

Exhibit 1022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FlSmidth Inc.,

Petitioner,

v.

Metso Outotec (Finland) Oy,

Patent Owner.

Patent 9,518,604 B2

Inter Partes Review No. To Be Assigned

DECLARATION OF DAVID SMITH

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I, David Smith, MS, MBA, PE, CSP, declare as follows:

1. I am over 21 years of age and otherwise competent to make this declaration. I make this declaration based upon facts and matters within my own knowledge and on information provided to me by others.

2. I have been retained as an expert witness to provide testimony on behalf of FLSmidth Inc. (“FLSmidth” or “Petitioner”) as part of the above-captioned *inter partes* review proceeding (“IPR”).

3. I understand that Metso Outotec (Finland) Oy owns U.S. Patent No. 9518604 (“the ’604 Patent”), entitled “FLUID BEARINGS,” the validity of which FLSmidth challenges.

4. I have reviewed and am familiar with the specification of the ’604 Patent as well as the prosecution history of the ’604 Patent.

5. I am familiar with the technology at issue at the time the ’604 Patent was filed (i.e., on or before June 28, 2012).

I. QUALIFICATIONS

6. I have a B.S. and M.S. in Mechanical Engineering from Brigham Young University.

7. I am a Licensed Professional Engineer in the states of Utah and Idaho and have consulted on hundreds of mechanical engineering related projects. Those projects have involved, among other things, heavy machinery, construction equipment, hydraulic equipment, oil and gas drilling equipment, and mining related equipment.

8. I am listed as an inventor on seven issued patents all of which involve principles of mechanical engineering and have published several articles related to principles of mechanical engineering.

9. In my work as a mechanical engineer, I have had significant experience evaluating and testing different types of bearings for different applications, including ball, needle and roller bearings, ceramic bearings, spherical bearings and polymer bearings. I have also evaluated press fits for bearings, and preload for bearings. I have also consulted on bearings that incorporate internal channels for hydraulic fluid power to seat and release press fit bearings. I also have significant experience with hydraulics and hydraulic components including fittings, valves, pumps, hosing, fluid channels, and the like.

10. I believe I have the necessary education, training, and practical experience to analyze the technology disclosed in the '604 Patent and provide opinions on how the person of ordinary skill in this art or technology (as further defined below) would have understood the scope and content of the claims made in the '604 Patent in light of what was known before the date the '604 Patent was filed.

II. PRINCIPLES OF ANALYSIS

11. I am generally aware of the patent process and related concepts but I am not a lawyer. That said, I am informed of certain legal issues that may arise in this matter. While I am not providing any legal opinions in this matter, I note some of the issues as I understand them by way of background.

12. I understand that the "claim" of a patent is a legal description of the technology that is purportedly invented by those listed as inventors on the patent. Whereas the "specification" (e.g., the description and figures) of the patent is

intended to teach a person of ordinary skill how to make and use the invention that is claimed.

13. I understand that in patent matters, the person of ordinary skill in the art is a hypothetical person presumed to have knowledge of the state of the art, or the state of the technology, including all prior art references within the relevant time frame (i.e., the time of the invention). Factors that may be considered in determining the level of ordinary skill may include: (1) type of problems encountered in the art; (2) prior art solutions to those problems; (3) the speed at which advancements in the technology are made (4) sophistication of the technology; and (5) educational level of active workers in the field.

14. As I noted above, I believe that I am a person of ordinary skill. Further, I believe that the technology of the '604 Patent represents fairly rudimentary mechanical engineering technology. The person of ordinary skill in the field of technology related to the '604 Patent would have at least a Bachelor's Degree in mechanical engineering, mining engineering, or an engineering discipline related to either of those two with at least 2 years of experience related to the design and/or operation of equipment that uses fluid bearings or a commensurate amount of additional education or comparable work experience related to bearings, hydraulics and/or heavy machinery.

15. I understand that in assessing the claims of a patent, the person of ordinary skill in the art looks to the scope and content of the prior art in view of what a patent claims. When considering whether a patent claim is legally "anticipated" or new, I understand that the person of ordinary skill looks to whether the patent claim falls within a single prior art reference.

16. When considering whether a patent claim is legally "obvious," I understand that the person of ordinary skill considers what would have been

known at the relevant time, and what such a person would have reasonably expected to have been able to do in view of that knowledge. What one of ordinary skill would have been reasonably expected to be able to do is guided by numerous principles including the following:

- a. the motivation or desire to combine different teachings from different prior art references according to known methods to yield predictable results;
- b. the substitution of one known element for another element to obtain a predictable result;
- c. the use of a known technique to improve the performance of a device or product to obtain a predictable result;
- d. choosing from a finite number of predictable solutions to a particular problem with a reasonable expectation of success;
- e. applying variations of known work based on design incentives or other market forces where the variations are known to one of skill in the art; and
- f. combinations of prior art teachings that have unexpected results.

17. I also understand that the prior art references must be evaluated for what they teach as a whole.

III. MATERIALS CONSIDERED

18. In addition to the '604 Patent and its file history, I have reviewed the following materials.

Exhibit	Description
1003	GB1,508,384
1004	German publication No. DE102007039364
1005	DE102007039364 English Translation

1006	Metso Brochure No. 2060 02-02
1007	US4,025,133
1008	US7,896,551
1009	Trygg, et al. CIM Article
1010	GB1,330,484
1011	US5,333,804
1012	Higgins, R.A. Textbook
1013	US2012/0099993
1014	US3,197,264
1015	US2003/0175074
1016	US2,744,799
1017	US4,408,808
1018	US3,799,628
1019	US4,320,926
1020	CN1904401
1021	CN1904401 English Translation
1025	Merriam Webster Dictionary, "Port"

IV. OPINIONS AND ANALYSIS

19. Part of my assignment includes a comparison of what was known to persons of ordinary skill in the art prior to the filing of the '604 Patent to what is claimed in the '604 Patent.

V. OVERVIEW OF '604 PATENT

20. I understand the '604 Patent is based on an earlier filed application that was filed on June 28, 2012. I have limited my review of what was known in the prior art to before that date.

21. The '604 Patent is titled "Fluid Bearings" and is related "to a fluid bearing and in particular a hydrostatic polymeric bearing for use in a mill." *See* Ex. 1001, 1:1 and 37-45.

22. The Background of the '604 Patent discusses technology that was known to persons of skill in the art prior to its filing. In that Background, the '604 Patent notes the following:

“[a] grinding mill has a mill chamber and two journal shafts, the journals being mounted upon supports for rotation. Typical bearings have two main components; a steel base for mounting to the support and a bearing pad or surface for contact with the mill journal. These mill bearings are installed between the mill journals and the supports so that the mill journals rotate on the bearing pads during operation of the grinding mill.”

This portion of the background explains what the '604 Patent states are “typical” bearings in grinding mills before the filing of the '604 Patent. *See* Ex. 1001, 1:58-64.

23. Figure 1 of the '604 Patent illustrates such a typical grinding mill:

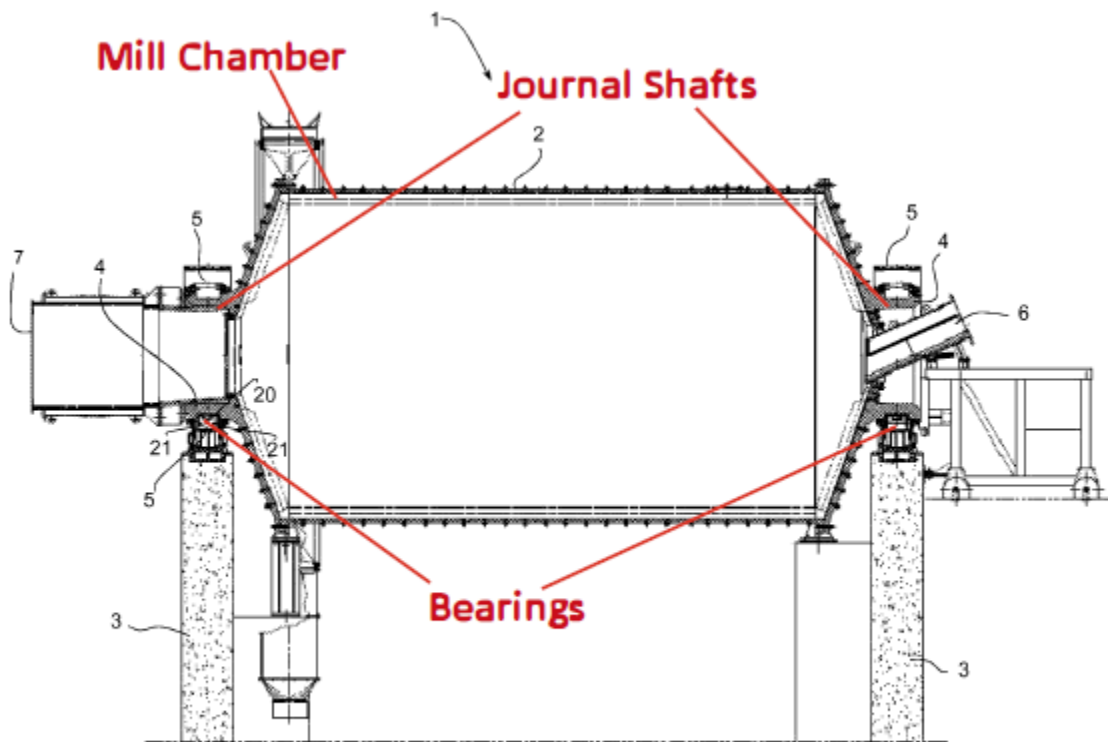


Fig. 1

24. The next paragraph of the Background continues to describe technology that was, at the time of the filing, “currently in use” (i.e., known to

persons of ordinary skill in the art). *See* Ex. 1001, 1:66. Specifically, the paragraph states that the patent owner had

“developed a hydrostatic pad bearing system for grinding mills that is currently in use. In this hydrostatic pad bearing system, an external oil supply system pumps high-pressure oil to recesses machined into the bearing so that the oil forms a thin film on the bearing pad surface. The resultant hydraulic pressure is sufficient to completely lift the mill journal off the hydrostatic pads and separate the sliding surfaces. Thus, mill actually ‘floats’ on a film of oil between journal and bearing. As such the bearing will operate under both static and dynamic conditions. Since the surfaces are completely separated and the bearing is self-aligning there is no metal-to-metal contact between the bearing surface and the mill journal due to the oil film, thus resulting in only low friction. Consequently, maintaining the oil film between the surfaces means that there is virtually no wear in the bearing.” *See* Ex. 1001, 1:65 – 2:1-13.

25. The above-referenced system was known to those skilled in the art prior to the filing of the ’604 Patent as acknowledged in the patent in that it states the technology was “currently in use”.

26. The next paragraph of the Background notes some of the disadvantages of fluid bearings that the ’604 Patent states are “currently in use”:

“Despite the advantages conferred by this hydrostatic bearing system, a loss of oil pressure (and thus a reduction in the oil film thickness) can cause failure of the bearings, leading to damage to the bearing pad and/or the mill journal. For example, it can take a few seconds for a grinding mill to stop turning in the event of a power failure, and when this happens there is a high risk of damage to the mill bearing pads or journal surfaces due to a loss of oil reducing the oil film thickness, thereby bringing the journal and bearings into direct metal to metal contact. The consequential downtime for replacement of any damaged bearings and/or journals severely impairs operation of the mill, reducing its efficiency.” *See* Ex. 1001, 2:13-25.

Put plainly, if the oil pressure system does not function properly, the mill journal will grind on the bearing surface and can cause damage and a potential shutdown of the equipment.

27. The Background of the '604 Patent also describes one solution to this problem, explaining how existing lubrication systems use pressure accumulators to store and deliver the high-pressure fluid required to keep the static or dynamic oil lubrication bearings functional during a power failure. *See Ex. 1001, 2:26-34.*

28. The Background also provides additional information about how fluid bearings were designed prior to the filing of the '604 Patent and problems with the design related to maintenance. Specifically, the '604 Patent states:

“Typically, to manufacture hydrostatic bearings, the recesses are machined into the steel base and then the oil supply ports for delivering high pressure oil to the recesses are then drilled into the base. Bronze is spray welded or cast onto the relevant parts of the steel base to form the bearing pad or lining. Spray welding enables the bronze metal to form a seal with the base. White metal may be used instead of bronze, but is cast onto the base. Due to this manufacturing process, the repair and/or refurbishment of these bearings involves initially cleaning the damaged bearing surface, machining any parts of the steel base and either spray welding the bronze or re-casting the bronze/white metal. This repair process cannot be performed on-site but requires the bearing to be returned to the manufacturer. Consequently, mills must keep a sufficient stock of spare bearings to account for the absence of damaged bearings being repaired. This adds to the maintenance costs of the mill. *See Ex. 1001, 2:35-52.*

29. The Background then notes the objects or purposes of the invention to overcome these alleged disadvantages. Namely, “to provide improved fluid bearings for mills that are more tolerant to the loss of oil film, distortions in the journal, require less strict manufacturing tolerances, can easily be repaired, [and]

minimize waste and reduce or eliminate the need for pressure accumulators.” *See* Ex. 1001, 2:56-62.

30. The alleged “improved fluid bearings” purport to include “a bearing assembly for supporting a journal of a grinding mill body, comprising a frame and a plurality of fluid bearings, said fluid bearings each comprising a polymer bearing pad mounted to a base, [the] polymer bearing pad comprising an outer surface, at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and mounting means for securely mounting said polymer bearing pad to said base” Ex. 1001, 2:67-3:8. Thus, in its own words, the ’604 Patent states that at least one part of the invention is the use of a polymer bearing pad instead of a steel or bronze bearing pad.

Description of Technology

31. Figures 5 and 6 of the ’604 Patent, reproduced below, show cross-sectional views of a radial hydrostatic bearing 11, which are annotated in the below illustration of these figures. Ex. 1001, 8:34-39, 9:40-42.

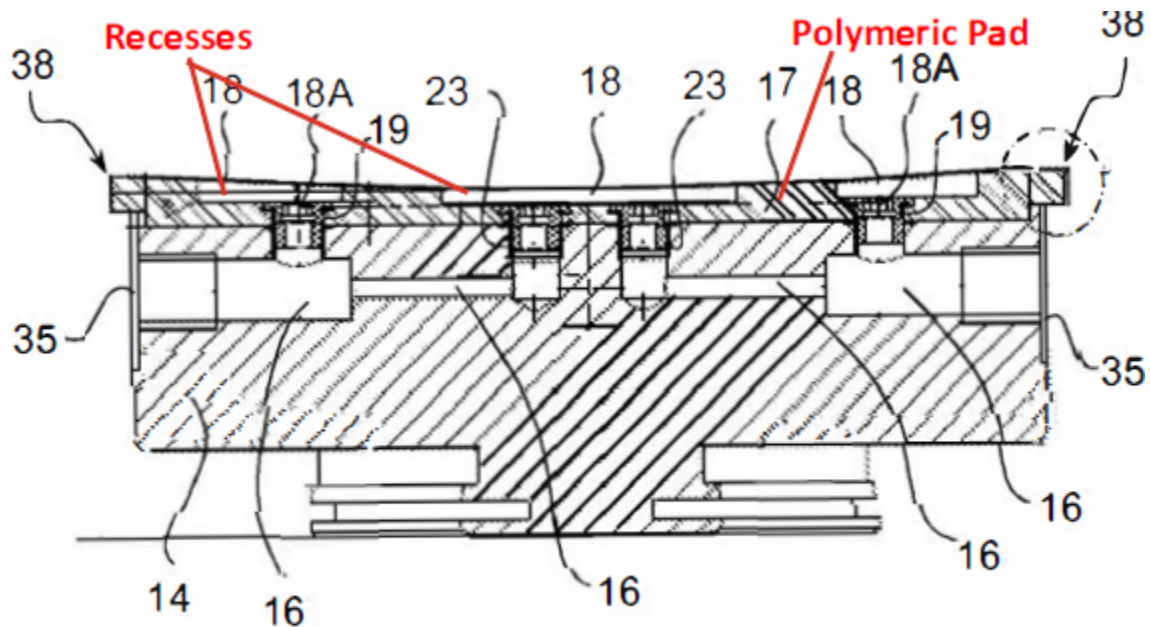
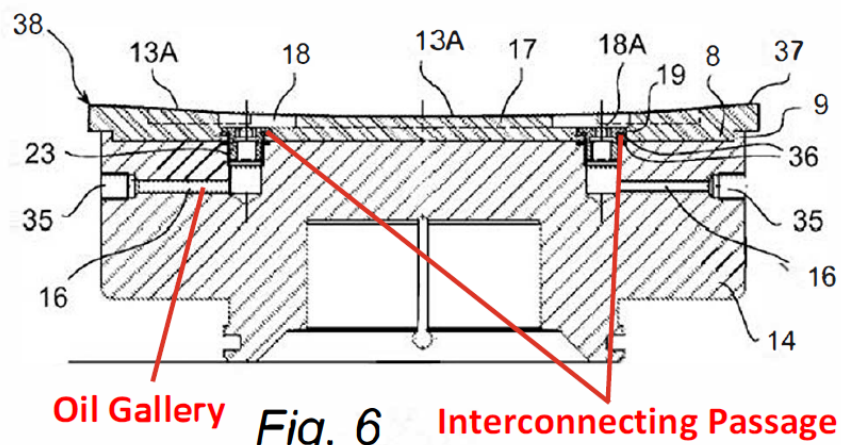


Fig. 5



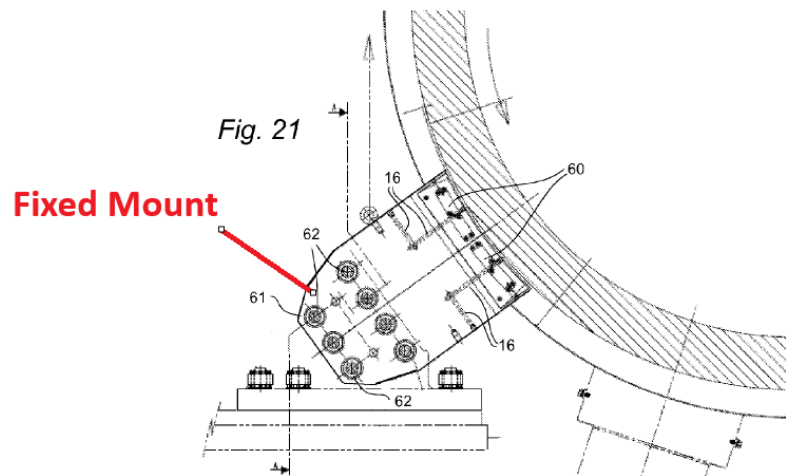
32. Figures 5 and 6 show “[a] polymer pad 17 is mountable to the base 14 of each radial hydrostatic bearing 11 via a mounting portion 8.” Ex. 1001, 9:54-55. “The polymer bearing pad 17 has at least one recess 18 for receiving oil from the oil gallery 16 and distributing it to the outer surface 13A to act as a lubricating fluid between the radial hydrostatic bearing 11 and the journal shafts 4.” Ex. 1001, 10:3-6. The “recess 18 is fluidly connected to the oil gallery 16 via interconnecting

passage 19.” Ex. 1001, 10:7-8. The “oil gallery 16” is “in fluid communication with the oil supply port 15.” Ex. 1001, 9:44-45.

