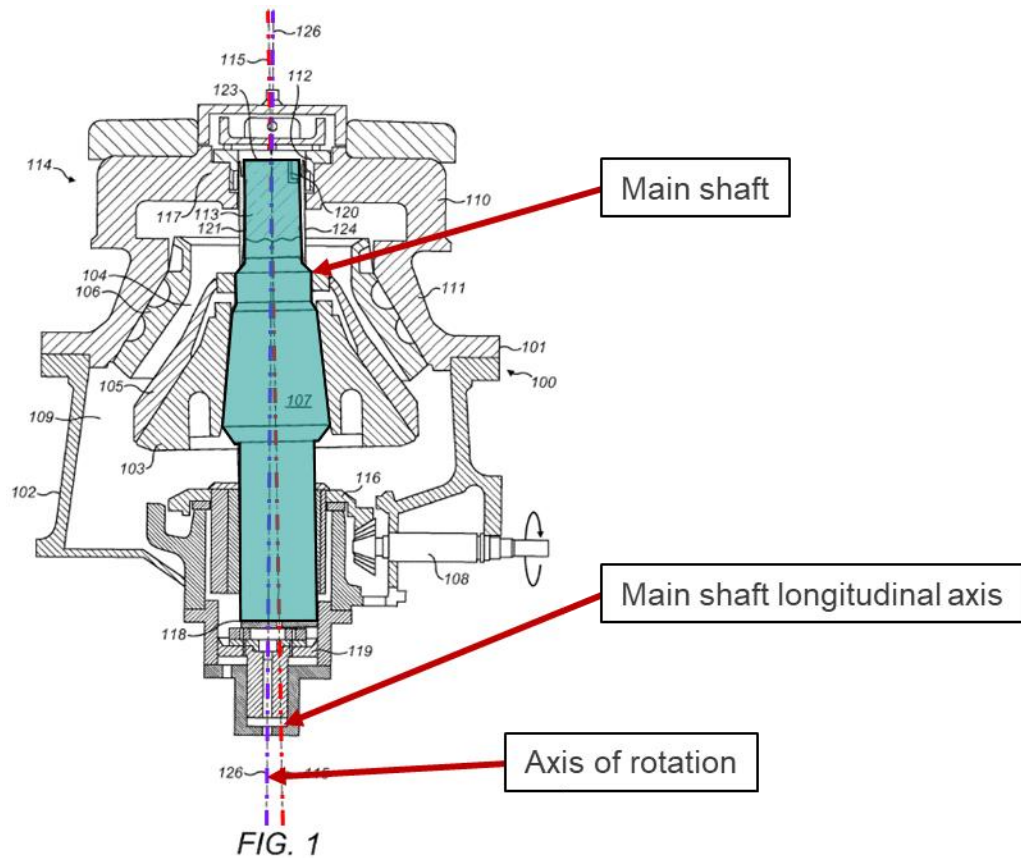
20. **First, operation.** A major distinction between the coal pulverizer described in Piepho and a gyratory crusher is the design and behavior of the main

shaft in each machine. The main shaft of the coal pulverizer is designed to rotate concentrically about the longitudinal axis of the shaft, and the longitudinal axis of the shaft is therefore nominally stationary and always aligned with the longitudinal axis of the coal pulverizer itself. (See Ex. 1018, 1:38–44; FIG. 1.) The concentrically rotating shaft of a coal pulverizer allows the use of conventional anti-friction bearings (i.e., roller bearings or ball bearings) to allow the shaft to rotate while constraining the shaft in all other directions, as illustrated in annotated FIG. 1 of Piepho, below.



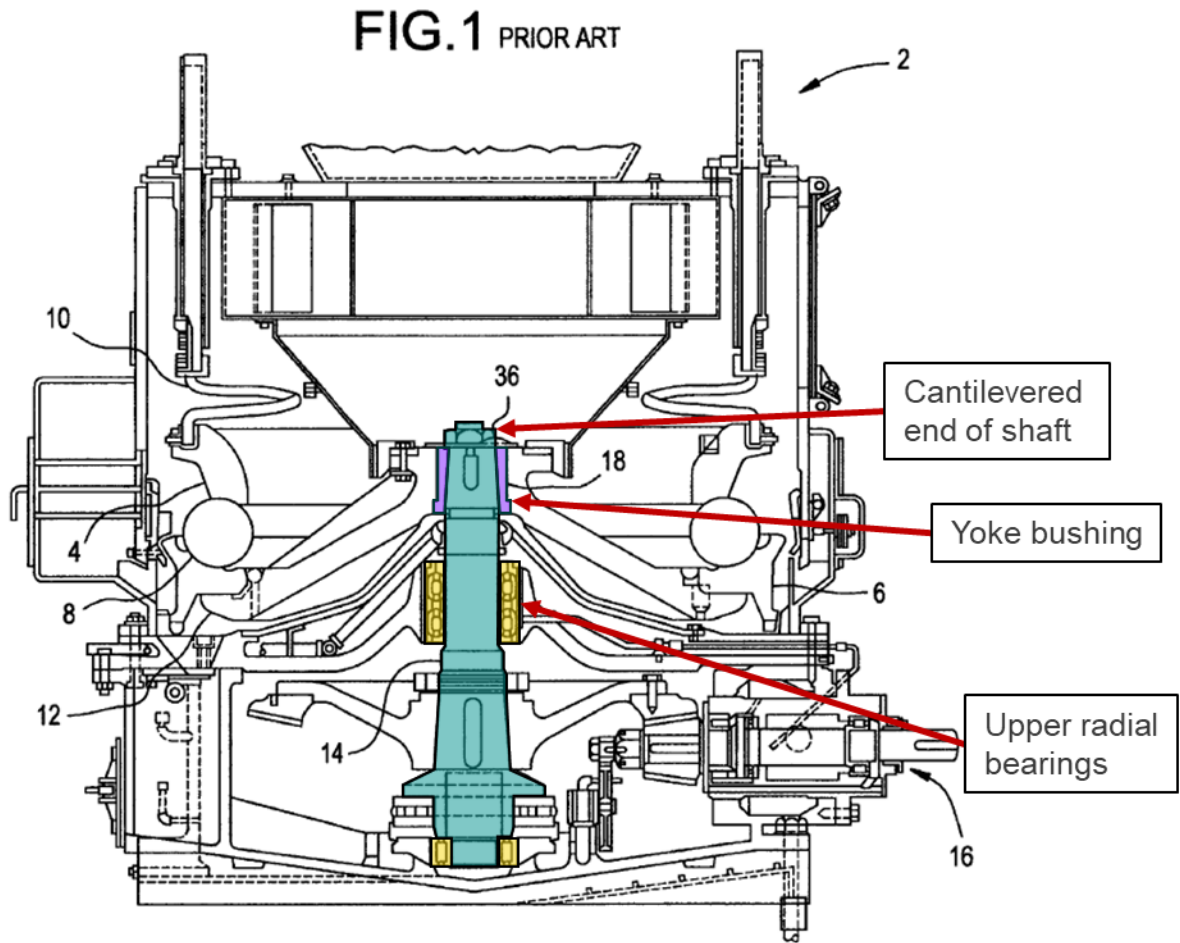
Ex. 1018, FIG. 1 (Annotated)