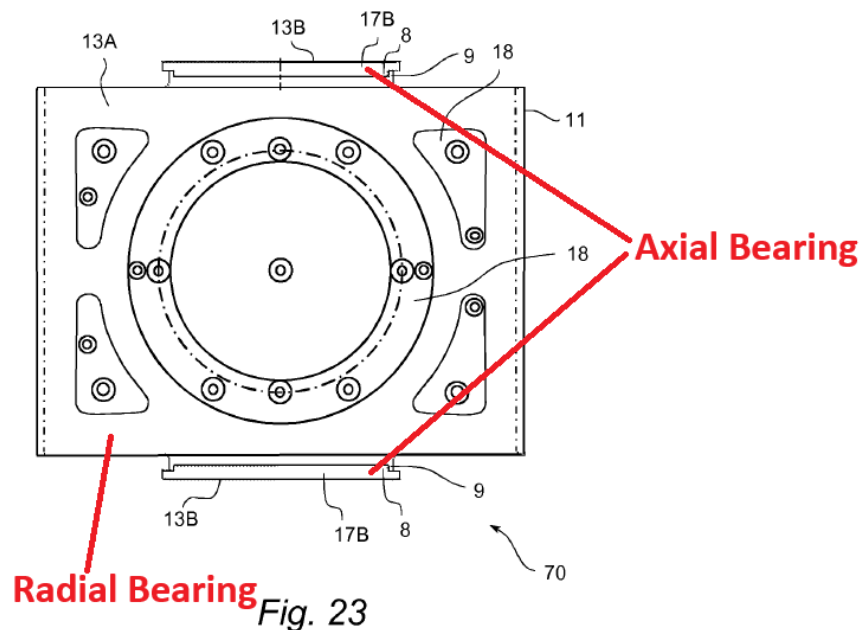
33. The oil passage 19 can be defined by a hollow bolt 23. Ex. 1001, 10:52-11:14. Each bolt has a bore 24 for the conveyance of lubricant from oil galleries 16 to recesses 18. *Id.* The fasteners (e.g. bolts 23) can be locked into place via locking elements, which can include “liquid thread locker, a Scotch key, a non-loosening thread, a non-loosening washer, or similar locking device.” Ex. 1001, 17:45-50. A “mounting portion 8 is a protrusion extending from a mounting surface opposite the outer surface 13A to engage flanges 9 located at respective outer edges or sides of the base 14.” Ex. 1001, 9:56-59.

34. The ’604 Patent further explains that the base 14 may either “self adjust” to any changes in the angular position of the journals 4 during operation of the mill 1 using a “spherical seat.” Ex. 1001, 9:45-51. As the ’604 Patent states, however, none of the figures of the ’604 Patent depict any structure that provides a self-adjusting feature, including the “spherical seat.” Ex. 1001, 9:45-51. This is likely because spherical seats for hydraulic bearings were so well known and common place in the art, as will be discussed below.

35. The ’604 Patent states that the base 14 may also be “fixedly mounted.” Ex. 1001, 16:15-19. Figure 21, below, shows a fluid bearing with a fixed mount.



36. As shown in annotated Figure 23 below, the '604 Patent further explains that its fluid bearing can include a multidirectional fluid bearing 70 that provides both a radial bearing with a polymer pad 17A and two axial bearings each with a polymer pad 17B.



VI. PATENT CLAIMS

37. Because I reference different claims in this declaration, I have presented them below for ease of reference.

1. A bearing assembly for supporting a journal of a grinding mill body, comprising a frame and a plurality of fluid bearings, said fluid bearings each comprising a polymer bearing pad mounted to a base, said polymer bearing pad comprising an outer surface, at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and mounting element for securely mounting said polymer bearing pad to said base, said base also comprising at least one lubricating fluid supply port in fluid communication with said at least one passage, wherein said base is mounted to said frame so that said fluid bearings self adjust to changes in the angular position of the journal during operation of said grinding mill body.

2. The bearing assembly of claim 1, wherein said mounting element comprises a mounting portion extending from said polymer bearing pad, said mounting portion comprising a protrusion from a mounting surface opposite to said outer surface for engaging a flange of said base, said flange being located at an outer edge of said base.

3. The bearing assembly of claim 1, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base; said at least one recess comprises a locking tab for retaining a head portion of said fastener within said at least one recess and said at least one fastener comprises a bore for conveying lubricating fluid from said at least one passage to said at least one recess.

4. The bearing assembly of claim 1, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base, said bearing assembly further comprising a locking element for retaining said at least one fastener within said at least one recess.

5. The bearing assembly of claim 1, wherein said polymer bearing pad substantially covers an outer surface of said base to create a fluid seal between said polymer bearing pad and said base.

6. The bearing assembly of claim 1, further comprising a chamfer at an outer edge for retaining lubricating fluid at said outer edge and transferring said lubricating fluid to a journal, wherein said chamfer has an outer edge that is displaced from a journal when said journal engages said polymer pad.

7. The bearing assembly of claim 1, said at least one recess of said polymer bearing pad comprises at least one interconnecting passage for fluidly connecting said at least one recess to said at least one passage of said base.

8. The bearing assembly of claim 1, further comprising a plurality of said polymer bearing pads, wherein said respective outer surfaces of said polymer pads form a substantially uniform bearing surface for said journal, wherein each of said polymer bearing pads comprises at least one lateral connecting portion for mutual engagement with a corresponding lateral connecting portion of an adjacent polymer bearing pad.

9. The bearing assembly of claim 1, wherein said base further comprises a first surface, a second surface, a plurality of said at least one passages and a plurality of said at least one lubricating fluid supply ports, wherein said at least one passages are in fluid communication with said at least one lubricating fluid supply ports, said first surface and said second surface, and

wherein there is a plurality of said polymer bearing pads, a first of said polymer bearing pads being mountable to said first surface and a second of said polymer bearing pads being mountable to said second surface,

wherein said first polymer bearing pad comprises a first outer surface and at least one recess for receiving lubricating fluid from at least one of said plurality of passages and distributing said lubricating fluid to said first outer surface, and said second polymer bearing pad comprises a second outer surface and at least one recess for receiving lubricating fluid at least one of said plurality of passages and distributing said lubricating fluid to said second outer surface,

wherein said first outer surface is partially curved such that said first polymer bearing pad acts as a radial hydrostatic bearing and said second outer surface is substantially planar such that said second polymer bearing pad acts as an axial bearing.

10. The bearing assembly of claim 1, wherein said polymer bearing pad is removably mounted to said base.

11. A bearing assembly for supporting a journal of a grinding mill body, comprising a frame and a plurality of fluid bearings, said fluid bearings each comprising a polymer bearing pad mounted to a base, said polymer bearing pad comprising an outer surface, at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and mounting element for securely mounting said polymer bearing pad to said base, said base also comprising at least one lubricating fluid supply port in fluid communication with said at least one passage, wherein said base is fixedly mounted to said frame.

12. The bearing assembly of claim 11, wherein said mounting element comprises a mounting portion extending from said polymer bearing pad, said mounting portion comprising a protrusion from a mounting surface opposite to said outer surface for engaging a flange located at an outer edge of said base.

13. The bearing assembly of claim 11, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base; said at least one recess comprises a locking tab for retaining a head portion of said fastener within said at least one recess and said at least one fastener comprising a bore for conveying lubricating fluid from said at least one passage to said at least one recess.

14. The bearing assembly of claim 11, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base, said bearing assembly further comprising a locking element for retaining said at least one fastener within said at least one recess.

15. The bearing assembly of claim 11, wherein said polymer bearing pad substantially covers an outer surface of said base to create a fluid seal between said polymer bearing pad and said base.

16. The bearing assembly of claim 11, further comprising a chamfer at an outer edge for retaining lubricating fluid at said outer edge and transferring said lubricating fluid to a journal, said chamfer having an outer edge that is displaced from a journal when said journal engages said polymer pad.

17. The bearing assembly of claim 11, said at least one recess of said polymer bearing pad comprises at least one interconnecting passage for fluidly connecting said at least one recess to said at least one passage of said base.

18. The bearing assembly of claim 11, further comprising a plurality of said polymer bearing pads, wherein said respective outer surfaces of said polymer pads form a substantially uniform bearing surface for said journal, wherein each of said polymer bearing pads comprises at least one lateral connecting portion for mutual engagement with a corresponding lateral connecting portion of an adjacent polymer bearing pad.

19. The bearing assembly of claim 11, wherein said base further comprises a first surface, a second surface, a plurality of said at least one passages and a plurality of said at least one lubricating fluid supply ports, wherein said at least one passages are in fluid communication with said at least one lubricating fluid supply ports, said first surface and said second surface, and

wherein there is a plurality of said polymer bearing pads, a first of said polymer bearing pads being mountable to said first surface and a second of said polymer bearing pads being mountable to said second surface,

wherein said first polymer bearing pad comprises a first outer surface and at least one recess for receiving lubricating fluid from at least one of said plurality of passages and distributing said lubricating fluid to said first outer surface, and said second polymer bearing pad comprises a second outer surface and at least one recess for receiving lubricating fluid at least one of said plurality of passages and distributing said lubricating fluid to said second outer surface,

wherein said first outer surface is partially curved such that said first polymer bearing pad acts as a radial hydrostatic bearing and said second outer surface is substantially planar such that said second polymer bearing pad acts as an axial bearing.

20. The bearing assembly of claim 11, wherein said polymer bearing pad is removably mounted to said base.

21. A multidirectional fluid bearing for a journal, comprising:
a base having a first surface orthogonal to a second surface, one or more lubricating fluid supply ports and a plurality of passages in fluid communication with said lubricating fluid supply ports, said first surface and said second surface, a first polymer bearing pad mountable to said first surface, said polymer bearing pad having a first outer surface and at least one recess for receiving lubricating fluid from at least one of said plurality of passages and distributing said lubricating fluid to said first outer surface, and

a second polymer bearing pad mountable to said second surface, said second polymer bearing pad having a second outer surface and at least one recess for receiving lubricating fluid at least one of said plurality of passages and distributing said lubricating fluid to said second outer surface,

wherein at least one of said first and second polymer bearing pads comprises at least one opening for receiving at least one fastener for mounting said at least one polymer bearing pad to said base, wherein said at least one recess comprises a locking tab for retaining a head portion of said fastener within said at least one recess, said head portion being tapered to facilitate retention of said at least one fastener within said at least one recess by said locking tab, and wherein said at least one fastener comprises a bore for conveying lubricating fluid from said at least one passage to said at least one recess, said at least one fastener being partially received in said at least one passage.

22. The multidirectional fluid bearing of claim 21, said first polymer bearing pad substantially covers said first surface and said second polymer bearing pad substantially covers said second surface to respectively create fluid seals between said first and second polymer bearing pads and said base.

23. The multidirectional fluid bearing of claim 21, wherein at least one of said first and second polymer bearing pads comprises a chamfer at an outer edge for retaining lubricating fluid at said outer edge and transferring said lubricating fluid to a journal, wherein said chamfer has an outer edge that is displaced from a journal when said journal engages said at least one polymer bearing pad.

24. The multidirectional fluid bearing of claim 21, wherein there is a plurality of at least one of said first and second polymer bearing pads, wherein said respective outer surfaces of said plurality of at least one of said first and second polymer pads form a substantially uniform bearing surface for said journal, wherein each of said plurality of at least one of said first and second polymer bearing pads comprises at least one lateral connecting portion for mutual engagement with a corresponding lateral connecting portion of an adjacent polymer bearing pad.

25. The multidirectional fluid bearing of claim 21, wherein said base comprises at least one flange for engagement with a mounting portion of at least one of said first and second polymer bearing pads to securely mount said at least one polymer bearing pad to said base, said flange being located at an outer edge of said base.

26. The multidirectional fluid bearing of claim 21, wherein said first outer surface is partially curved such that said first polymer bearing pad acts as a radial hydrostatic bearing and said second outer surface is substantially planar such that said second polymer bearing pad acts as an axial bearing.

VII. PORTIONS OF PATENT FILE HISTORY

38. In an Office Action mailed on April 27, 2016, the Examiner rejected the claims then numbered as 63, 64 and 69 as obvious under pre-AIA 35 U.S.C. § 103 over U.K. Patent No. GB1508384 (“GB384”; Ex. 1003) in view of U.S. Patent Publication No. 2012/0099993 (“the ‘993 publication”; Ex. 1013). *See* Prosecution History of the ‘604 Patent, Ex. 1002, p. 45.

39. In support of the rejection of prosecution claim 63 (which eventually became claim 21), the Examiner found that GB384 discloses all of the elements of the claim except that it did “not disclose the antifriction material as [a] polymer.” Ex. 1002, p. 46. The Examiner found that the ‘993 publication’s disclosure of “a fluid bearing for a journal, in which the bearing pad lining comprises a polymer lining” supplied this missing teaching. Ex. 1002, p. 46. The Examiner then found the claim was obvious because “[i]t would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize known antifriction material in [GB384], including polymer, as taught by [the ‘993 publication] as exhibiting favorable stability and stiffness, as well as other beneficial properties to fluid bearings.” Ex. 1002, p. 46.

40. In support of the rejection of what was claim 64 (which eventually became claim 5), the Examiner found that GB384 “discloses said first antifriction material bearing pad substantially covers said first surface and said second antifriction material bearing pad substantially covers said second surface to

respectively create fluid seals between said first and second antifriction material bearing pads and said base.” Ex. 1002, p. 46.

41. With respect to the rejection of what was claim 69 (which eventually became claim 26), the Examiner found that GB384 “discloses the first outer surface being partially curved such that the first bearing pad acts as a radial hydrostatic bearing and the second outer surface is substantially planar such that the second bearing pad acts as an axial bearing (Figure 5).” Ex. 1002, p. 46.

42. Patent Owner amended what was then claim 63 (which eventually became claim 21) by adding the elements of “at least one fastener,” a “locking tab,” and a “bore” as shown in the underlined portion below.

63. (currently amended) A multidirectional fluid bearing for a journal, comprising:

a base having a first surface orthogonal to a second surface, one or more lubricating fluid supply ports and a plurality of passages in fluid communication with said lubricating fluid supply ports, said first surface and said second surface,

a first polymer bearing pad mountable to said first surface, said polymer bearing pad having a first outer surface and at least one recess for receiving lubricating fluid from at least one of said plurality of passages and distributing said lubricating fluid to said first outer surface, and

a second polymer bearing pad mountable to said second surface, said second polymer bearing pad having a second outer surface and at least one recess for receiving lubricating fluid at least one of said plurality of passages and distributing said lubricating fluid to said second outer surface,

wherein at least one of said first and second polymer bearing pads comprises at least one opening for receiving at least one fastener for mounting said at least one polymer bearing pad to said base, wherein said at least one recess comprises a locking tab for retaining a head portion of said fastener within said at least one recess, said head portion being tapered to facilitate retention of said at least one fastener within said at least one recess by said locking tab, and wherein said at least one fastener comprises a bore for conveying lubricating fluid from said at least one passage to said at least one recess, said at least one fastener being partially received in said at least one passage.

Ex. 1002, pp. 28-29 (underlining in original).