21. The shaft of a gyratory crusher, on the other hand, is designed to rotate eccentrically, that is, gyrate, with the longitudinal axis of the main shaft angled relative to the longitudinal axis of the rock crusher itself. (Ex. 1001, 1:24–40; 4:42–67.) The axis of main shaft sweeps a conical pattern as the crusher operates, shifting the location of the main shaft in a pendulum motion relative to the outer crushing shell. The eccentric rotation of the gyratory crusher shaft means that the shaft axis must move and requires that the upper bearing be capable of allowing tilting of the main shaft axis. The lower end of the gyratory crusher shaft is mounted in an eccentric bushing to control the amount of eccentric motion, whereas the coal pulverizer shaft uses conventional anti-friction bearings for radial support at upper and lower bearing locations. The main shaft of the gyratory rock crusher is free to rotate about its longitudinal axis as a consequence of interactions with the material being processed. This gyrating motion is illustrated in annotated FIG. 1 of the '090 patent, below.



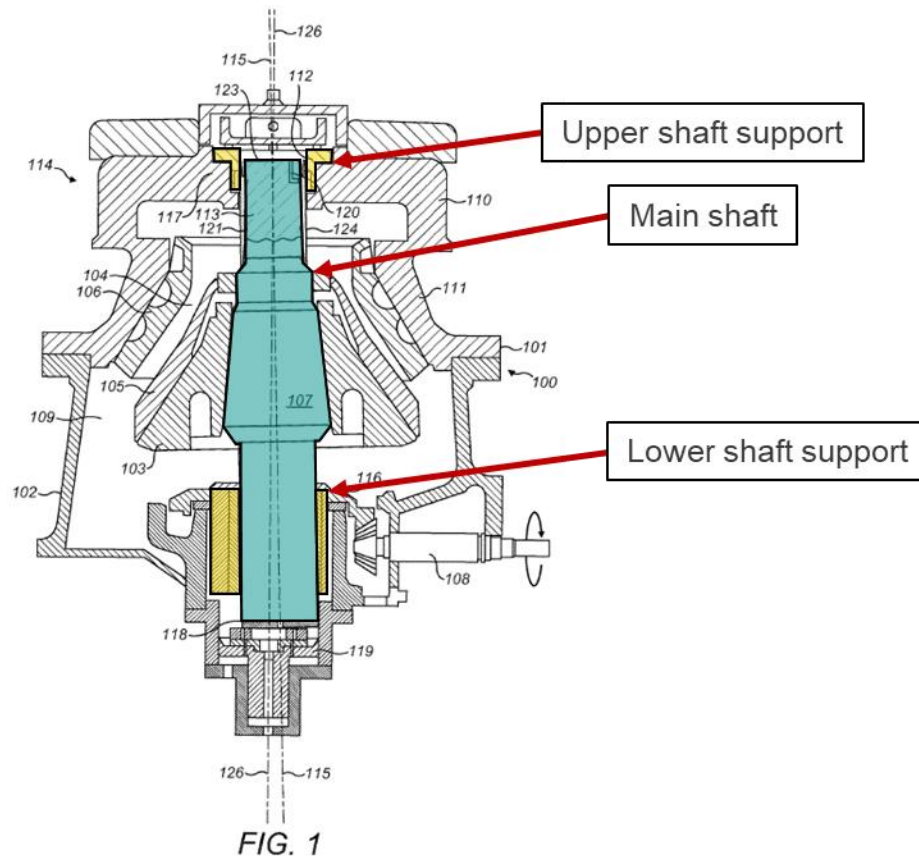
Ex. 1001, FIG. 1 (Annotated)

22. The main shaft of the coal pulverizer in Piepho is also supported with a different configuration than the main shaft of the gyratory crusher described in the '090 patent. The main shaft 14 of the coal pulverizer in Piepho has an upper bearing located roughly in the middle of shaft with the upper end of the shaft cantilevered above the upper bearing. (Ex. 1018, FIG. 1.) The yoke 12 and yoke bushing 18 are attached to the cantilevered end of the shaft 14 as illustrated below.



Ex. 1018, FIG. 1 (Annotated)

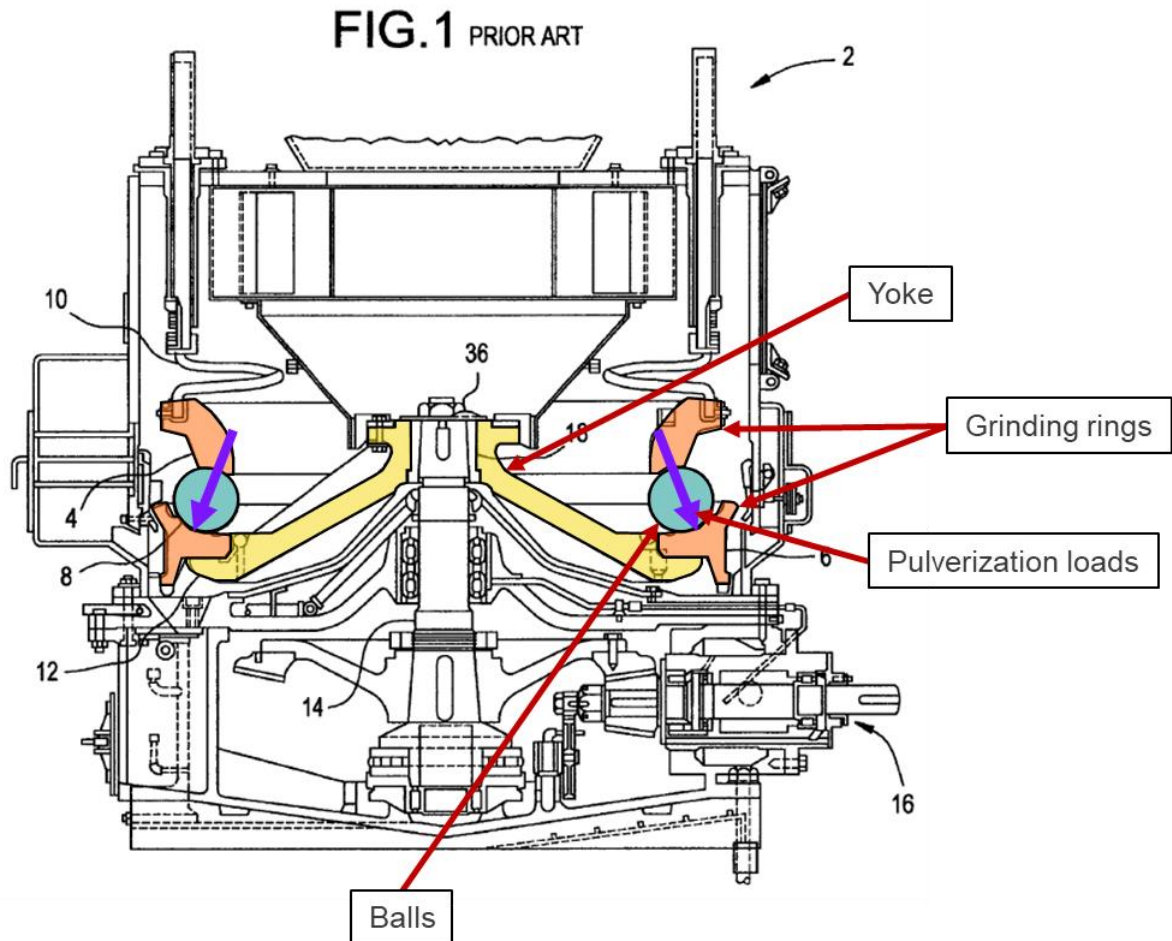
23. The main shaft of the gyratory crusher of the '090 patent is not cantilevered. Rather, it is supported by bearings near each end of the shaft and is therefore simply supported, (Ex. 1001, 4:57–62), as illustrated below.



Ex. 1001, FIG. 1 (Annotated)

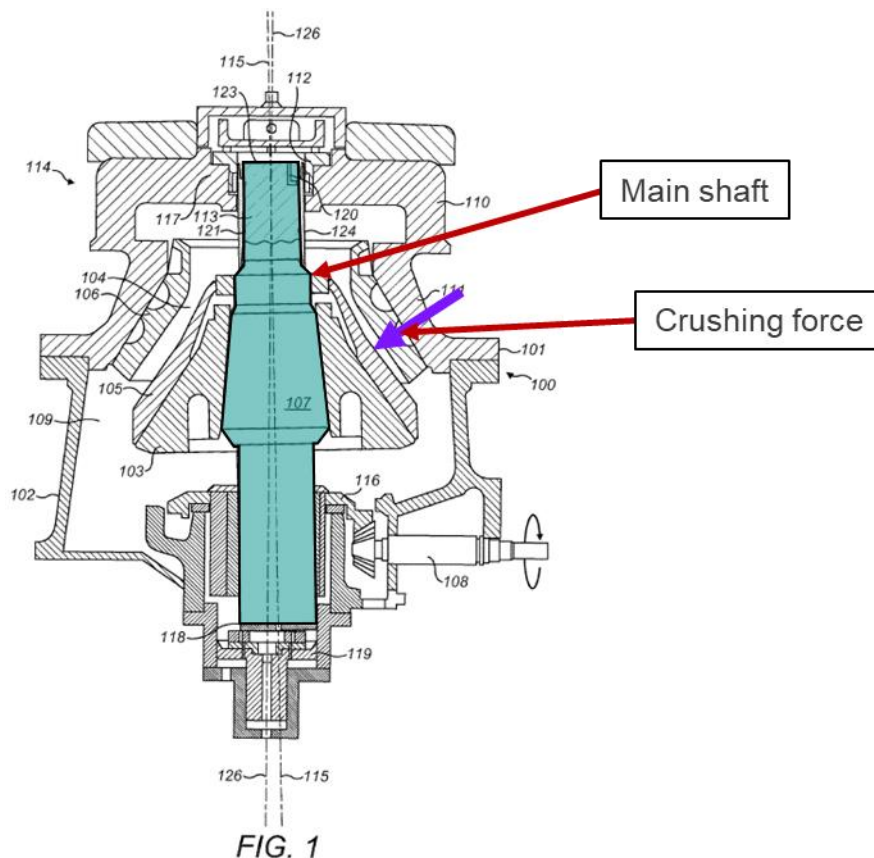
24. The difference in shaft support configuration results in a significant difference in dynamic behavior, loading, and stress for the shaft and attached components. The main shaft sleeve for the gyratory crusher of the '090 patent is aligned with the upper shaft support point (bearing assembly 112), so it predominately supports radial loads and is intended to minimize the transmission of torsional loads, whereas in Piepho the upper end region of the shaft primarily transmits torsional loads to drive the yoke while accepting bending, axial, and radial loads. (Ex. 1001, FIG. 1.)

25. **Second, loading.** In the coal pulverizer described in Piepho, coal is pulverized by balls that roll in grinding rings which extend around the entire circumference of the yoke. The grinding loads are therefore applied around the entire circumference of the yoke as illustrated below.



26. In contrast, in the gyratory crusher described in the '090 patent, crushing force is only applied on one side of the shaft when the gyratory motion reduces the size of the crushing zone between the opposing crushing shells. Unlike

the coal pulverizer, crushing forces are always concentrated on one side of the shaft and not distributed around the circumference, as illustrated below.



Ex. 1001, FIG. 1 (Annotated)

27. **Third, wear environment.** The yoke bushing described in Piepho is not directly exposed to the coal being processed and the resulting abrasive environment. In contrast, the main shaft sleeve described in the '090 Patent is directly exposed to the materials being processed and the resulting abrasive environment.

28. **Fourth, rotation.** The purpose of the yoke bushing in Piepho is to secure the yoke to the main shaft. (Ex. 1018, 3:6–7.) The yoke bushing must be

able to transmit torque between the shaft and the yoke. Consequently, there is not intended to be any relative motion between the yoke and the yoke bushing or the yoke bushing and the shaft. This is in contrast with the main shaft sleeve of a gyratory crusher described in the '090 patent, which is intended to slide within the bearing assembly as the main shaft moves. (*See* Ex. 1001, 5:11–15.)

29. **Fifth, assembly and disassembly.** The yoke bushing is not a wear component in the coal pulverizer and, as such, a POSITA would recognize that the yoke bushing would not be expected to require regular replacement. The main wear components in the coal pulverizer in Peipho are in the grinding zone including the balls and the grinding rings, not the yoke bushing. (*See* Ex. 1018, 1:62–64.) The main shaft sleeve of the '090 patent, in contrast, is a wear component in a gyratory crusher, and Sandvik recommends that the main shaft sleeve for its CH440 rock crusher be replaced annually or after 2000 hours of operation. (*See* Ex. 2026.)

30. The main shaft sleeve of the '090 patent performs a very different function than the yoke bushing in Piepho and the difference in function is directly related to the invention of the '090 patent. The main shaft sleeve is a wear component exposed to relative motion and abrasive materials on its exterior surface whereas the yoke bushing in Piepho is not exposed to abrasive materials or

relative motion on any surface. The main shaft sleeve therefore requires more frequent replacement.