VIII. PATENT CLAIM CONSTRUCTION

43. I am informed that patent claims are given their ordinary and customary meaning they would have to the person of ordinary skill. One exception to that is if the claims are given some special meaning in the patent or by the patent owner during its interactions with the patent office. I did not see any terms in the '604 Patent that had any kind of meaning other than what would be ordinarily understood by the person of ordinary skill in the art (POSITA). To the extent there is any dispute about what certain terms might mean, I have provided an explanation of what certain terms mean to the person of ordinary skill in the art with reference to how the term is used in the '604 Patent.

a. “bearing pad” and “polymer bearing pad”

A POSITA would understand the term “bearing pad” to mean a pad or a lining that is placed on an outer surface of a bearing to provide a low-friction surface between the bearing base or shoe and a rotating body or journal. *See* Ex. 1001, 2:35-52. A POSITA would understand the term “polymer bearing pad” to mean a bearing pad “made from any suitable polymer, including, but not limited

to, polyetheretherketone (PEEK), PEEK composites, polyamide, polyamide composites, polyamide-imide and polyamide-imide composites.” Ex. 1001, 4:14-19.

b. “base”

A POSITA would understand the term “base” to mean the portion of the bearing between the support and the journal upon which a bearing lining or bearing pad is placed. Ex. 1001, 1:57-64, 4:23-30. The ’604 Patent describes the “base” as being either (i) mounted to a frame so that the bearings “self adjust” (Ex. 1001, 3:11-13) or (ii) “fixedly mounted” to the frame. Ex. 1001, 3:26-27. In the art, the base is often referred to as a shoe. The terms base and shoe may be used interchangeably throughout this declaration.

c. “fluid bearings”

A POSITA would understand the term “fluid bearings” to include, for example, hydrostatic or hydrodynamic bearings designed to transport a lubricating fluid, e.g. oil, to an outer surface of such bearing. Ex. 1001, 9:35-39. An oil supply system pumps high-pressure oil to recesses machined into the fluid bearings so that the oil forms a thin film on the bearing pad surface so that the mill “floats” on a film of oil between journal and bearing. Ex. 1001, 1:66-2:6.

d. “mounting element”

A “mounting element” is not discussed specifically in the specification though it does appear in the claims. Based on my reading of the specification and claims, it appears that the mounting element would include any structure of the bearing pad that “can be arranged in any manner that would act to hold captive the bearing pad 17.” Ex. 1001, 9:62-65. In certain of the claims, however, a mounting element has a “protrusion extending from a mounting surface opposite the outer surface 13A” of

a polymer bearing pad that is designed “to engage flanges 9 located at respective outer edges or sides of the base 14.” Ex. 1001, 9:55-59.

e. “at least one passage of said base”

A POSITA would understand the term “at least one passage of said base” to mean a passage within the base that fluidly connects “recess 18” of a “bearing pad 17” to a supply of hydraulic fluid. Ex. 1001, 10:24-25, *see also id.* at 10:5-11 and 10:30-35.

f. “at least one lubricating fluid supply port”

A POSITA would understand the term “at least one lubricating fluid supply port” to mean an opening in an outside portion of the base that is in fluid communication with an external supply of hydraulic fluid. Ex. 1001, 12:5-14. *See also*, <https://www.merriam-webster.com/dictionary/port> attached as Exhibit 1025. (where port includes “an opening (as in a valve seat or valve face) for intake or exhaust of a fluid.”)

g. “self-adjust”

A POSITA would understand that the term “self-adjust” refers to the ability of the bearings to move in response to changes in the angular position of the journal during operation. Ex. 1001, 3:10-14. The ’604 Patent describes this feature as “typically achieved by having the base 14 mounted on a spherical seat (not shown) to permit self-adjustment to any angular movement of the journals 4.” Ex. 1001, 9:49-51.

h. “fixedly mounted”

A POSITA would understand that the term “fixedly mounted” refers to a base of a bearing that is securely attached or affixed in a position to a frame such that it is not intended to move or pivot during operation. Ex. 1001, 19:15-25; Figure 21.

i. “chamfer”

A POSITA would understand the term “chamfer” to refers to an outer edge that is sloped, changing the angle of a corner. According to the ’604 Patent, “[t]he chamfer 37 creates a lead-in and lead-out for the oil, especially when residual oil on the outer surfaces 13A, 13B must be relied upon for lubrication in the event of an unexpected loss of normal oil supply to the bearings 11, 12. The chamfer 37 inhibits or prevents oil being wiped off the journal 4, as would occur with a bearing having a sharp straight edge.” Ex. 1001, 13:61-67.

j. “locking tab”

A POSITA would understand that the term “locking tab” is a structure “for retaining the head portion 26 [of a fastener] within the recess 18” of a bearing pad. Ex. 1001, 11:10-12.

k. “locking element”

A POSITA would understand that the term “locking element” could be any device for helping retain a fastener within a recess of a bearing pad. The ’604 Patent discloses that a “locking element” may include “liquid thread locker, a Scotch key, a non-loosening thread, a non-loosening washer, or similar locking device.” Ex. 1001, 17:45-50.

l. “journal”

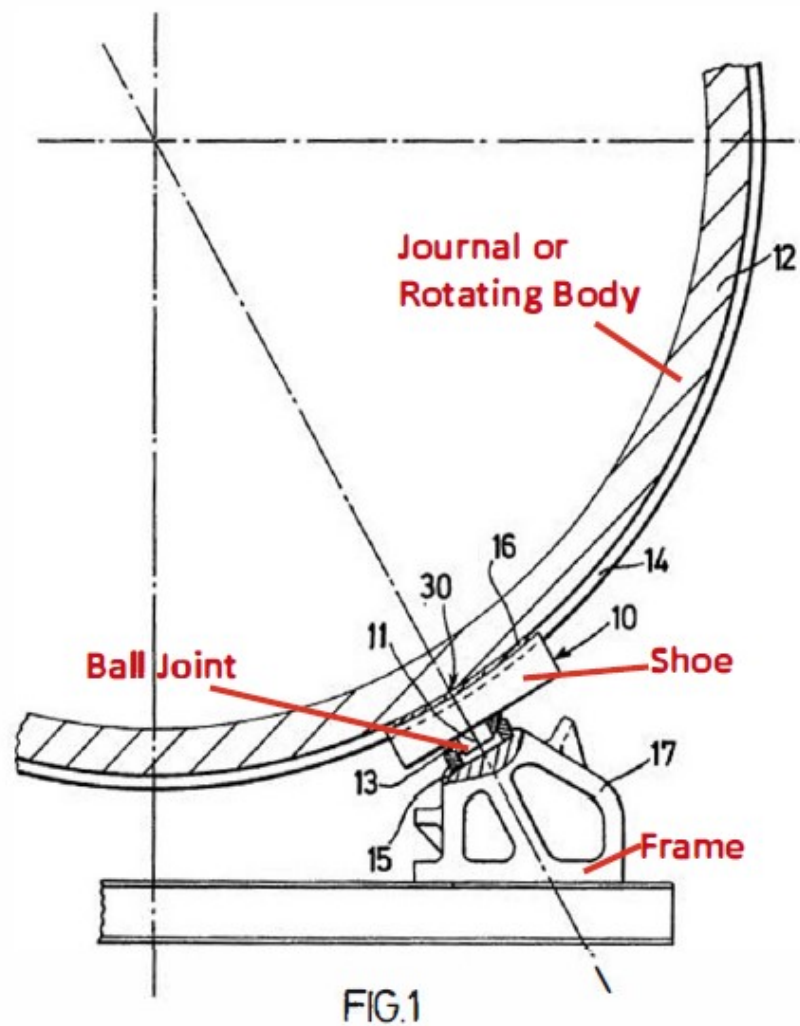
A POSITA would understand that a “journal” in the mechanical arts, is a portion of a shaft that rotates on a bearing. In the case of the ’604 Patent, “[a] grinding mill has a mill portion and two journal shafts, the journals being mounted on supports for rotation. Typical bearings have two main components; a steel base for mounting to the support and a bearing pad or surface for contact with the mill journal.” Ex. 1001, 1:57-61.

IX. OVERVIEW OF PRIOR ART

Ex. 1003 – U.K. Patent No. GB1508384 (“GB384”)

44. GB384 discloses a device for supporting a rotating body that is for use in conjunction with “bearings of tubular grinding mills.” Ex. 1003, 3:25-26. “In the present device for supporting a rotating body, when in use, lubrication of the relatively slidable surface of the shoe may be affected in known manner by means of oil introduced into a transverse channel extending substantially parallel to the axis of the rotating body formed on said surface and not opening on to sides of the shoe.” Ex. 1003, 1:59-66.

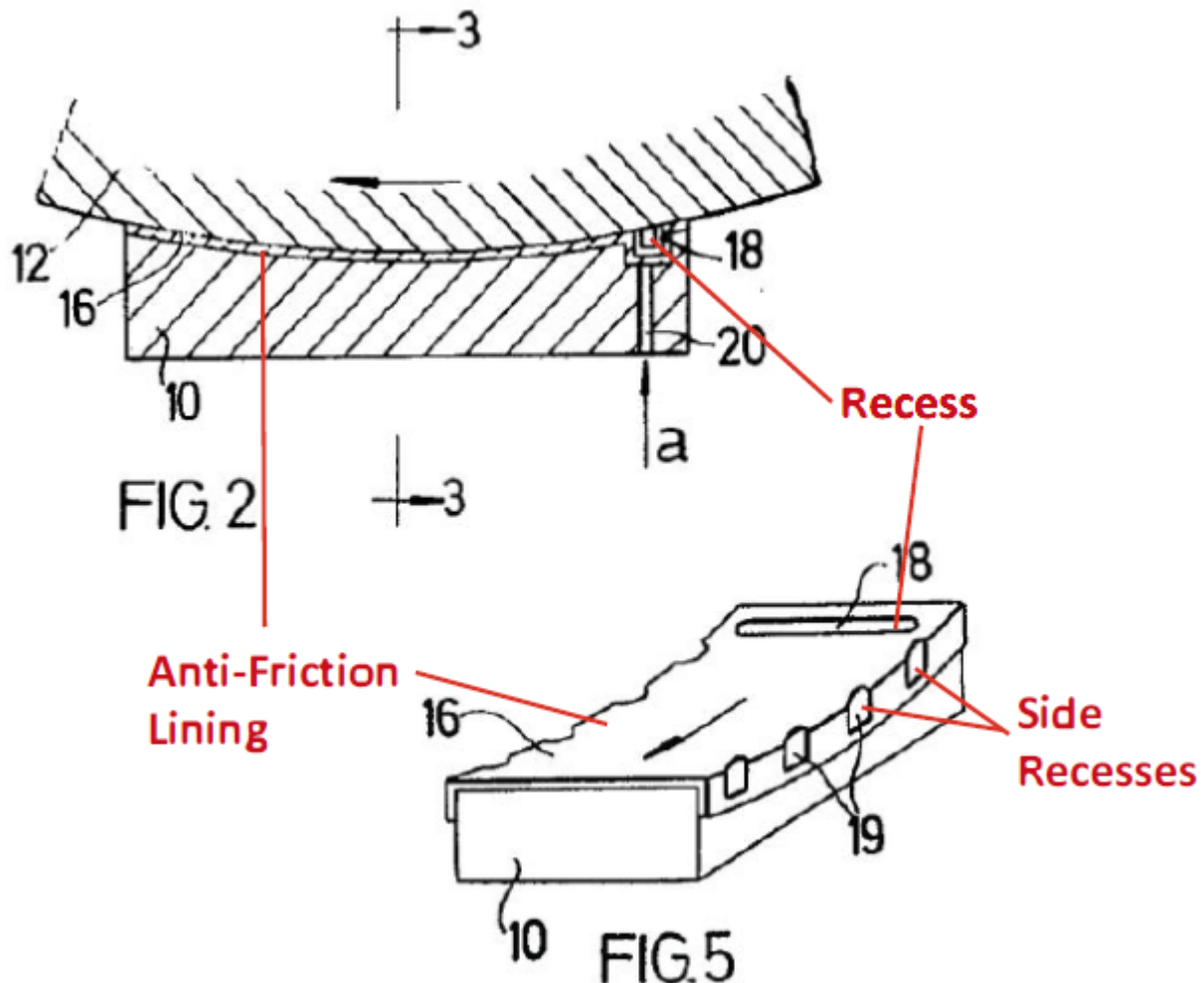
45. Annotated Figure 1 from GB384 shows a bearing assembly for supporting a journal (rotating body 12) that comprises a frame (frame 17) and a plurality of fluid bearings (shoe 10).



46. Annotated Figure 1 further shows a ball joint between the bearing base (shoe 10) and the frame (frame 17). Ex. 1003, 2:45-54. The ball joint includes member 13 that has “a part spherical lower surface . . . [that] bears on an upper, part-spherical surface of a seat 15 ...” Ex. 1003, 2:45-54. The ball joint allows the bearing (shoe 10) to self-adjust to changes in the angular position of the journal (rotating body 12). Ex. 1003, 1:19-44.

47. Figures 2 and 5, reproduced below, show that the upper face and the sides of the shoe 10 are covered with the “lining 16 of anti-friction material.” Ex.

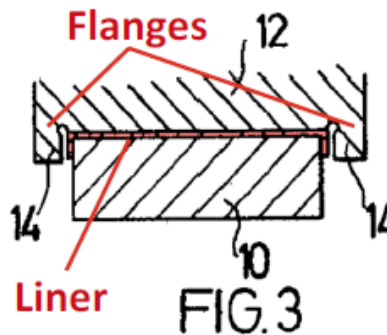
1003, 2:69-72 illustrating how orthogonal surfaces of the base (shoe 10) function as both a radial and axial bearing.

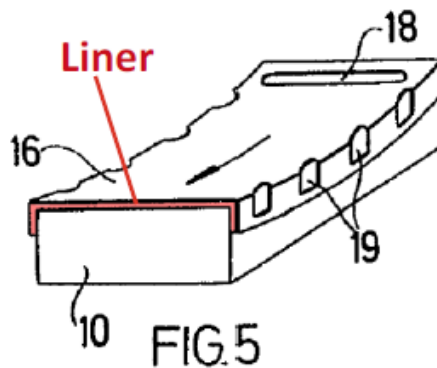


48. Figures 2 and 5 above further show that the bearing pad (lining 16) includes a recess (channel 18) for receiving lubricating fluid from at least one passage (duct 20) in fluid communication with a lubricating fluid supply port. Annotated Figures 2 and 5 further show that the lining 16 has side recesses 19 for forming containers for oil, which can be introduced via duct 20 and channel 18. Ex. 1003, 2:114-118; 2:79-81. These oil containers 19 are “recesses forming container for oil.” Ex. 1003, 2:1-2.

49. Because it covers both the upper surface and sides of the shoe 10, the lining 16 operates as both a radial and axial bearing. Ex. 1003, 2:42-45; 2:64-68. In addition, “[t]o take up axial forces, flanges or collars may, if desired be provided on the rotating body, and may be arranged with a small clearance at each side of the shoe. The lubrication of the sides of the shoe can then be ensured by means of two circumferential grooves formed at the junctions of the flanges or collars with the rotating body and two passages opening on the relatively slidable surface of the shoe and providing communication between the transverse channel and the two grooves, the cross-sectional areas of the orifices being partly defined by the slidable track of the rotating body...” Ex. 1003, 1:67-81.

50. Figure 3 of GB384 shows a cross section of the arrangement showing how the flanges 14 of the journal or rotating body 12 bound the sides of the shoe 10. Figure 5 shows the liner 16 extending over the side surfaces of the shoe to provide a bearing surface to interact with the flange 14 addressing axial forces.

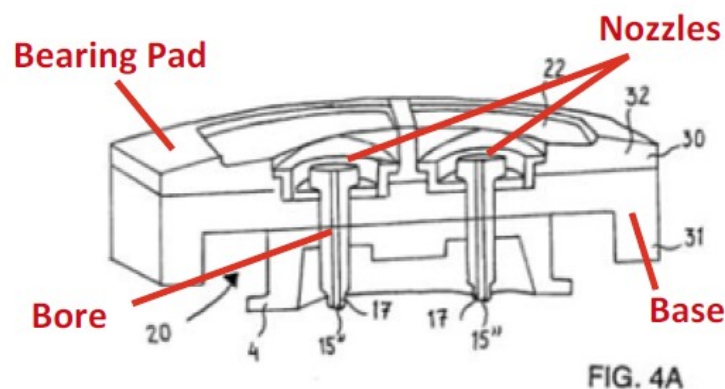




51. GB384 notes that “[b]y way of a variant, axial forces can be taken up by flanges of the shoes enclosing or bounding the slidable track of the rotating body.” Ex. 1003, 2:3-6. In other words, instead of the arrangement shown in Figures 3 and 5, for example, where the journal comprises flanges that extend over the sides of the bearing, the bearing itself has flanges extending upward and “enclosing or bounding” the sides of the journal.

Exs. 1004 & 1005 – DE102007039364 (“DE364”)

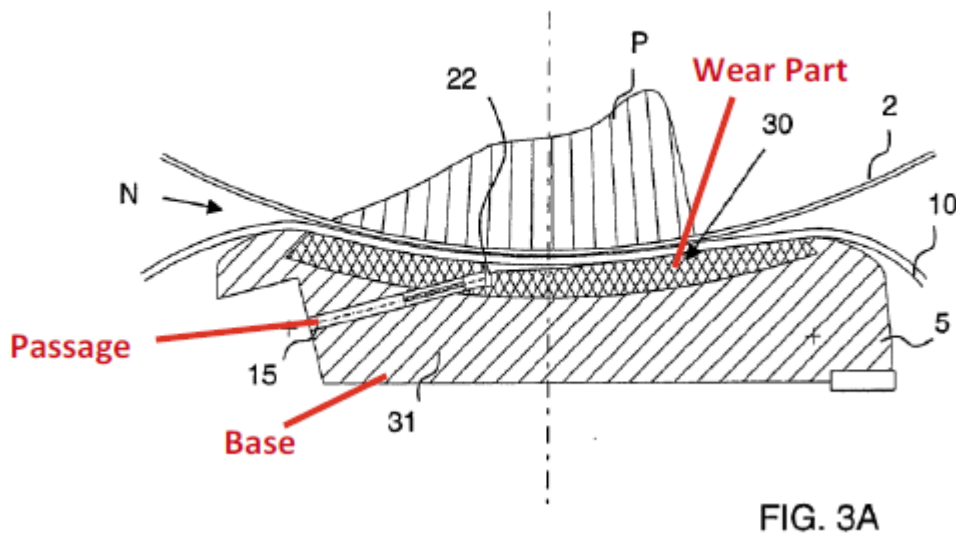
52. As shown in annotated Figure 4A, DE364 discloses a bearing assembly 20 having a bearing pad 30 mounted on a base 31.



53. DE364 explains that the bearing pad 30 and the base 31 “are attached to each other, for example by screws, adhesive, or rivets.” Ex. 1005, ¶ [0011]. As

shown in annotated Figure 4A, above, nozzles 17 with internal passages 15" allow oil to flow to the surface of the bearing pad 30.

54. The internal passage within the nozzles (i.e., the fasteners) are fluidly coupled to an oil passage 15 through the base or shoe of the bearing as shown below.



55. DE364 further states that the bearing pad 30 is formed of a polymer. For example, DE364 teaches that the “preferred material” for the bearing is “an advanced engineering plastic, for example polyetherketone (PEEK) polyamide-imide (PAI) or polyimide (PI), which is preferably supplemented with a small amount of polytetrafluoroethene (PTFE) and / or graphite to improve the sliding properties.” Ex. 1005, ¶[0011].

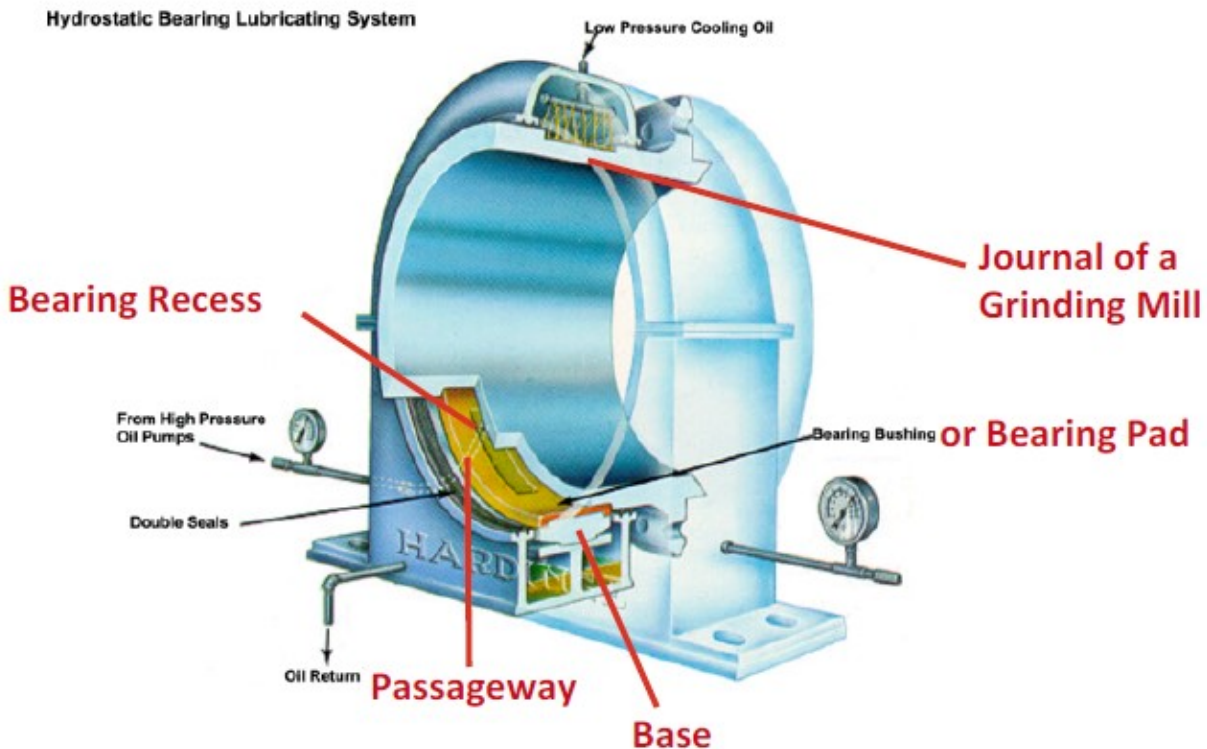
56. DE364 also states that the bearing pad 30 “can extend in one piece over the entire length of the shoe (i.e. in the direction of the CD) or be made of sections, in which case only the damaged section needs to be replaced.” Ex. 1005, ¶[0012].

57. While DE364 is related to a paper mill, the engineering principles addressed in DE364 are pertinent to those addressed in the '604 Patent. For

example, DE364 addresses fluid bearings, bearing surfaces, and all the attendant structures and systems that are used to operate a fluid bearing, particularly for supporting a rotation body. While it is not a bearing in a mining mill, it is operating in the same general field of technology and principles, and specifically relates to hydraulic fluid bearings.

Ex. 1006 – Metso Brochure No. 2060 02-02

58. Similar to what the Patent Owner asserts it had done prior to the filing of the '604 Patent (*see*, e.g., paragraphs ¶¶22-27), this reference depicts a hydrostatic mill journal that includes a fixed fluid bearing with a bearing pad (orange in image below referred to as a “bearing bushing”). The bearing pad has a recess connected to a fluid passageway (shown by dotted white lines) for oil (yellow) to flow to the wear surface of the bearing pad. The bearing pad has a recess which is in fluid communication with an opening. That opening is in fluid communication with the fluid passageway.

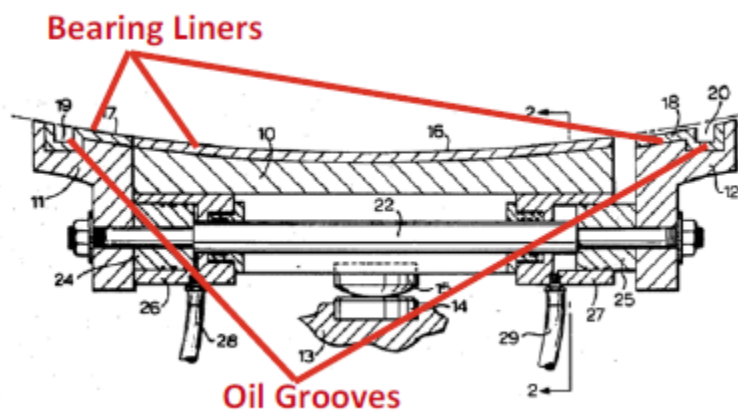


59. The Metso hydrostatic lubrication system shows a hydrostatic bearing system in use with a journal mill that is supported by journal supports. The pressurized system provides oil to an opening disposed within a recess located on the face of the bearing surface. That recess is coupled to a passageway (which is at least partially shown by the dotted white line) through the bearing liner and the bearing shoe. The back side of the shoe has a fluid port where the oil “From High Pressure Oil Pumps” is communicated through the bearing shoe. This allows the journal mill to “float” on the top of the bearing pad. The bearing pad is supported on a base.

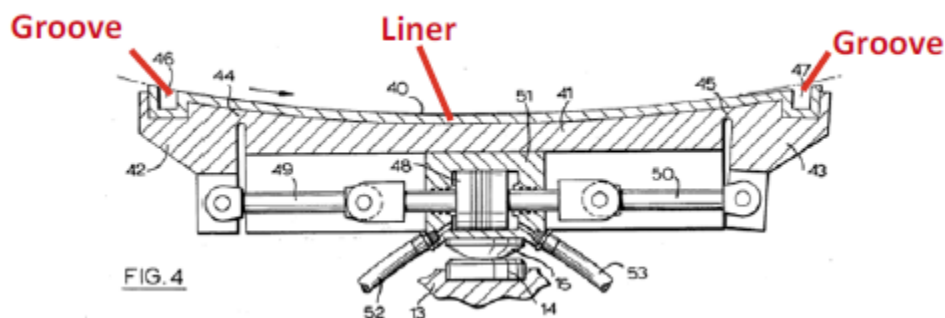
Ex. 1007 – U.S. 4,025,133

60. U.S. 4,025,133 to Cornford discloses “a bearing assembly for supporting a rotating journal having a cylindrical surface.” Ex. 1007, 2:21-22. The

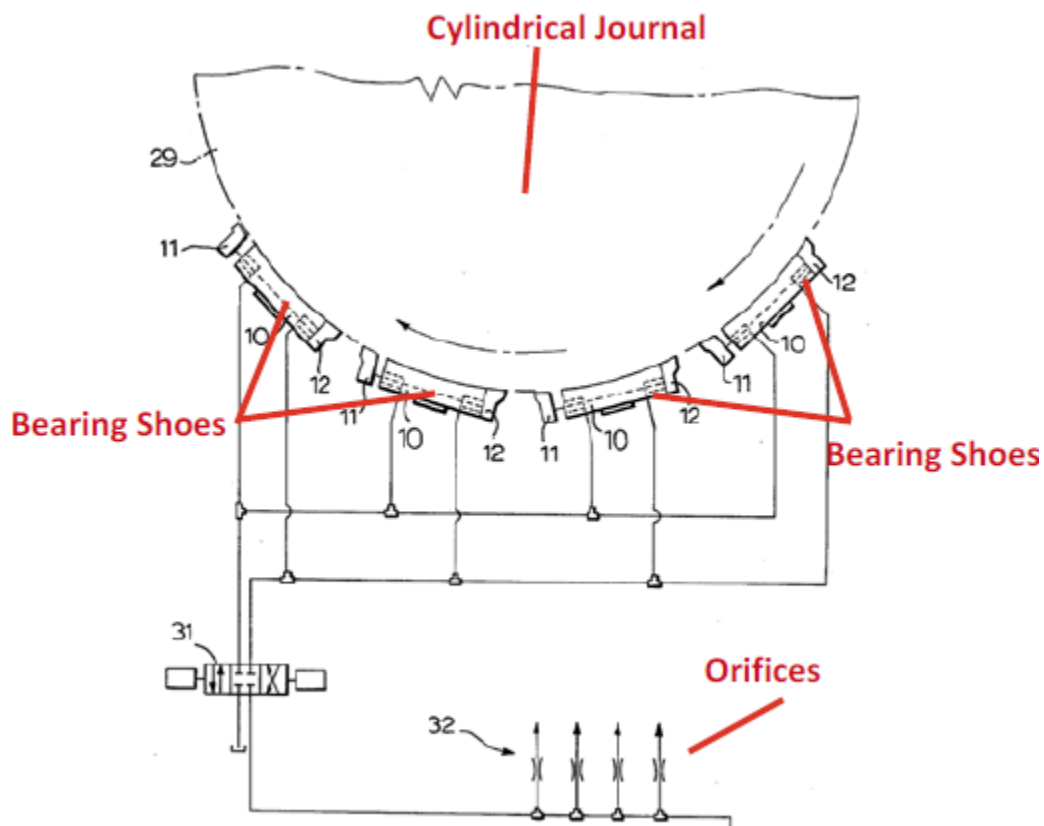
bearing assembly comprises a plurality of bearing liners (e.g., 16, 17, and 18) disposed upon “shoe members” 10, 11, and 12, respectively. *See id.*, 2:32-40. “As illustrated in FIG. 1, each of the auxiliary shoe members 11, 12 provides an oil groove 19, 20, to which oil is fed in the conventional manner so as to apply an oil film to the bearing face of the shoe to establish a hydrodynamic wedge of oil.” *Id.*, 2:39-45.



61. “In the alternative bearing shoe construction shown in FIG. 4, the bearing face is provided by a unitary lining 40, and the shoe itself is a unitary structure comprising a main shoe portion 41 and auxiliary shoe portions 42, 43 connected to the main shoe portion by thin bridge pieces 44, 45 which are capable of flexure. The end portions of the bearing face are formed with transverse oil grooves, 46, 47 as in the first construction.” *Id.*, 3:16-23.

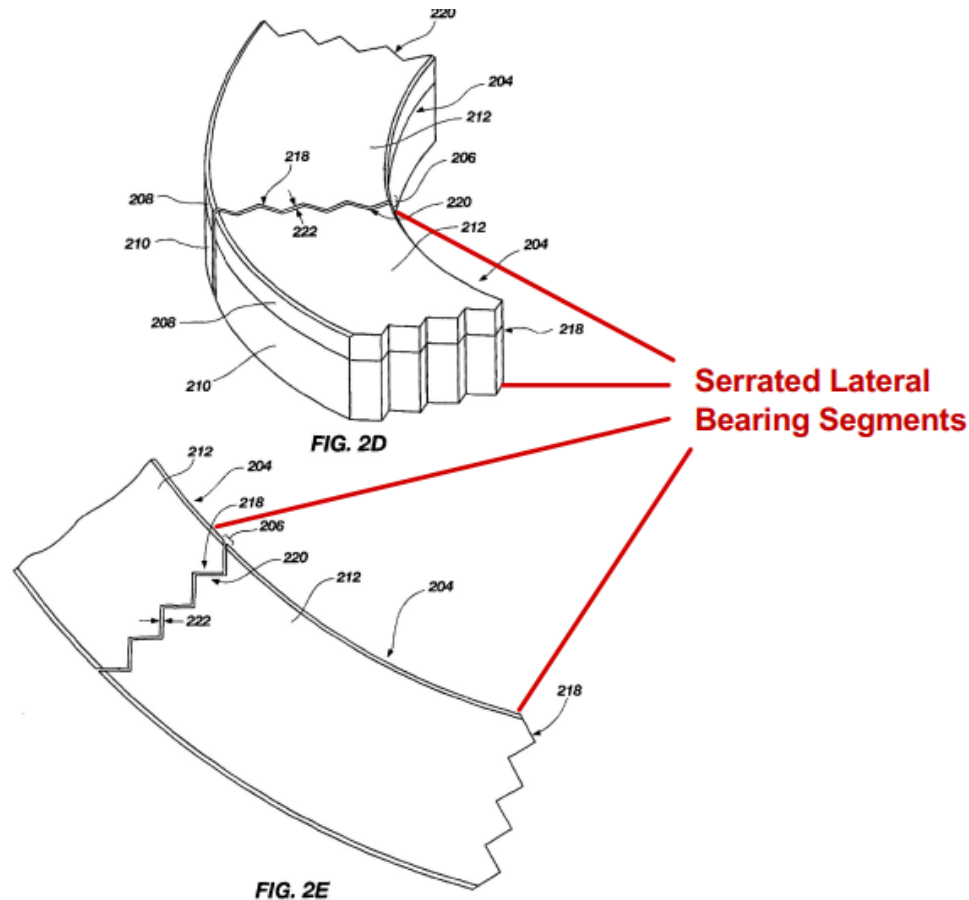


62. In the assembly shown in Figure 3, “the cylindrical journal 29 is supported by four bearing shoes of the construction illustrated in Figures 1 and 2. The system includes a hydraulic pressure source indicated diagrammatically at 30, and circuit means including a solenoid-operated selector valve 31 for selectively and alternatively connecting the hydraulic pressure source to the hydraulic rams of the bearing shoes whereby to displace the auxiliary shoe members 11, 12 to and from their operative positions. Lubricating oil for the bearing faces of the shoes may be derived from the pressure fluid circuit via orifices 32, or alternatively may be derived in any other manner.” *Id.*, 3:3-15. Figure 3 from the '133 Patent is shown below.