31. Each of these differences on its own would be sufficient to functionally and structurally distinguish a gyratory crusher from a coal pulverizer, but collectively they underscore that the apparatuses are not only different but also operate in entirely different ways. Treating the '090 patent and Piepho as being in the same field because they merely reside within the broad universe of comminution equipment improperly elevates a high-level industrial label over the actual field of endeavor defined by the '090 patent. In my opinion, no POSITA would consider a gyratory crusher of the '090 patent to be in the same field as Piepho's coal pulverizer.

B. Reasonably Pertinent To The Problem

32. A POSITA would not view Piepho as reasonably pertinent to the problem solved by the '090 patent. The '090 patent and Piepho are directed to different problems. The '090 patent concerns the problem of assembling and disassembling a wear sleeve from a main shaft of a gyratory crusher. (Ex. 1001, 1:51–2:9; *see also* Ex. 2027 (video showing the benefits provided by aspects of the invention, including increased safety and efficiency); *see also* Ex. 2011, 21:9–22:1 (Mr. Smith stating that the problem addressed by the '090 Patent is “the best ways

for seating or assembling of the sleeve over the conical section of the main shaft.”).)

33. Piepho, on the other hand, addresses the problem of a coal pulverizer shaft failing due to fretting-induced bending fatigue at the joint between the yoke bushing and the main shaft. (Ex. 1018, 1:45–2:14.) As I discussed above, the wear components in Piepho are its balls and rings—not a sleeve (which Piepho does not disclose) or even its yoke bushing. There is also no discussion in Piepho on the yoke bushing being disassembled from the shaft or the yoke. Indeed, the reason that Piepho is concerned with *fretting-induced* fatigue is because the yoke bushing remains assembled with the main shaft, such that fretting wear would not be readily identifiable during machine maintenance.

34. Petitioner and Mr. Smith emphasize that Piepho discloses a tapered yoke bushing and main shaft. (Paper 33, 12; Ex. 1051, p. 66.) But Piepho also discloses that the shaft/yoke bushing interface may be cylindrical as well. (Ex. 1018, 2:33–35; Ex. 1051, ¶ 360 (Mr. Smith testifying on the “interchangeability” of cylindrical and tapered joints in Piepho).) Piepho does not consider a cylindrical fit to be a problem, unlike the ’090 patent. Accordingly, there is no discussion in Piepho on the tapered fit with respect to disassembly, because Piepho’s problem is with fretting *during operation* as opposed to disassembling the yoke bushing.

35. Petitioner and Mr. Smith also emphasize that a tapered shaft aids in sleeve-shaft alignment. (Paper 33, 13; Ex. 1051, p. 67.) But fretting-induced fatigue—not yoke bushing-shaft alignment—is the problem on which Piepho focuses. Piepho does describe “accurate alignment” but that is with respect to the *yoke*—not the yoke bushing. (Ex. 1018, 3:27–29 (“For accurate alignment and for reliable support of the *yoke*, this joint (21) must be capable of accepting radial, axial, and bending or overturning loads.”).) The yoke must be aligned accurately to drive the pulverizer’s balls. (Ex. 1018, 1:25–26.) The yoke also has a much greater inertia than the yoke bushing, so the yoke is more susceptible to dynamic imbalance, and the resulting undesired vibration, than the yoke bushing. A cylindrical interference fit is at least equally capable of accurate alignment and load capacity as compared to the tapered fit. As discussed in my previous declaration, a tapered fit, in fact, has less load capacity for upward axial loads than a cylindrical interference fit. (*See e.g.*, Ex. 2020, ¶¶ 16–35.) Thus, under either test, Piepho is not analogous art.

VII. THERE IS NO MOTIVATION TO COMBINE COXHILL, PIEPHO, AND YAGI

A. There Is No Motivation To Combine Coxhill and Piepho

36. I understand that when a reference is directed to a different purpose, the inventor would accordingly have had less motivation or occasion to consider it in an obviousness analysis. I also understand that the combination of elements

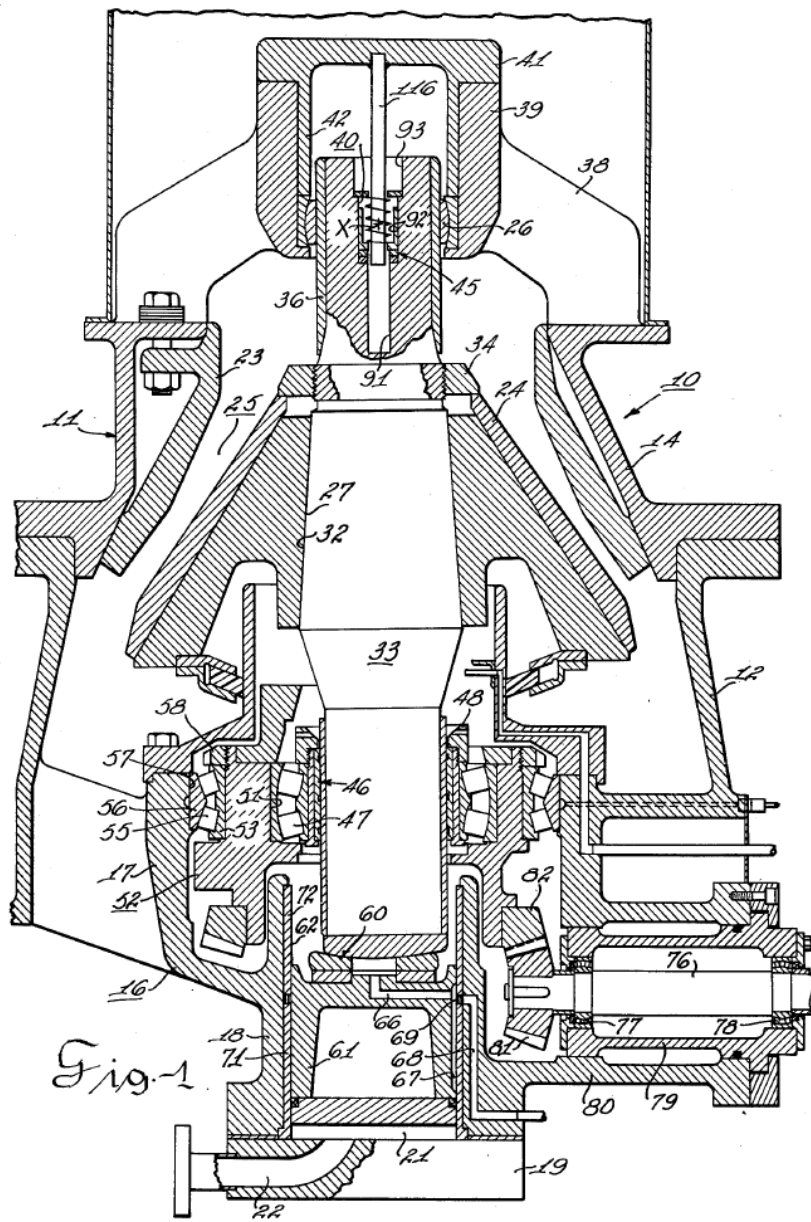
from non-analogous sources, in a manner that reconstructs the invention only with the benefit of hindsight, is insufficient to render an invention obvious.