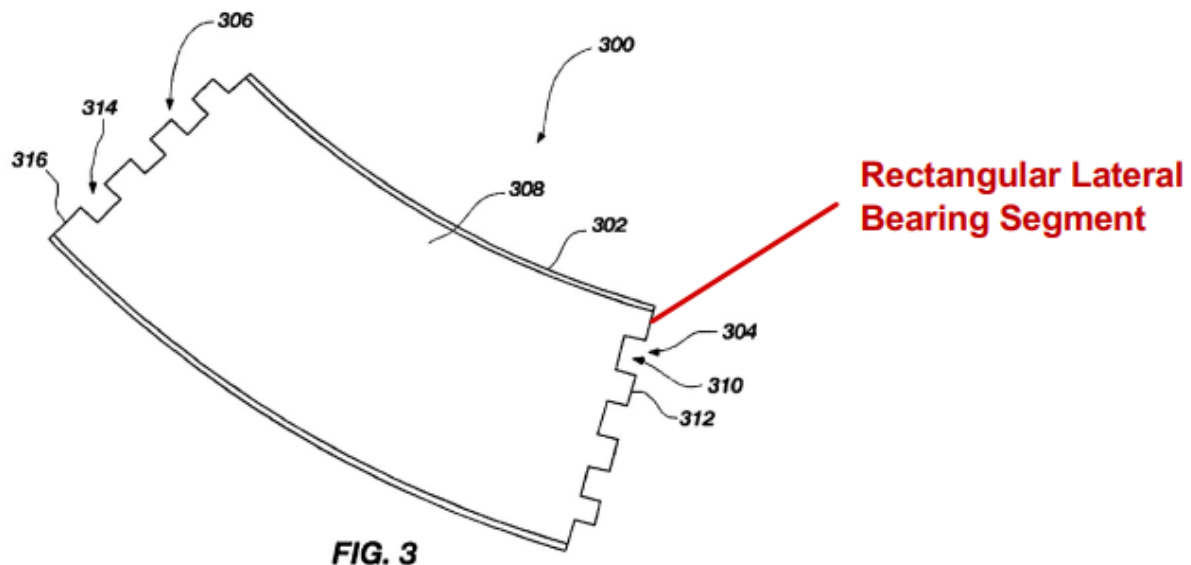
Ex. 1008 – U.S. 7,896,551

63. U.S. 7,896,551 to Cooley discloses a hydrodynamic thrust bearing assembly. “FIGS. 2D and 2E are isometric and plan views, respectively, that show the structure of the bearing segments 204 and the manner in which the bearing segments 204 may be assembled together. Each bearing segment 204 includes a first end region 218 and a second end region 220, with one of the bearing surfaces 212 extending therebetween. Each first end region 218 and second end region 220 may be configured to limit fluid from being able to leak through the seams 206 formed between adjacent bearing segments 204. For example, the second end region 220 of one bearing segment 204 may be configured to correspond with and, in some embodiments, may mesh with the first end region 218 of an adjacent bearing segment 204. In the illustrated embodiment, each first end region 218 and second end region 220 of the bearing segments 204 is configured with a serrated geometry. Such a configuration may provide a tortuous path to limit fluid leakage radially through the seams 206.” Ex. 1008, 4:46-63.



64. “In other embodiments of the present invention, each first end region 218 and second end region 220 may exhibit another, selected non-planar configuration that departs from the illustrated embodiment shown in FIGS. 2D and 2E. For example, FIG. 3 is a top plain view that shows a bearing segment 300 according to another embodiment of the present invention. The bearing segment 300 includes a superhard table 302 bonded to a substrate (not shown) including a first end region 304, a second end region 306, and a bearing surface 308 of the superhard table 302 extending between the first end region 304 and second end region 306. The first end region 304 comprises rectangular-shaped slots 310 and rectangular-shaped ridges 312 and the second end region 306 also includes rectangular-shaped slots 314 and rectangular-shaped ridges 316 to enable at least

partial interlocking of a first end region 304 of one bearing segment 300 with a second end region 306 of another, circumferentially-adjacent bearing segment 300.” Ex. 1008., 5:10-27.



65. The ‘551 patent discloses a hydraulic thrust bearing, not a bearing used in a horizontal mining mill. But the principles of engineering and fluid bearing design disclosed in the ‘551 patent are pertinent to the problems identified in the ‘604 Patent—namely, the use of laterally connecting bearing segments and their geometric design to minimize fluid leakage.

Ex. 1009 – Trygg et al., *Hydrostatic Shoe Bearing Eliminates Problems for Large Mills*, CIM (Canadian Institute of Mining, Metallurgy and Petroleum), Vol. 75, No. 841, 1982.

66. Trygg is an article published in 1982. Trygg shows both fixed-mounted and self-aligning fluid bearings for journals of grinding mills. Trygg discloses “hydrostatic shoe bearings” for use with “grinding mills.” Ex. 1009,

p.105. Trygg further teaches that when using hydrostatic shoe bearings, “the sliding surfaces are completely separated by means of oil under pressure.” Ex. 1009, p.105.

67. Annotated Figure 1 of Trygg, reproduced below, shows a bearing assembly for supporting a journal (girth ring) of a grinding mill body that comprises a plurality of fluid bearings (hydrostatic shoes) mounted to a frame.

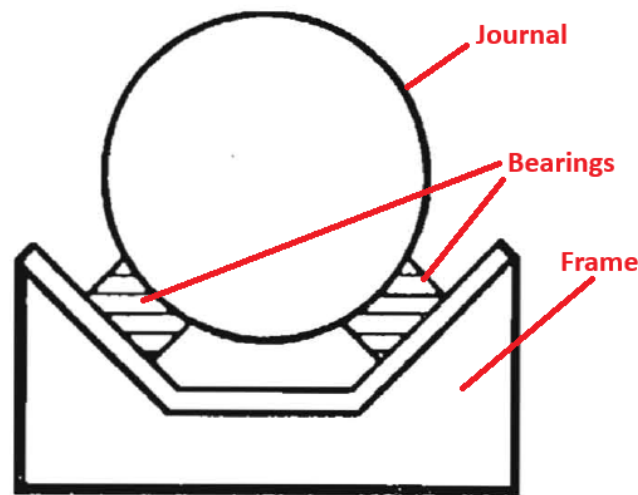


FIGURE 1. Radial position of girth ring.

68. Annotated Figure 2 of Trygg, reproduced below, shows one of the options for the fluid bearings in Figure 1, above. As shown, this fluid bearing includes a base, an outer surface, an oil passage, at least one recess for receiving lubricating fluid, and a lubricating fluid supply port in fluid communication with the oil passage. Moreover, the base of the fluid bearing is “fixedly mounted” to the frame.

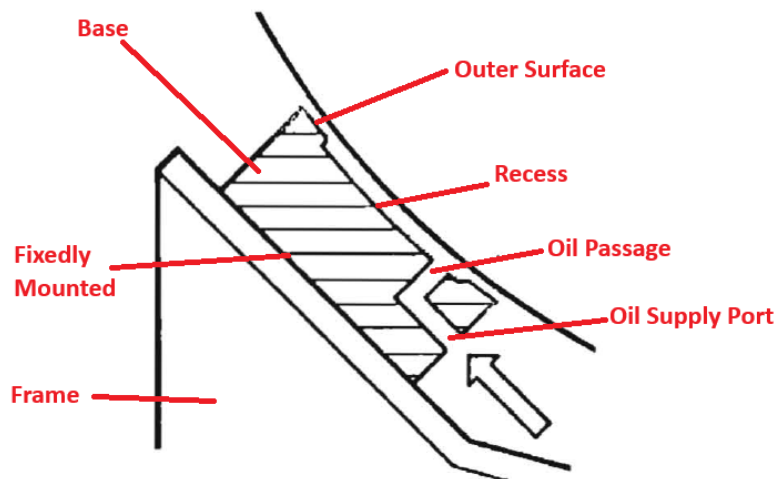


FIGURE 2. Separation of surfaces by oil film.

69. Annotated Figure 4 of Trygg, reproduced below, shows an alternative of a fluid bearing that includes a self-adjustment feature.

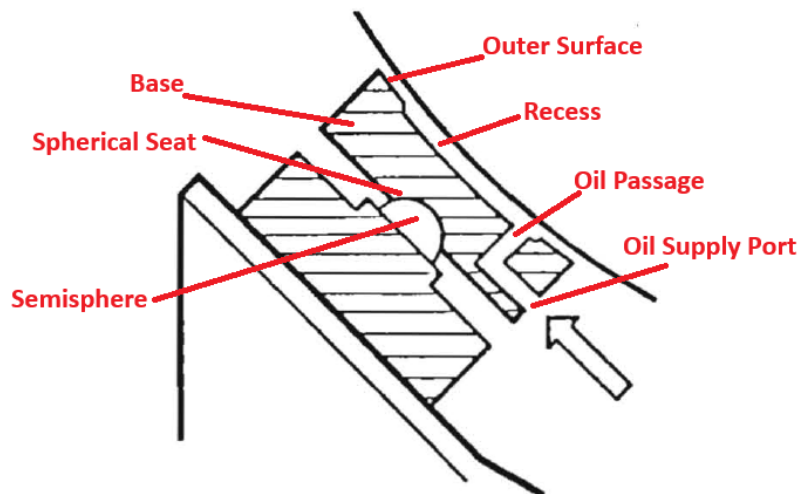


FIGURE 4. Articulated shoes.

70. As can be seen in Figure 4 above, this fluid bearing includes a base, an outer surface, an oil passage, at least one recess for receiving lubricating fluid, and a lubricating fluid supply port in fluid communication with the oil passage. As

can be further observed, the base of the fluid bearing includes a spherical seat formed in its bottom surface that is mounted on a semisphere. Ex. 1009, p. 106. Trygg explains that the spherical seat and the semisphere allow the base (sliding shoe) to self-adjust, i.e., to “be able to tilt and turn in all directions” to compensate for “errors of form and angular misalignments of the girth ring.” Ex. 1009, p. 106.

71. Thus, Trygg teaches fluid bearings with both a “fixedly mounted” base (Ex. 1009, Figure 2) and a base that can “self adjust” to changes in the angular position of a journal during mill operation. Ex. 1009, Figure 4.

72. Trygg also discloses a hydrostatic shoe bearing that is capable of handling both axial and radial loads. Specifically, Trygg notes that “Hydrostatic shoe bearings can be used to advantage to take axial loads as well. If axial location in both directions is required, it is possible to choose between the two methods, as shown in Figure 9.” Ex. 1009, p. 107.

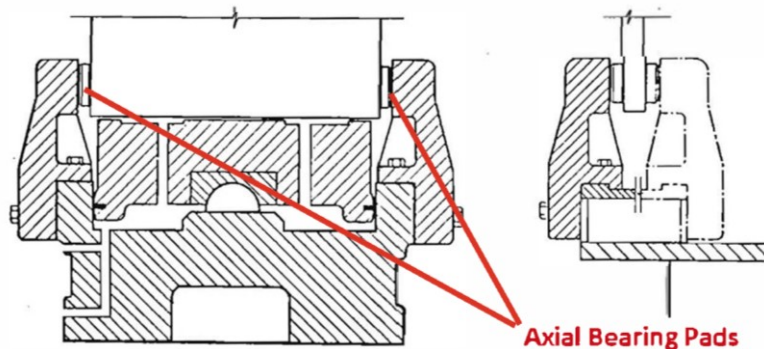
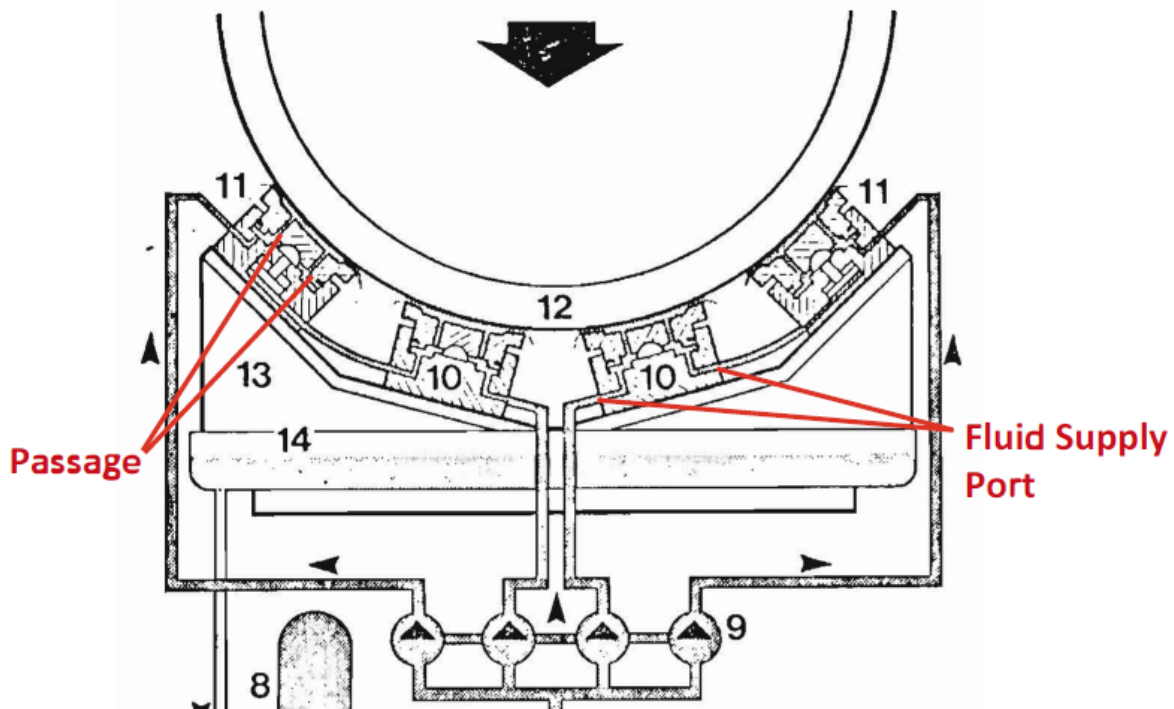


FIGURE 9. Hydrostatic thrust bearing arrangements.

73. “The left-hand illustration shows a thrust bearing which consists of vertical sliding shoes mounted directly on the radial shoe. The sliding shoes are located at each side of the girth ring. Alternatively, the sliding shoes can be located against a special guide flange.” Ex. 1009, p. 107.

74. Trygg also discloses wherein the bearing shoes comprise a plurality of internal fluid passages and plurality of fluid supply ports. *See* annotated Figure 10 from Trygg below.



Ex. 1010 – U.K. Patent Pub. No. GB1330484 (“GB484”)

75. GB484 is a U.K. patent application that published on September 19, 1973. Ex. 1010, cover page. GB484 discloses “a bearing for supporting heavy rotatable machine elements, such as the cylinders of stone crushers.” Ex. 1010, 1:13-16. The stone crusher includes “a rotatable cylinder” and “shaft ends 11 and 12 of which are carried by bearings,” which are bearing units 14 and 15. Ex. 1010, 2:37-50. The bearing units are “mounted on a common base” of the stone crusher. Ex. 1010, 2:46-51. In annotated Figures 1 and 2, below, GB484 shows a bearing assembly for supporting a journal (bearing ring 13) of grinding mill body (rotatable cylinder 10), the bearing assembly comprising a frame and a plurality of fluid bearings (bearing units 14/15).

FIG. 1

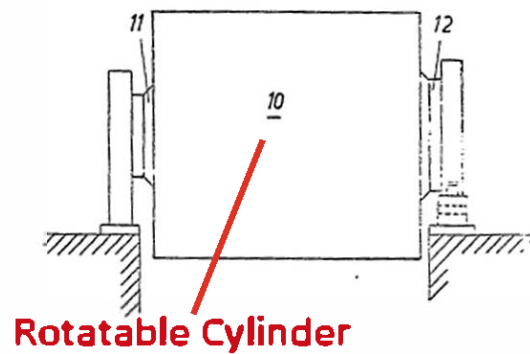
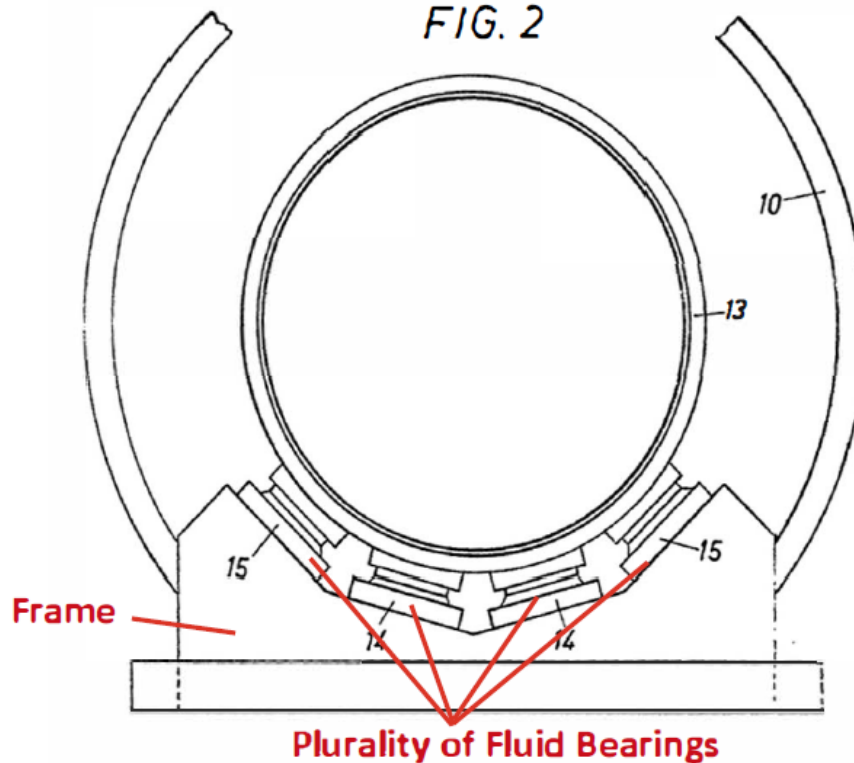
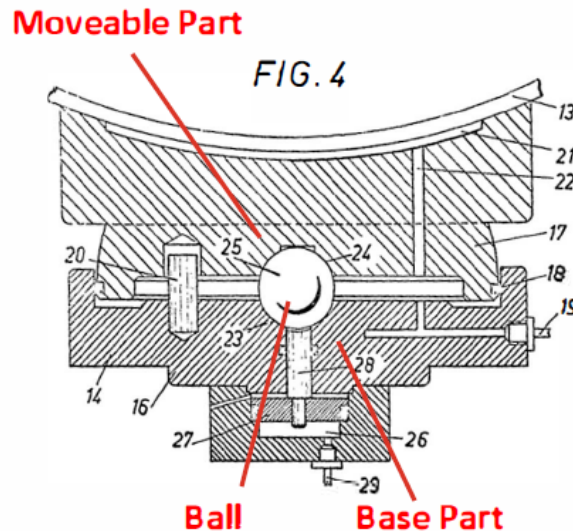


FIG. 2



76. Each of the fluid bearings (bearing unit 14) includes a base (moveable part 17) having an outer surface with a recess (pocket 21) for receiving lubricating fluid from at least one passage (passage 22), at least one lubricating fluid supply

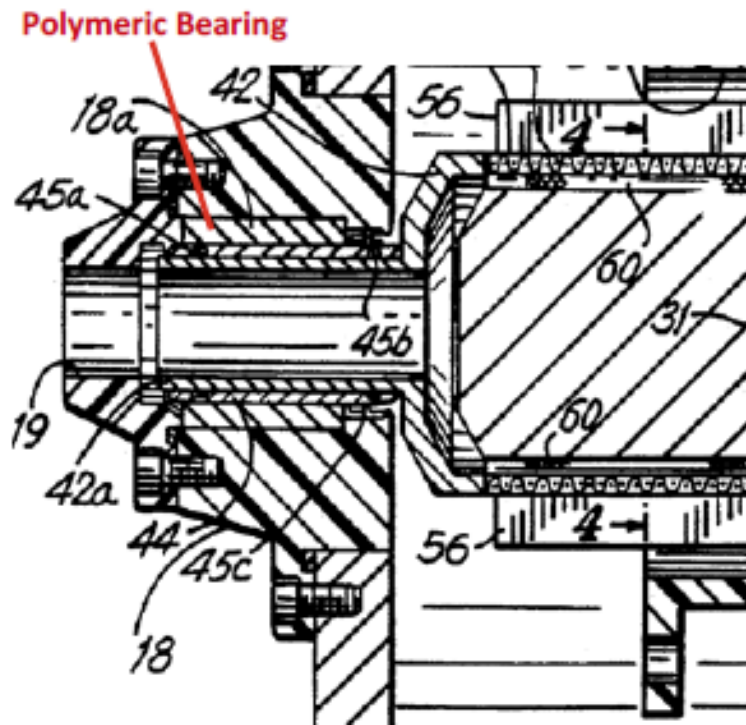
port (supply conduit 19) in fluid communication with at least one passage (passage 22).



77. Referring to Figure 4 above, the fluid bearings (bearing units 14) are mounted to the frame so that they self-adjust to changes in the angular position of the journal (bearing ring 13). In this regard, GB484 discloses that each of the fluid bearings (bearing units 14) includes “a ball 25 in the centre of the cooperating surfaces between base part and moveable part, the latter is automatically adjusted with respect to the bearing ring, since, as mentioned above, the moveable part can be pivotally adjusted with respect to the base part.” Ex. 1010, 3:13-19.

Ex. 1011 – U.S. Patent No. 5,333,804

78. U.S. Patent No. 5,333,804 to Liebert issued on Aug. 2, 1994. Ex. 1011. The '804 patent shows an agitator mill that has a polymeric bearing 18a that is “formed from a low friction polymeric material.” Ex. 1011, 3:45-48.



Ex. 1012 – Higgins, R.A. *Materials for Engineers and Technicians*. 4th ed., Elsevier, 2006.

79. Higgins is an engineering textbook published in 2006. Ex. 1012, copyright page. Higgins discloses the desirability of use of polymer materials as bearing surfaces. For example, Higgins teaches that PTFE (“Teflon”), a polymer, may be used as a bearing surface due to its “very low coefficient of friction.” Ex. 1012, p. 255. Higgins further teaches that “bearing surfaces coated with PTFE can be used without lubrication....” Ex. 1012, p. 255. Higgins further teaches that, due to its low coefficient of friction, “PTFE is widely used as a bearing material....” Ex. 1012, p. 282. Higgins further teaches that nylon, another polymer, is suitable for use as a bearing. Ex. 1012, p. 257. Higgins further discloses that homopolymer, another polymer, is suitable for use as a bearing. Ex. 1012, p. 259. Higgins further discloses that polyimide, another polymer, is suitable for use as a bearing. Ex. 1012, pp. 261, 267.

Ex. 1013 – U.S. Patent Pub. No. 2012/0099993

80. U.S. Patent No. 2012/0099993 discloses a “wind turbine main bearing” and a “method of performing maintenance on a wind turbine, including the steps of halting a rotation of the shaft, operating a lifting arrangement to raise the shaft, and removing a bearing pad of the wind turbine main bearing from the bearing housing of the wind turbine main bearing.” *See* Ex. 1013, Abstract.

81. “[I]n a preferred embodiment of the invention, the fluid bearing is realized as a hydrostatic bearing and preferably comprises a bearing pad with a number of cavities located on the inner surface of the bearing pad, wherein a cavity comprises a fluid inlet for the injection of a fluid lubricant to the inner surface of the bearing pad. In this way, the lubricant can be injected under very high pressure directly to the surface of the main shaft under the bearing pad, thus forcing a layer of lubricant between these two surfaces, and allowing the main shaft to move under favourably low friction even at start-up. Since the high-pressure fluid injected between the bearing pad and the main shaft causes the bearing pad to be raised and supported by the fluid film, the pressure is distributed more evenly over the pad, and the load-carrying capacity of the bearing pad is increased as a result.” *Id.* ¶26.

82. “In a further preferred embodiment of the invention, the inner surface of a bearing pad comprises a polymer lining with a low module of elasticity, for example a material such as PTFE (polytetrafluoroethylene), PVDF (polyvinylidene fluoride), POM (polyoxymethylene), PEEK (polyether ether ketone), etc. These materials exhibit favourable stability and stiffness, are lightweight, have low coefficients of friction, and can be immersed in oil without damage. Use of such a material as an inner surface of the bearing can be advantageous, since a polymer with these properties will deform slightly while under pressure, so that the bearing

has more ‘give’. This allows a better fluid film thickness to be built up during hydrodynamic operation. The thickness of the polymer layer can depend on the conditions of use of the fluid bearing, and on the dimensions of the bearing pads. For a hydrostatic bearing, the cavities mentioned above can also be cut into or excised from the polymer lining.” *Id.* ¶30

83. “In a preferred embodiment of the invention, a bearing pad of the fluid bearing comprises a pivot bearing to tiltably connect the bearing pad to the bearing housing. The pivot bearing can comprise a ball and socket arrangement for each bearing pad, so that the outer surface of the bearing pad comprises a socket, and the ‘ball’ or hemisphere is part of the outer containing structure. These types of fluid bearing are also referred to as ‘tilting-pad fluid bearings’. In the following, for the sake of simplicity, the terms ‘fluid bearing’ and ‘tilting-pad fluid bearing’ may be used interchangeably without restricting the invention in any way.” *Id.* ¶22.

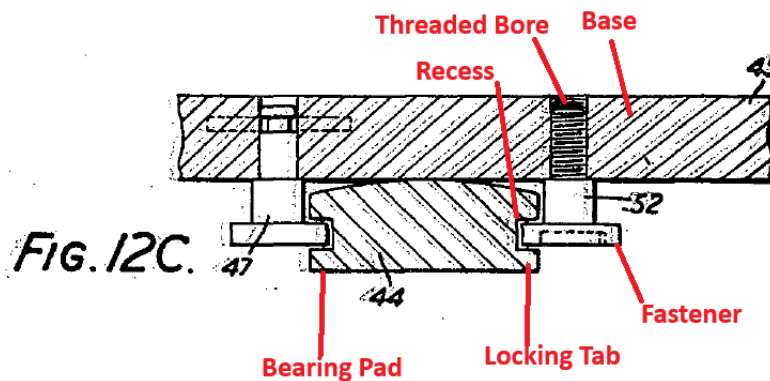
84. “In the wind turbine according to the invention, individual pads can be removed or inserted while the remaining pads continue to support the load. The maintenance of such a fluid bearing in a wind turbine, according to the invention, is therefore considerably easier and quicker than a comparable maintenance of a roller bearing, for which the drive train must first be lifted by a crane and then disassembled in order to access the bearings, as outlined above in the introduction. Therefore, since the fluid bearing of a wind turbine according to the invention is more robust than the conventional type of bearing used up until now in prior art wind turbines, such a wind turbine will require less maintenance, and, when maintenance is required, this can be carried out quicker and with less effort.” *Id.* ¶16.

85. The ’993 publication discloses fluid bearings for a wind mill. The field of endeavor of the ’993 publication is the same as that of the ’604 patent. For

example, the problems solved by technology of the '993 publication are pertinent to those addressed in the '604 patent—namely, the use of a polymer bearing pad in a hydrostatic fluid bearing.

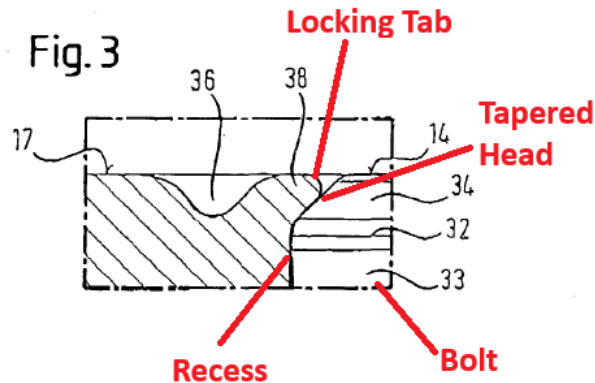
Ex. 1014 – U.S. Patent No. 3,197,264

86. U.S. Patent No. 3,197,264 to Hill issued on July 27, 1965. Ex. 1014, cover page. Shown in Figure 12C, the '264 patent teaches a bearing pad 44 with a recess, where the bearing pad 44 comprises a locking tab for retaining a head portion of a threaded fastener 52 within the recess.



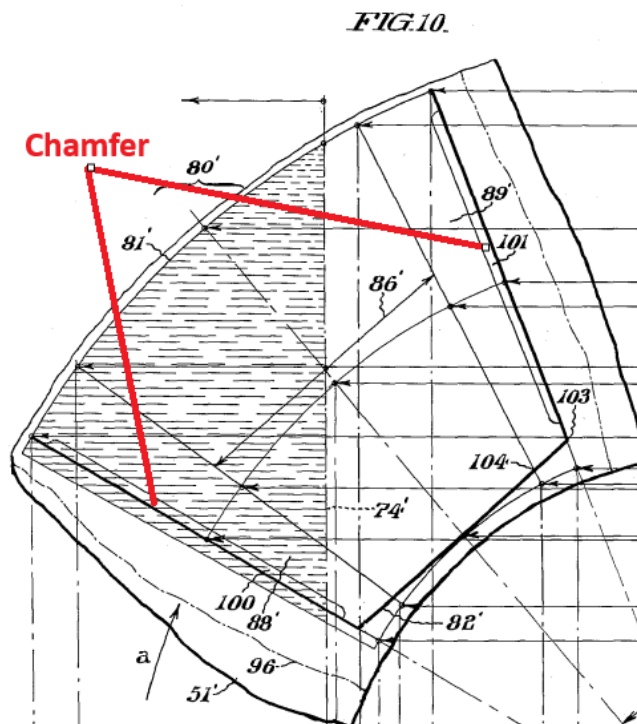
Ex. 1015 – U.S. Patent Pub. No. US2003/0175074

87. U.S. Patent Pub. No. US2003/0175074 to Humpert published on September 18, 2003. Ex. 1015, cover page. As shown in annotated Figure 3 below, the '074 publication teaches a recess with a locking tab for retaining a tapered head of a bolt within the recess.



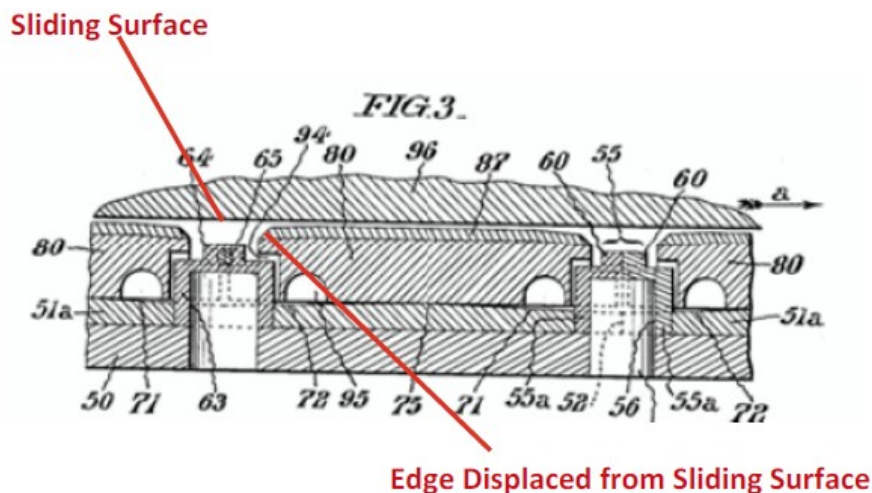
Ex. 1016 – U.S. Patent No. 2,744,799

88. U.S. Patent No. 2,744,799 to Howarth issued on April 23, 1952. Ex. 1016, cover page. As shown in annotated Figure 10 below, the '799 patent discloses a bearing with a leading-edge chamfer 100 and a trailing edge chamfer 101. Ex. 1016, 7:26-34.



89. The chamfer in the '799 Patent is described as forming “a face angled about 45 degrees” and is configured so that it can “receive the impact pressure of

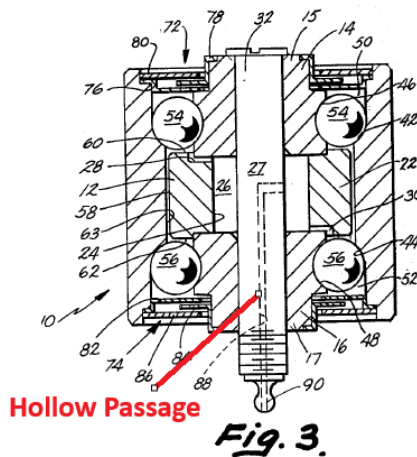
lubricant in a high speed bearing.” Ex. 1016, 7:26-31. As shown in Figure 2 of the ’799 Patent, a flat horizontal hydrostatic bearing surface has an outside edge that is displaced from the sliding surface. The sliding surface here is equivalent to the journal surface of a rotating mill.



90. The ’799 Patent discloses a hydraulic thrust bearing, not a bearing used in a horizontal mining mill. But the principles of engineering and fluid bearing design disclosed in the ’551 patent are pertinent to the problems identified in the ’604 Patent—namely, the use of chamfers and edge displacement in bearing design to minimize impact pressure and prevent fluid loss.

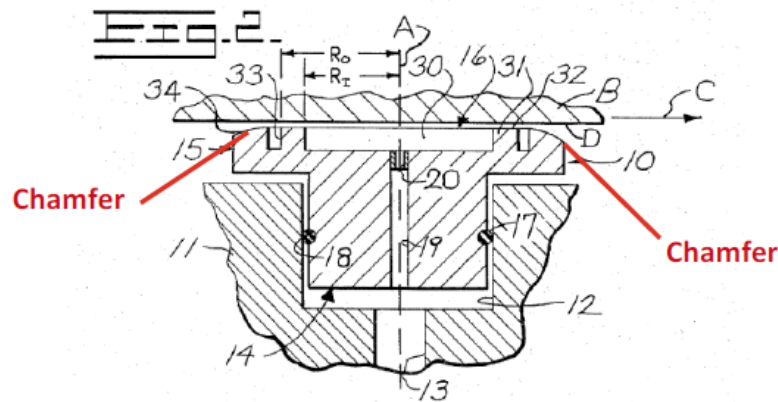
Ex. 1017 – U.S. Patent No. 4,408,808

91. U.S. Patent No. 4,408,808 to Redmann issued on October 11, 1983. Ex. 1017, cover page. As shown in Figure 3 below, the ’808 Patent teaches a bearing 10 that “is mounted using hollow bolt” such that the “bearing 10 may be relubricated by introducing lubricant into reservoir 26 through hollow bolt 32.” Ex. 1017, 3:58-61. The hollow bolt 32 has a passage 88 and is positioned to both provide a passage for lubricant and to mount the bearing 10. *Id.*, 4:2-9.