37. Mr. Smith has chosen isolated snippets from Piepho and applies them to Coxhill. Mr. Smith testified that he did not consider Piepho beyond its disclosure of a tapered shaft. (Ex. 2021, 65:5–16.) His approach suggests to me that he improperly used the tapered shaft claim language as a blueprint to select Piepho—a non-analogous reference—through hindsight. Only by ignoring Piepho’s field and focus—in other words, everything other than Piepho’s disclosure of a tapered shaft—could Petitioner and Mr. Smith conclude obviousness. When Piepho is considered for all that it teaches, there would be no motivation to combine Piepho with Coxhill.

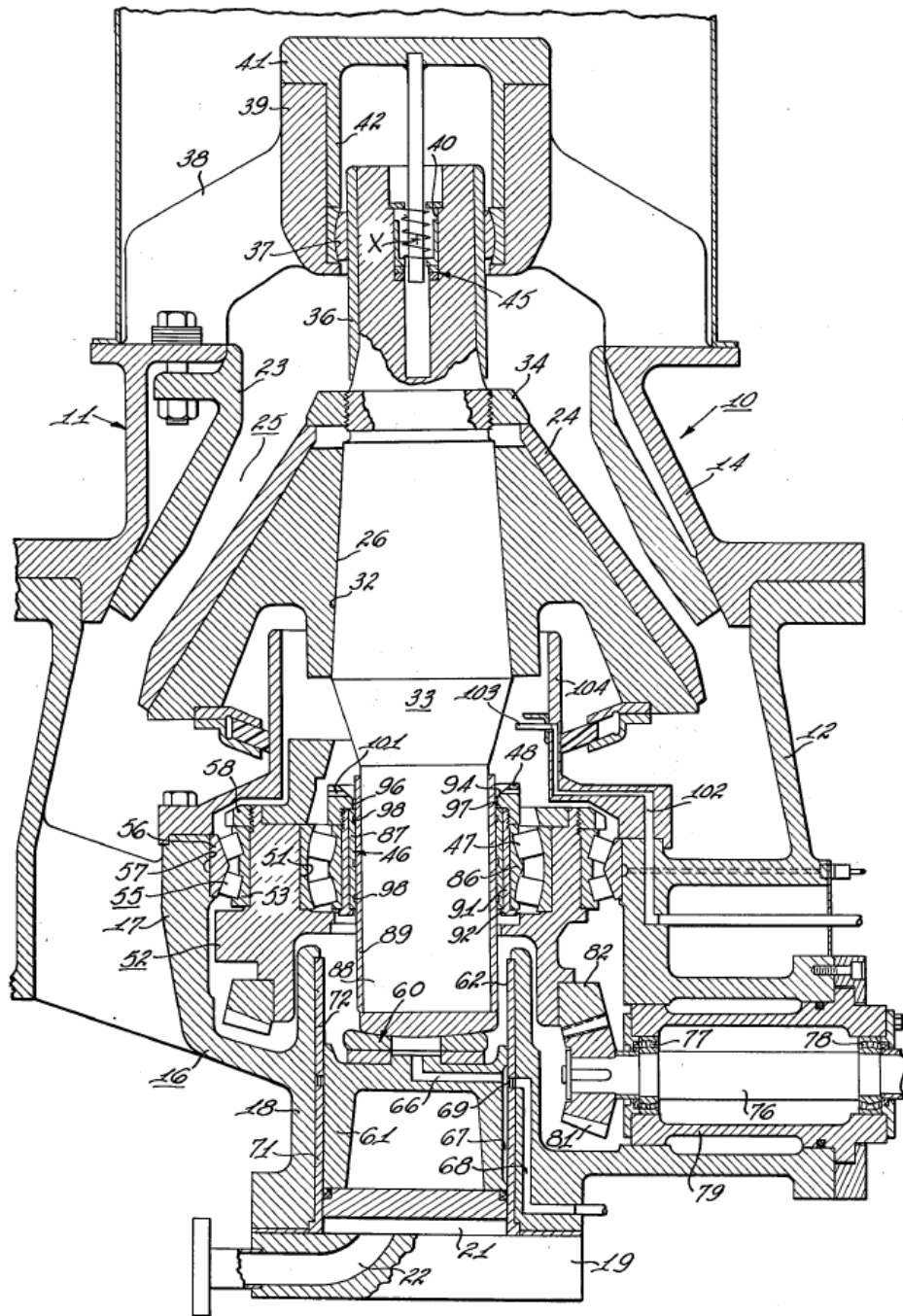
B. A POSITA Would Not Be Motivated To Cut Oil Groove(s) Into Coxhill’s Main Shaft

38. Petitioner’s and Mr. Smith’s proposed combination of Coxhill and Yagi would require a POSITA to machine oil grooves into the external surface of Coxhill’s main shaft. A POSITA, however, would have understood that introducing additional grooves into the Coxhill shaft could increase the risk of catastrophic fatigue failure—a modification that a POSITA would not undertake given his or her experience level. Thus, a POSITA would not have been motivated to machine oil grooves into the external surface of Coxhill’s main shaft.

39. As I have discussed at length in my previous declarations, Polinski—previously relied upon by Petitioner—describes that connecting a crushing head directly to the crusher main shaft via threads cut into the shaft has led to fatigue failure of the shaft. (Ex. 1017, 1:11–37.) Petitioner and Mr. Smith now rely upon U.S. Patent No. 4,037,800 to Coxhill (Ex. 1053, “Coxhill ’800”) as the base reference, as discussed above. Notably, however, the arrangement criticized by Polinski as leading to fatigue failure is identical to the shaft configuration disclosed in Coxhill ’800. More precisely, the criticized arrangement in Polinski corresponds to U.S. Patent No. 4,034,922 to Coxhill (“Coxhill ’922”). Coxhill ’922 and Coxhill ’800 disclose an essentially identical gyratory crusher, as shown by the substantially identical FIG. 1 embodiments in each patent, shown below. (*See* Ex. 1053; Ex. 2023.)



Ex. 1053, FIG. 1



Ex. 2023, Sole Figure, i.e., FIG. 1

40. Additionally, the two patents share the same filing date, inventor, and assignee. A POSITA would have understood that the shaft-failure issues Polinski describes with respect to Coxhill '922 are equally present in Coxhill '800. Thus, as of the '090 Patent's filing date, it was already known that the shaft disclosed by Coxhill '800 was prone to fatigue failure. (Ex. 1017, 1:11–37.)

41. Specifically, Polinski explains that the “relatively abrupt changes in the cross-sectional area of the shaft above and below the threaded section have resulted in high local stress concentrations in these regions of the shaft,” in addition to the “substantial stresses generated by the cyclic bending loads applied to the shaft by the mantle during operation of the crusher,” leading to “fatigue cracks or fractures in the threaded section of the shaft as well as immediately above and below it,” which ultimately “render the shaft unserviceable.” (Ex. 1017, 1:11–37.)

42. Although Mr. Smith, relied on Polinski as his primary reference in his first two declarations, he indicated that he had not “seen anything in Coxhill that would suggest that this invention is prone to failure,” and that he “would think it's been designed in a way that it works properly.” (Ex. 2019, 61:18-62:1.) However, Smith also noted that he understood Polinski's discussion to indicate that “[i]n some instances, if it's not designed properly, [using threads to attach the mantle] can result in fatigue cracking.” (Ex. 2011, 52:23-53:15.) Thus, Mr. Smith

recognizes that Polinski teaches that some shafts may be designed such that fatigue cracking can arise due to stresses from attaching the mantle to the shaft via threads. Mr. Smith simply fails to recognize that Coxhill '800 *is* such a shaft design criticized by Polinski. Thus, Mr. Smith's assertions that a POSITA would modify Coxhill '800 fail to account for the fact that Coxhill '800's shaft is prone to fatigue failure.

43. As I have discussed in my previous declarations (Ex. 2001, 2007, 2010, and 2020), adding grooves to a shaft creates structural discontinuities that would increase the likelihood of fatigue failure. (E.g., Ex. 2020, ¶¶ 67–75.) As set forth in Kytömaa IV, Shigley explains that stress concentrations can arise from a single groove. (Ex. 2003, 10; Ex. 2020, ¶ 68.) Adding grooves also adds more regions near the edge of contact area where fretting wear can occur and provide still more potential initiation sites for fatigue cracks. (Ex. 2020, ¶ 68.)

44. Although my previous testimony addressed the lack of motivation to add grooves to Polinski (E.g., Ex. 2020, ¶¶ 67–75), a POSITA—being aware of Polinski—would be more wary of adding grooves to the Coxhill shaft. Again, Polinski teaches that the Coxhill shaft was prone to fatigue failure. Polinski took steps to mitigate those failure problems, alleviating the risk of fatigue failure for the shaft in Polinski. (Ex. 1017, 61–67.) The shaft in Coxhill '800—lacking such

mitigations—was at higher risk of failure than the shaft in Polinski, making the addition of oil grooves to the shaft a riskier endeavor in the eyes of a POSITA.

45. Petitioner argues that a POSITA would be motivated to introduce oil grooves between the sleeve and the shaft of Coxhill '800 because hydraulic processes for making and breaking interference fits are “well known to protect the shaft from damage,” citing Behm (Ex. 1035 1:13-42), “able to be used in more locations as they do not require presses and gear pullers,” “[do] not require the maintenance that presses and gear pullers do,” citing Sillett (Ex 1034, 15-24), and “make removing component on a tapered shaft particularly easy,” citing Harless, (Ex. 1033 3:15-22). (See Paper 33, 13–14.)

46. However, the advantages of hydraulic processes Petitioner and Mr. Smith point to, in my opinion, would not have been sufficient to motivate a POSITA to introduce oil grooves into the main shaft disclosed by Coxhill in view of the known fatigue failure risk of the particular shaft in Coxhill. Indeed, during prosecution, the Examiner *considered* Coxhill '825 (Ex. 2028), which has the same relevant disclosure as Coxhill '800 and '922. Yet she allowed the (broader) issued claims over them, underscoring the deficiency of the art. Petitioner is simply recycling considered art and arguments. *See* 35 U.S.C. § 325(d). Polinski explains that the Coxhill shaft is susceptible to catastrophic fatigue failure due to high local stress concentrations in the region above and below the threaded section, combined

with substantial cyclic bending loads during operation of the crusher. (Ex. 1017, 1:11–37.) A POSITA would have understood that machining oil grooves into the external surface of Coxhill’s main shaft in that already fatigue prone region would reduce cross sectional area of the shaft and introduce additional stress raisers and thus increase the likelihood of fatigue cracking and shaft failure. In the context of a gyratory crusher main shaft—where failure leads to unplanned shutdowns and complete shaft replacement—a POSITA would have given controlling weight to preserving shaft integrity, particularly in view of Polinski’s discussion of Coxhill ’800. Thus, a POSITA would not have been motivated to modify Coxhill ’800 in view of Yagi.

VIII. THE NEW GROUNDS DO NOT DISCLOSE OR SUGGEST THE OIL PATH OF CLAIMS 16 AND 24

47. Coxhill, Piepho, and Yagi, fail to disclose or suggest “an oil path consisting of: a fluid inlet positioned at the second end; the first groove; the second groove; an axially extending channel indented at the external surface of the shaft body to couple the first groove and the second groove in fluid communication; and an internal oil path extending within the shaft body only to the first groove, the internal oil path consisting of: a first conduit extending axially toward the first end from the fluid inlet; and a second conduit extending from the first conduit toward the radially outward facing external surface of the shaft body to the first groove,” as recited in substitute claims 16 and 24.

48. I understand that even though Yagi does not disclose each limitation of claims 16 and 24, Petitioner and Mr. Smith assert that the limitations recited in these claims amount to an obvious “design choice” or that it would have been “obvious to try” the claimed features. (Paper 33, 15.) Mr. Smith has described what he means by “design choice” as follows:

Q. And what do you mean by design choice in the context of your obviousness analysis?

A. Sure. So there are often multiple known ways of doing something, or assembling components, or aligning things. And if they are all known ways that have been used in prior art, that are known in the -- known in the art, then choosing which one you implement on a new design is really just a design choice as opposed to an inventive step, so to speak. (Ex. 2011, 40:24-41:11.)

49. I understand that a finding of obvious “design choice” is precluded where the claimed structure and the function it performs are different from the prior art, and that courts have found that structural rearrangements of claimed features that confer operational advantages weigh against a finding that the claimed arrangement is an obvious design choice. I further understand that the “obvious to try” rationale applies only in certain circumstances where the problem is known, the possible approaches to solving the problem are known and finite, and the solution is predictable through use of a known option.

50. Finally, I understand that the “consisting of” language in claims 16 and 24 narrows the claim in two important ways. First, the internal oil path is limited to exactly one axial conduit and one radial conduit. Second, that internal path extends within the shaft body only to the first groove—that is, there is no internal branch or continuation to the second groove. The claimed configuration therefore defines a single internal path that terminates at the topmost (first) groove, with the second groove fed only via the external, axially extending channel. Neither Coxhill nor Piepho disclose any oil grooves, much less the flow path recited in claim 16 and 24. Petitioner and Mr. Smith rely on Yagi for the above limitations. However, for the following reasons, Yagi also fails to disclose or suggest the limitations of claims 16 and 24.