Ex. 1018 – U.S. Patent No. 3,799,628

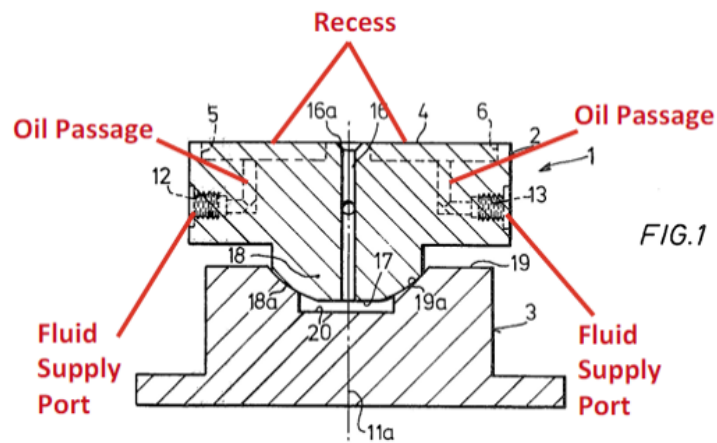
92. U.S. Patent No. 3,799,628 to Van Gaasbeek et al. issued on March 26, 1974. Ex. 1018, cover page. The '628 Patent discloses a hydrostatic bearing with chamfered edges to “prevent[] any sharp peripheral edges from being prominently exposed to the runner surface D thereby eliminating gouging thereof.” Ex. 1018, 2:65 – 3:1. Figure 2 shows those edges.

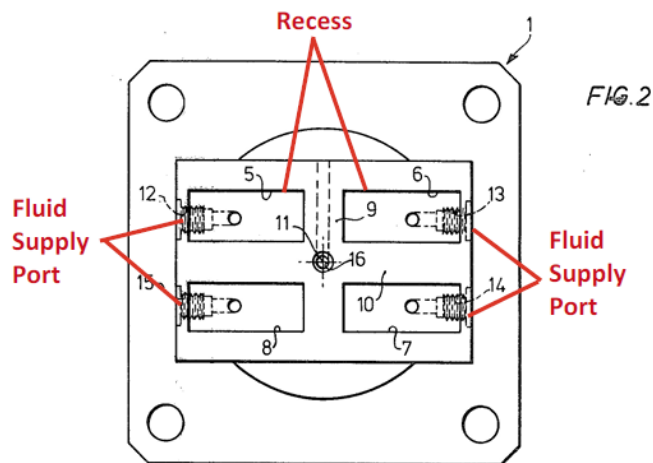


Ex. 1019 – U.S. Patent No. 4,430,926

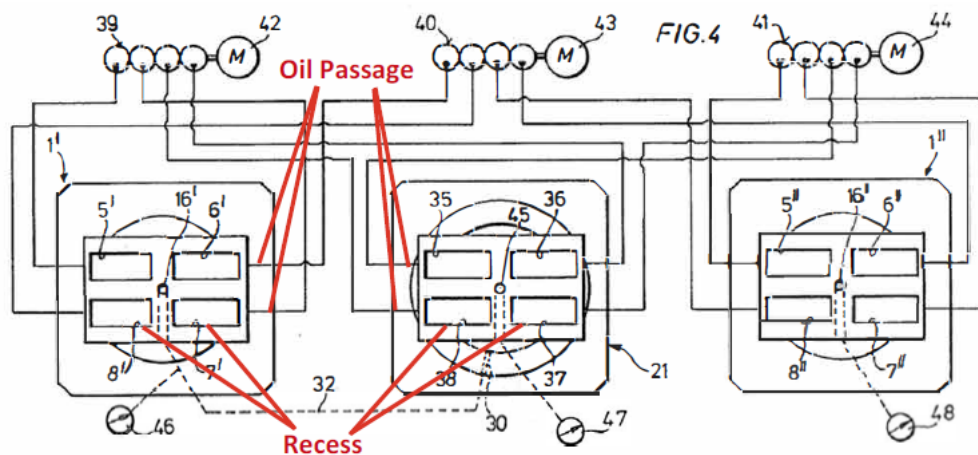
93. U.S. Patent No. 4,430,926 to Heinemann et al. issued on March 23, 1982. Ex. 1019, cover page. The '926 Patent discloses a hydrostatic bearing with a plurality of recesses coupled to plurality of oil passages and a plurality of fluid

supply ports. “The bearing shoe 1 shown in FIGS. 1 and 2 comprises an upper part which is tiltably and rotatably supported on a lower part 3. The upper surface of the upper part 2 forms a bearing surface 4 which is divided into several pressure pockets 5, 6, 7, 8 (also known as oil pockets).” Ex. 1019, 3:29-34. “Each pressure pocket 5 to 8 is supplied with hydraulic pressure medium, preferably oil, through separate connections 12, 13, 14, and 15...” *Id.* 3:39-40. “In operation i.e., when the machine part (not shown) is rotatingly supported by the bearing surface 4 of the upper part 2, the pressure pockets 5 to 8 receive through their connections 12 to 15 an amount of oil sufficient to ensure that, depending on the load, a more or less wide oil gap is formed and can be maintained between the machine part to be supported and the bearing surface 4.” *Id.* 4:12-18.





94. Figure 4 from the '926 Patent is a schematic representation of how oil is supplied to the different ports and passages related to the recesses located on the bearing surface shown in that patent.



Exs. 1020 and 1021 - CN1904401 (“CN401”)

95. CN401 is a Chinese patent application for a slide bearing for use with a horizontal ball mill. The application discloses a sliding bearing with a bearing surface made of a plastic alloy layer. “[T]he plastic alloy layer 4 is a mixture of polytetrafluorethylene, polyimide and molybdenum disulfide...” Ex. 1021 at 2. The plastic alloy is “made into a shape matching the friction surface” of the bearing. *Id.* CN401 notes that “[c]ompared with the prior art, a friction surface

layer ... has a low friction coefficient, a small elastic modulus, [and] good running-in performance...” *Id.* at 5.

X. GENERAL KNOWLEDGE IN THE ART

96. While I discuss specific prior art references herein as compared to specific claims, I believe it is helpful to provide some background about the general knowledge that one of ordinary skill in the art possesses. The '604 Patent itself discusses what was general knowledge to one of ordinary skill as it relates to roller mill design, the use of hydrostatic fluid bearings, and the use of bronze as an anti-friction pad or liner. See *supra*, ¶¶22-28. The liner or pad covers the entire upper surface of the bearing pad forming a fluid tight seal (Ex. 1001, 3:54-56) so that the oil (or other fluid) used as a lubricant is efficiently distributed over the upper surface of the bearing pad.

General Knowledge of Polymers as Low Friction Material

97. The use of a polymer as a low friction alternative to other bearing surfaces was generally known to persons of ordinary skill in the art before the filing of the '604 Patent. For example, Higgins, a material textbook for engineers, teaches that polymers are suitable for use as bearing pads. For example, Higgins teaches the desirability of using of PTFE (“Teflon”), a polymer, on bearing surfaces due to its “very low coefficient of friction” and that “bearing surfaces coated with PTFE can be used without lubrication....” Ex. 1012, p. 255. In fact, Higgins teaches that, due to its low coefficient of friction, “PTFE is widely used as a bearing material....” Ex. 1012, p. 282. Higgins further teaches that nylon, another polymer, is suitable for use as a bearing. Ex. 1012, p. 257. Higgins further teaches that homo-polymer, another polymer, is suitable for use as a bearing. Ex. 1012, p. 259. Higgins also teaches that polymide, another polymer, is suitable for use as a bearing. Ex. 1012, pp. 261, 267. The '804 Patent, directed to a grinding mill,

teaches a polymeric bearing that is “formed from a low friction polymeric material” such as “PTFE.” Ex. 1011, 3:45-49.

98. In addition, DE364 teaches a bearing pad that is formed of a polymer. For example, DE364 teaches that the “preferred material” for the bearing is “an advanced engineering plastic, for example polyether ketone (PEEK) polyamide-imide (PAI) or polyimide (PI), which is preferably supplemented with a small amount of polytetrafluoroethene (PTFE) and / or graphite to improve the sliding properties.” Ex. 1005, ¶[0011].

99. The '993 publication likewise discloses a hydrostatic bearing with a polymeric bearing pad and explains the attendant benefits of its use. Specifically, the '993 publication states that “[i]n a further preferred embodiment of the invention, the inner surface of a bearing pad comprises a polymer lining with a low module of elasticity, for example a material such as PTFE (polytetrafluoroethylene), PVDF (polyvinylidene fluoride), POM (polyoxymethylene), PEEK (polyether ether ketone), etc. These materials exhibit favourable stability and stiffness, are lightweight, have low coefficients of friction, and can be immersed in oil without damage. Use of such a material as an inner surface of the bearing can be advantageous, since a polymer with these properties will deform slightly while under pressure, so that the bearing has more ‘give’. This allows a better fluid film thickness to be built up during hydrodynamic operation.” Ex. 1013, ¶ [0030].

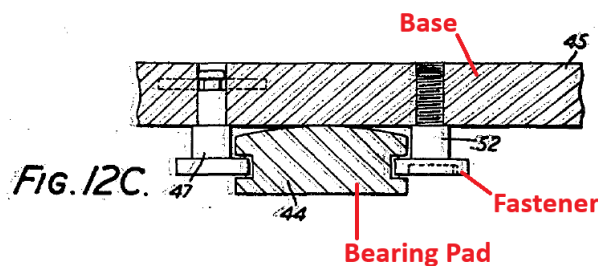
100. Likewise, CN401 discloses use of a polymer in connection with a bearing surface for a horizontal ball mill. *See supra*, ¶90.

General Knowledge Regarding Common Fasteners

101. Using bolts and screws to mount a pad to a surface is also general knowledge well within the scope of what a person of ordinary skill would have.

Pre-drilling or manufacturing holes in the pad prior to placing the screw or the bolt is a known method of preparing a device to be mounted onto a base. In addition, the use of hollow bolts, bolt plugs, covers, and tabs are all well-known temporary fastening devices. The use of bolts, for example, is commonly used on a device that one may wish to remove at some future date due to normal wear or breakage. As the journal rides on the bearing pad, it is well known that you do not want to have stationary metal contact the rotating metal of the journal. Thus, it is well known and common to provide a recess in the pad, in combination with the hole, for the head of the bolt or fastener such that the head is below the top surface of the pad. In this fashion, the bolt can hold the pad in place without contacting the rotating journal and causing damage.

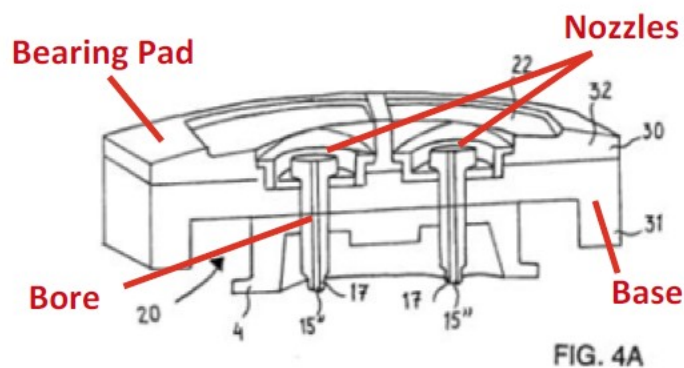
102. While the principles discussed above are within the general knowledge of any mechanical engineering, I cite to several different pieces of art below to illustrate some of these commonly known principles. DE364, for example, teaches that a polymer bearing pad and a base “are attached to each other, for example by screws, adhesive, or rivets.” Ex. 1005, ¶[0011]. The ’264 patent also teaches a bearing pad 44 that is secured to a base 42 using a fastener 52, as shown in annotated Figure 12C, below.



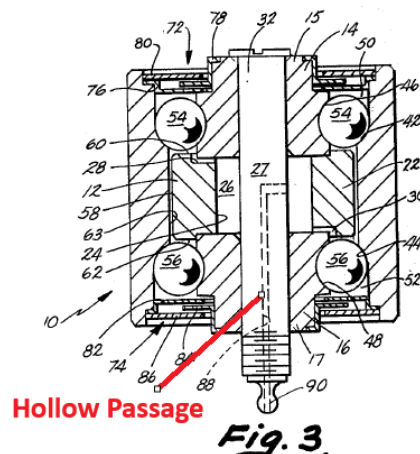
DE364 and the '808 Patent Show a Fastener with a Hollow Bore for Conveying Lubricating Fluid

103. DE364 shows hollow fasteners 17 with a bore 15” which are used to supply oil to the polymer bearing pad 30. Specifically, “[t]he support element 20 is

attached to the loading piston 4 via the nozzles 17, in which the medium channels, i.e., the capillaries 15", run." Ex. 1005, ¶ [0025]. "A film of lubricant is placed between the sliding surface and the inner surface of the shell 10 by introducing the pressure medium through capillaries 15" of the support element 20 into the recesses 22 formed on the sliding surface and acting as lubrication chambers." *Id.* ¶23.

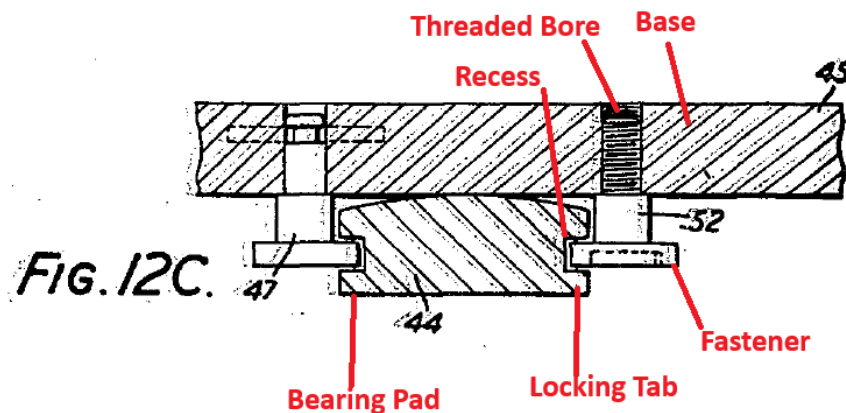


104. The '808 Patent discloses a bearing 10 that "is mounted using hollow bolt" such that the "bearing 10 may be relubricated by introducing lubricant into reservoir 26 through hollow bolt 32." Ex. 1017, 3:55-62. For example, as shown in annotated Figure 3 of Redmann, below, the hollow bolt 32 has a passage 88 and is positioned to both provide a passage for lubricant and to mount the bearing 10. Ex. 1017, 3:55-62; 4:2-9.

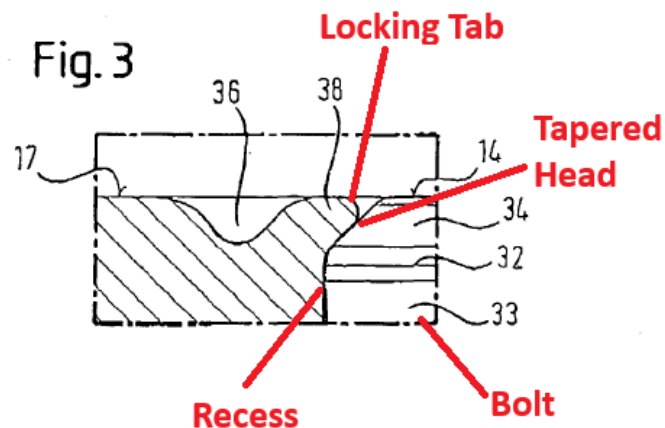


The '264 Patent and The '074 Publication Teach a Locking Tab for Retaining a Fastener

105. As shown in annotated Figure 12C, below, the '264 patent teaches a bearing pad 44 with a recess, where the bearing pad 44 comprises a locking tab for retaining a head portion of a threaded fastener 52 within the recess.



106. As shown in annotated Figure 3, below, the '074 publication also teaches a recess with a locking tab for retaining a head of a bolt within the recess.



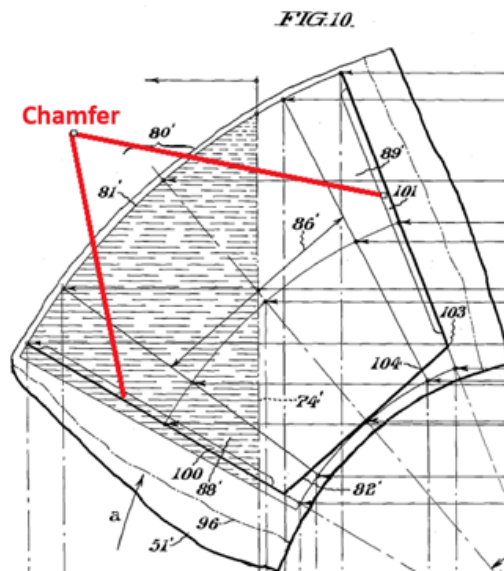
General Knowledge of Chamfers

107. The use of a chamfer at an outer edge of a bearing pad to retain lubricating fluid at the outer edge and transfer lubricating fluid to the journal was

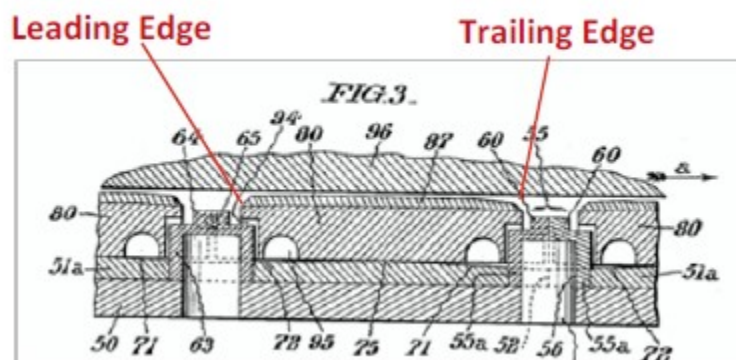
within the general knowledge of one of ordinary skill at the time the '604 Patent was filed. As a general principle of mechanical engineering, a chamfer is well-understood to be a transitional surface or edge between two faces of an object. For example, a side surface and a top surface may typically adjoin at an edge that forms a right angle. A chamfer may instead provide a sloped edge or corner transition, for example at 45 degrees, between the side surface and the top surface.