A. The New Ground Does Not Disclose Or Suggest the “Oil Path Consisting Of . . .” Limitation

51. Yagi’s embodiments either route the internal passage to a single groove (first embodiment), both grooves (second embodiment) or route the internal passage only to the second groove and feed the first groove externally along the shaft *downstream* from the second groove (third embodiment). (See Ex. 1040, FIGS. 1B, 3A–3B, 4, 5A–5C.)

52. Petitioner’s suggestion that Yagi “includes each feature in the claim, but ports to the second groove rather than the first” is an admission that the Yagi’s internal path terminates in a different groove than the one claimed—Yagi’s

structure is thus inconsistent with the claimed “consisting of” limitation.

Importantly, neither Petitioner nor Mr. Smith identifies any figure or passage in Yagi that actually discloses an internal passage routed to only the first groove, as claimed. Petitioner’s assertion that “[i]n one embodiment Yagi teaches an internal oil path that extends only to the first groove” is unsupported by any citation to such an embodiment because none exists where Yagi also contemplates multiple grooves. (Paper 33, 15.) Where Yagi contemplates multiple grooves, it always teaches to include a fluid path to the second groove.

53. Petitioner and Mr. Smith also rely on Yagi’s FIG. 6B and the statement that “oil is fed from the first oil groove 44 only.” But FIGS. 6A–6C do not depict a new shaft fluid-path architecture. They depict a procedure for decoupling the tapered shaft 40 from the hub 30 in the second embodiment (the embodiment having two radial passages 43 and 45 that each port to a respective one of the two circumferential grooves). (See Ex. 1040, 7:37–57.) This procedure does not meet the claim limitations. The claims recite a specific structure, not a procedure. They require that the internal oil path itself extend “only to the first groove” and “consist of” a single axial conduit and a single radial conduit to that groove. The second embodiment of Yagi, even when used according to the FIG. 6B procedure, still has an internal path extending to both grooves, does not have an

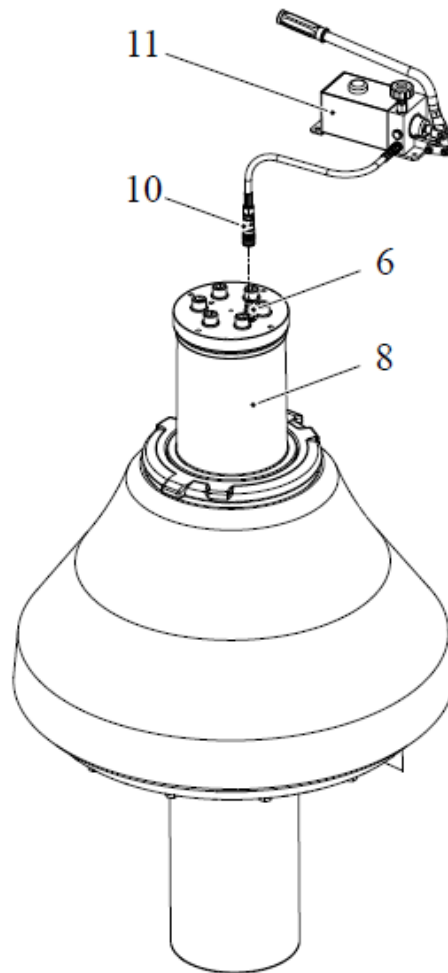
axial channel connecting the grooves at the shaft surface, and thus cannot satisfy claim 16 or 24.

B. The Claimed Oil Path Is Not A Mere Design Choice

54. Petitioner asserts that “the design choice to port to one or the other grooves does not make any material difference to the functionality of the device and is merely a design decision.” (Paper 33, 15.) Mr. Smith similarly asserts that “the choice to run the fluid path to either the first or second grooves is merely a design decision,” reasoning that the “choice will not affect the intended purpose to assist in removal of the sleeve in any way.” (Ex. 1051, 77–81.) In so concluding, Petitioner and Mr. Smith fail to acknowledge the significant improvement in manufacturability provided by the claimed oil path. In addition to the fact that “[m]inimizing an axial length of an internally extending fluid supply conduit is advantageous during manufacture as the use of very long and thin drills should be avoided” (Ex. 1001, 3:6–9), the shorter internal bore also provides additional functional benefits by requiring less oil volume is to fill the system.

55. An internal oil flow path that extends only to the topmost groove, as recited in claims 16 and 24, would have less internal volume relative to an oil path that extends to the lower groove and then feeds the upper groove downstream via an axial channel in the external surface of the shaft. Consequently, the total amount of residual oil to be cleaned up following separation of the sleeve would

also be less than for an oil path in which the internal flow path extends to the lower groove. In addition to the reduced oil cleanup, a smaller oil volume reduces the time to fill the oil grooves with the manual pump (hydraulic oil pump 11) shown in Sandvik's Maintenance Instructions below. Both of these benefits combine to reduce the time required to replace the shaft sleeve.



- 6 Nipple
- 8 Main shaft sleeve
- 10 Hydraulic hose
- 11 Hydraulic oil pump

Ex. 2019, p. 85.

56. The claimed arrangement thus yields concrete manufacturing and operational benefits. Neither Petitioner nor Mr. Smith have engaged with these functional distinctions.

57. Moreover, in concluding that the claimed configuration of the internal oil path is merely a “design choice,” Mr. Smith has failed to satisfy his own criteria that the claim recites a “known way[] that [has] been used in prior art.” Neither Mr. Smith nor Petitioner have identified anything in the relied upon art that discloses the claimed configuration—thus, Mr. Smith and Petitioner have not demonstrated that the claimed configuration was a “known way[] that [has] been used in prior art.”

C. The Claimed Oil Path Would Not Have Been Obvious To Try

58. Petitioner and Mr. Smith have not identified any finite set of porting options, nor has Petitioner or Mr. Smith shown that the claimed arrangement was an “identified, predictable solution” at the time of the ’090 patent’s filing date. Yagi describes a broad range of options for introducing oil between a shaft and hub, none of which correspond to the claimed oil flow path. Moreover, as I discussed above, the oil path recited in claims 16 and 24 provides several manufacturing and operational benefits. Thus, it would not have been obvious to try the claimed arrangement.

* * *

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code.

Dated: December 16, 2025



Harri Kytömaa, Ph.D.

Expert Testimony of
Harri K. Kytömaa, Ph.D.

Four-Year Testimony History

Name of Case	Type	Docket	Year
CMS Cepcor Ltd., and CMS Cepcor Americas LLC v , Sandvik Intellectual Property AB	Deposition	Inter Partes Review No. IPR2024-01380 United States Patent And Trademark Office	2025
Claimant v Respondent Gas Turbine Combined Cycle Power Plant (Malaysia)	International Arbitration	The Singapore International Arbitration Centre SIAC No. 278 of 2018 Tribunal: Mr. Chan Sek Keong SC, Datuk Veron Ong Lam Kiat, and Mr. V K Rajah SC	2025
Impulse Downhole Solutions, Ltd. and Impulse Downhole Tools, USA Ltd. v Downhole Well Solutions, LLC	Deposition (3)	United States District Court for the Southern District of Texas, Houston Division 4:23-cv-02954	2025
GE Renewable Energy Canada, Inc. v Canmec Industrial Inc.	Trial	Federal Court of Canada Docket No. T-1471-21	2024
City of East St. Louis v Monsanto Company et al.	Deposition	United States District Court for the Southern District of Illinois 3:21-CV-232-DWD	2024
Sacramento Downtown Arena LLC, Sacramento Kings Limited Partnership, SAC Mubi Hotel, LLC and SGD Retail LLC v Factory Mutual Insurance Company	Deposition	United States District Court Eastern District of California, Sacramento Division 2:21-cv-00441-KJM-DB	2024
Impulse Downhole Solutions Ltd. and Impulse Downhole Tools USA, Ltd. v Downhole Well Solutions, LLC	Deposition	United States District Court Southern District of Texas 4:23-cv-02954	2024
REDACTED, Claimant, v REDACTED, Respondent: In the Matter of an Arbitration under the 2021 Rules of the International Court of Arbitration of the International Chamber of Commerce	International Arbitration	ICC Case No.: 27020/PDP New York, New York, April 2023 Arbitrators: Roger Peters, William K. “Bill” Andrews (President), Matthew Sullivan	2024
Impulse Downhole Solutions Ltd., et al. v Downhole Well Solutions, LLC	Motion Hearing	United States District Court Southern District of Texas 4:23-cv-02954	2024
Claimant v Respondent	International Arbitration	International Chamber of Commerce (London, UK) Case No. 26684/XZG Tribunal Members Sir Robert Akenhead, John Bishop, Nicholas Fletcher KC	2024

Name of Case	Type	Docket	Year
Angela B. Heit et al. v Monsanto Company et al.	Trial	Superior Court of the State of Washington In and For King County No. 18-2-55641-4-SEA	2023
Lilianna Silvestry et al. v Falcon Safety Products et al.	Deposition	Superior Court of New Jersey Law Division: Essex County Docket No.: L-003103-20	2023
Kristina Rene Frost and Gary Allen Mays et al. v Amsafe Commercial Products, Inc. et al.	Deposition	United States District Court for the Western District of North Carolina, Asheville Division Case No.: 1:21-cv-156-	2023
Tony E. Rardon et al. v Falcon Safety Products, Inc. et al.	Deposition	United States District Court Western District of Missouri Case No. 5:20-cv-06165-BP	2023
InMusic Brands, Inc. v Roland Corporation	Deposition	United States District Court for the District of Rhode Island 1:17-cv-00010-JJM-LDA	2023
Kerr Machine Co. v SPM Oil & Gas Inc. and S.P.M. Flow Control, Inc.	Deposition	United States District Court for the Northern District of Texas Case No.: 4:21-cv-1191	2022
Thomas P. Gorczynski et al. v Electrolux Home Products Inc, et al.	Hearing	United States District Court, District of New Jersey 1:18-CV-1066-RMB-KMW	2022
Roland Corporation v InMusic Brands, Inc.	Trial	United States District Court Southern District of Florida Case No.: 1:17-cv-22405	2022
GD Energy Products, LLC v Premium Oilfield Technologies, LLC	Deposition	United States District Court Western District of Texas, Waco Division Case No. 6:21-cv-00864-ADA	2022
Michael Evard, Sue Wiechmann, Michael Orrel, Sonia Martin-Ahmed, and Ronald E. Bryan v Monsanto Company	Deposition	Circuit Court of Cook County, IL County Department, Law Division Case No.: 2019-L-011574	2022
David Back et al. v Bayer Cropscience LP et al.	Deposition	Circuit Court of St. Louis County State of Missouri Cause No.: 18SL-CC03530	2022
Dana J. Allison and Tyler J. Allison et al. v Monsanto Company et al.	Deposition	Superior Court of the State of Washington In and For King County 18-2-26074-4-SEA	2022
Holly A. Mills Hiley et al. v Monsanto Company et al.	Deposition	Superior Court of the State of Washington In and For King County 21-2-14303-9-SEA	2022
City of Seattle v Monsanto Company et al.	Deposition	United States District Court Western District of Washington at Seattle 2:16-cv-00107-RAJ	2022

Name of Case	Type	Docket	Year
Gardner Denver Petroleum Pumps, LLC v Premium Oilfield Technologies LLC	Deposition	United States District Court for the Western District of Texas 6:21-CV-864	2022
State Farm Fire and Casualty Company as subrogee of Robert and Kristine Paterson v Omega Flex, Inc.	Deposition	United States District Court for the District of Connecticut 3:20-cv-00648-VAB	2022
Neal Frank v Monsanto Company, Pharmacia Corporation, Solutia Inc., Pfizer, Inc., Big Jo True Value Hardware, Inc. and JANT Group III, Inc.	Deposition	State of New Mexico, County of Santa Fe, First Judicial District Court D-101-CV-2021-00481	2022
Claimant v Respondent, Arbitration Institute of Stockholm Chamber of Commerce (Virtual)	International Arbitration	SCC Arbitration Heard before the President of the Tribunal Mr. Eric Schwartz, Adrian Hughes, QC, and Mauricio Almeida Prado	2022
Sunoco Partners Marketing & Terminals L.P. v Powder Springs Logistics LLC and Magellan Midstream Partners, L.P.	Trial	United States District Court for the District of Delaware Case No. 17-1390 LPS	2021
Comisión Federal de Electricidad (Claimant) and AES Merida III, S. DE R. L. DE C. V. (Respondent)	International Arbitration	ICC Case 25165/JPA Tribunal Miguel Virgós (Chair), Alejandro Ramón, Castellort Espinola, Francisco González de Cossio	2021
In Re: 3M Combat Earplug Products Liability Litigation – Joseph Frank Palanki Trial	Trial	United States District Court Northern District of Florida Pensacola Division Case No. 3:19-md-2885	2021
Ashen S. Diehl v 3M Company	Deposition	State of Minnesota County of St. Louis District Court Sixth Judicial District 69-DU-CV-18-2662	2021
Roland Corporation v InMusic Brands, Inc.	Deposition	United States District Court Southern District of Florida 1:17-cv-22405-FAM	2021
Impulse Downhole Solutions Ltd. v Rubicon Oilfield International Holdings LLC	Deposition	United States District Court for the Western District of Texas, Waco Division 6:19-cv-378-ADA	2021
Kerry Erickson et al. v Monsanto Company, Solutia, Inc., Pharmacia LLC, et al.	Trial	Superior Court of the State of Washington in and for the County of King 18-2-11915-4 SEA	2021

Compensation

Exponent, Inc. is compensated at \$875 per hour for Dr. Kytömaa's consulting services in 2025.

No part of Exponent's compensation is contingent on the outcome of the matter.

Updated December 2025