108. In the context of a bearing pad for use with rolling bodies, one of ordinary skill would understand that at least two edges of the bearing pad may include a chamfer: the leading edge, or the edge of the pad first encountered by a point on the rotating surface (e.g., of a mill), and a trailing edge, or the opposite edge of the pad that is last touched by the point on the rotating surface of the mill. A right angle on either the leading or trailing edge of a bearing pad will contribute to lubricating fluid or oil being “scraped” off by the sharp edge of the right angle. Those of ordinary skill at the time the '604 Patent was filed, would understand that a chamfered edge helps minimize the amount of lubricating fluid that is removed from the bearing pad, while also providing additional space for the film of lubricating fluid to build up and be distributed across the bearing pad.

109. The '799 Patent further demonstrates that a chamfer used in connection with bearing pads is within the general knowledge of one of ordinary skill. Ex. 1016, cover page. As shown in annotated Figure 10, below, the '799 Patent discloses a bearing with a leading-edge chamfer 100 and a trailing edge chamfer 101. Ex. 1016, 7:26-34.



110. The chamfer of the '799 Patent is further described as forming “a face angled about 45 degree” and configured “to receive the impact pressure of lubricant in a high speed bearing.” Ex. 1016, 7:26-31. As shown below, where the “runner” 96 is moving in the direction pointed by arrow “a,” the cross-sectional view of the pad of the '799 Patent further illustrates the leading edge chamfer and the trailing edge chamfer.

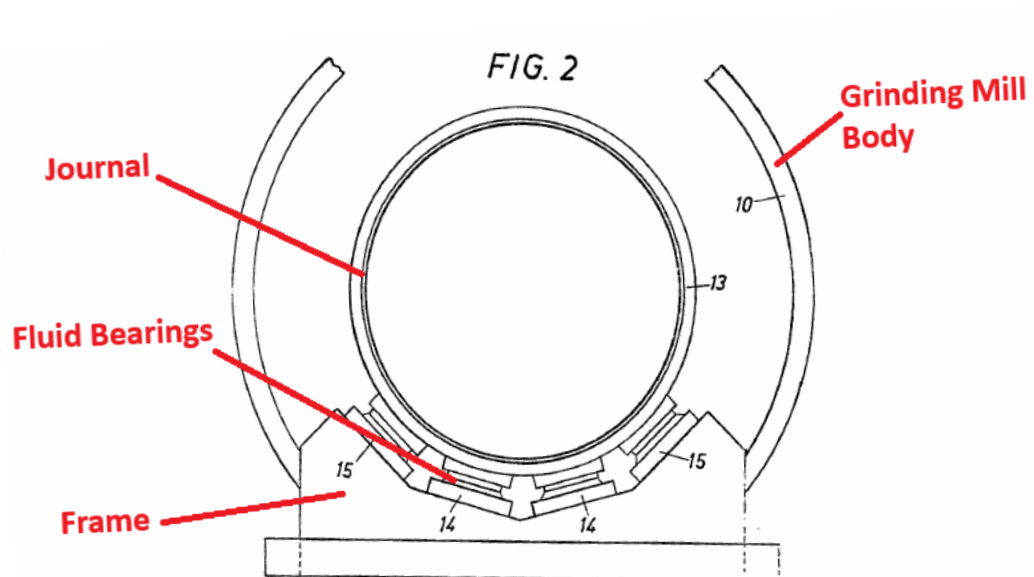


111. The '628 Patent also shows that use chamfers on bearing surfaces was generally known to persons of ordinary skill in the art prior to the filing of the '604

Patent. As noted above in paragraph 86, the '628 Patent discloses a chamfered bearing surface to prevent gouging of the “runner surface” which in this case is equivalent to the journal surface of a mill.

General Knowledge of One Bearing Or Numerous Bearings

112. It is also common knowledge to use a plurality of bearings in connection with a rotating body. In fact, it would be uncommon to only use one hydraulic bearing surface in connection with a rotating body. Generally speaking, at least two points of contact on a rotating cylindrical mill would be used to support a journal as it rotates. One could theoretically use a large single bearing across an entire bottom surface but that would be unnecessarily costly because of the increased surface area of the bearing to extend from one side to the other. It would also be more difficult to service as you would have to effectively lift the entire rotating body up. That said, examples of multiple bearing journal mills are common knowledge as discussed in the '926 Patent (*see* Ex. 1019, 4:45-50), Figure 2 of GB484, shown below (Ex. 1003), and the '133 Patent (*see* Ex. 1007, Figure 3).



General Knowledge of Self Aligning vs. Fixed Bearings

113. The use of both “self-aligning” or “fixed” fluid bearings is well within the general knowledge of one of skill in the art. Fixed fluid bearings are exactly what the name suggests. The bearing itself is fixed to a frame and does not move with respect the load it is encountering. Self-aligning fluid bearings are typically engineered to pivot to account for changes in axial, radial, or circumferential loads (i.e., uneven loads). With respect to the use of fluid bearings in connection with rolling surfaces, the person of ordinary skill in the art may use one or the other depending on a specific engineering need. For example, if the rotating system is encountering relatively low-weight loads, or a system that did not encounter changes in axial, radial, or circumferential loads, the use of a fixed fluid bearing might be desirable over a self-aligning. The self-aligning bearing typically introduces another component to the system. That is another component that costs more money, could fail, or requires maintenance. However, in a system with relatively heavy loads or uneven loads (i.e., one where changes in axial, radial, or circumferential loads is anticipated), a self-aligning system might be desirable. Heavier rolling loads can have asymmetric weigh distribution during operation causing variable radial and circumferential loads on the fluid bearing. Those variable loads can cause fixed fluid bearings to fail. The person of ordinary skill in the art would look to understand engineering needs and then apply the proper known engineering solution to that need.

114. Examples of self-aligning fluid bearings are found in GB384. Ex. 1003. And examples of both fixed and self-aligning bearings are shown in Trygg. Ex. 1009.

General Knowledge of One or More Fluid Passages, Fluid Supply Ports, and Interconnecting Passages

115. The use of one or more fluid passages to distribute a fluid to the surface of a fluid bearing is within the general knowledge of one of ordinary skill at the time the '604 Patent was filed. Hydraulic fluid bearings were a mature technology when the '604 Patent was filed. The '604 Patent itself notes the “currently in use” hydrostatic bearing system that has a recess machined into a bearing to receive high pressure oil. That high pressure oil is delivered to the recess in many ways, including closed vessels or passageways in the bearing pad itself.

116. It was generally known that one could use one passageway or multiple passageways depending on a number of factors including, the number of recesses that existed on a bearing pad and the amount of pressure that would be encountered on the bearing pad surface. GB384, for example, shows one fluid passageway 20 for one recess 18. Contrast that with the '926 Patent where a plurality of fluid passageways are used to supply oil to a plurality of recesses. *See supra*, ¶¶ 88-89. Trygg likewise is an example of multiple passageways and ports as is the '133 Patent. Figures from those references are shown below to illustrate this.

Figure from GB384

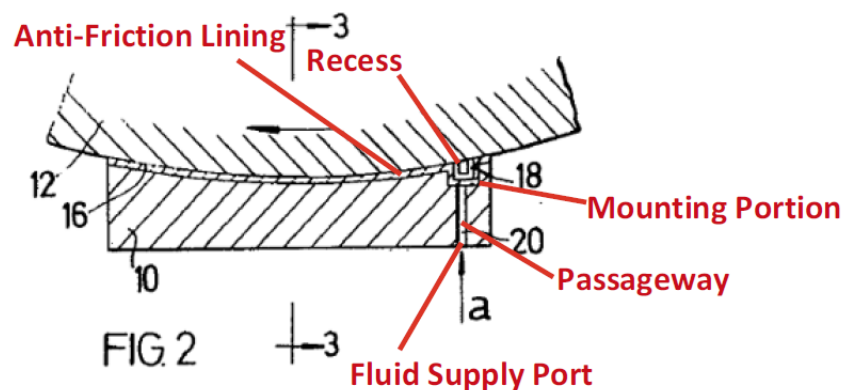
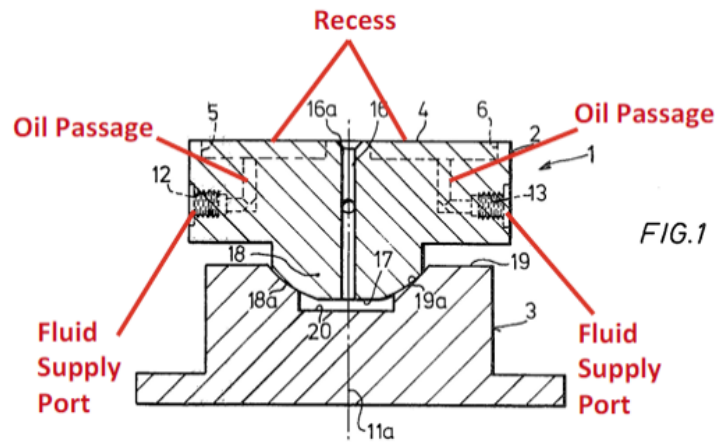
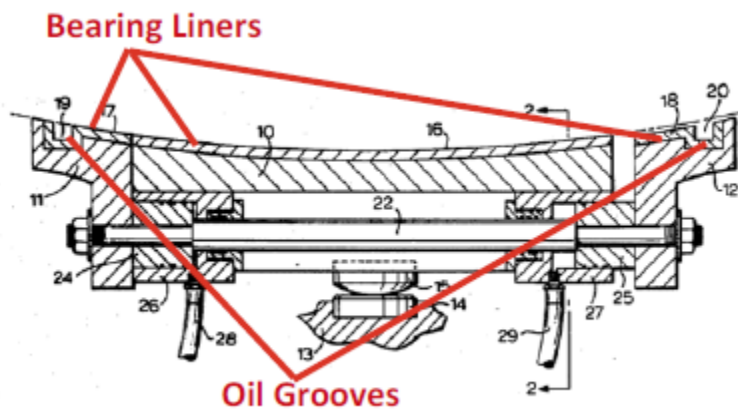


Figure from the '926 Patent



Figures from The '133 Patent to Cornford



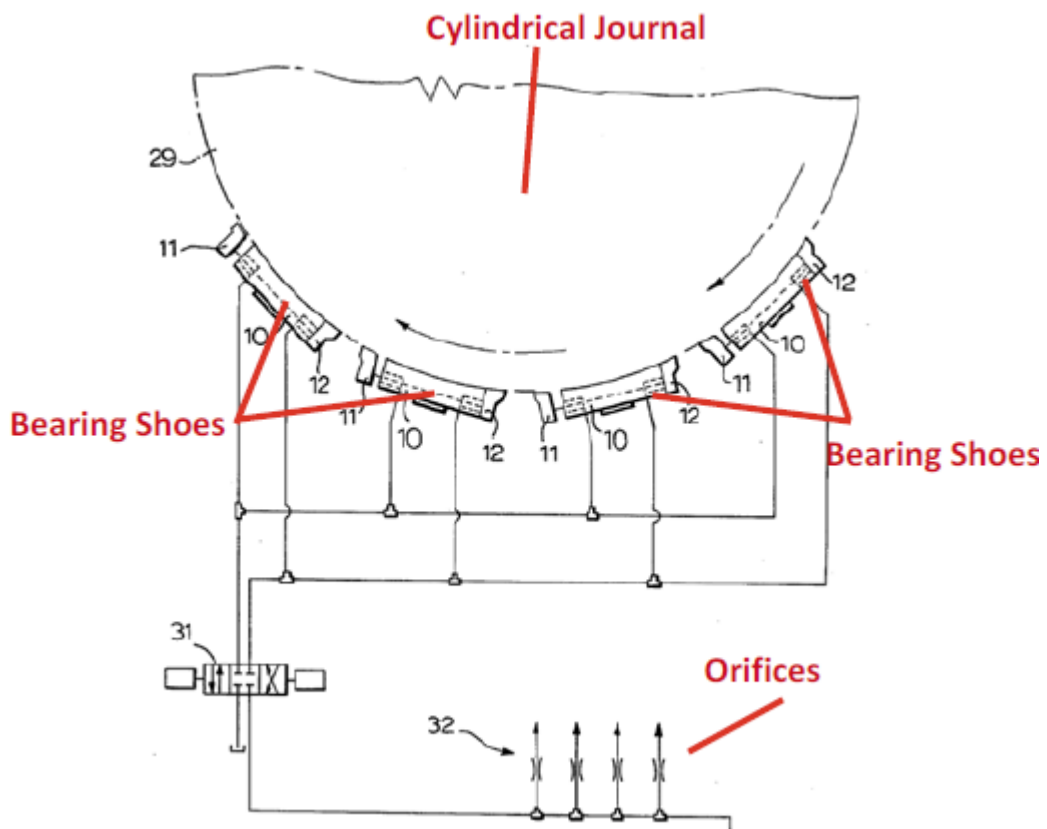
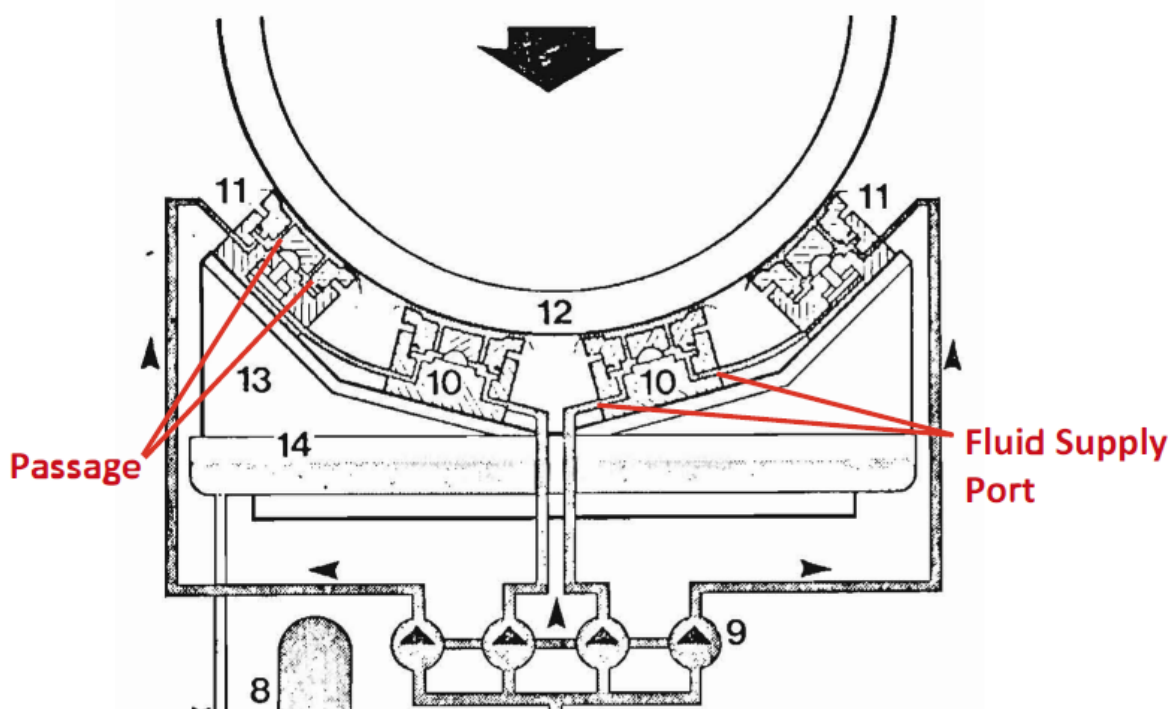


Figure from Trygg



117. It was also general knowledge that in order for hydraulic fluid to be communicated with the passageway in the shoe, an opening (i.e., a port) in the shoe is inherently present in every such arrangement. Otherwise, there would be no means to deliver fluid to the passageway. Multiple passageways implicate multiple ports, though it would not be absolutely necessary to have multiple ports to accommodate multiple passageways. An example of multiple passageways and multiple parts may be seen in the '926 Patent and Trygg shown above.

118. It was also general knowledge to have some opening or passageway between the recess of the bearing pad or liner to communicate with the fluid passageway in the shoe. If not, there would be no way for fluid to move from the passageway in the shoe to the recess within the bearing pad.

General Knowledge of “Mutually Engaging” Connections

119. The '604 Patent discloses a “mutual engagement” of two separate bearing pads using a “lateral connecting portion.” Figure 19 shows this mutual engagement which is a type of tongue and groove joint. The use of tongue and groove joints is a known technique where one member has a raised ridge called a “tongue” that fits snugly into a corresponding groove cut along the edge of another adjacent member, creating a connection between the two members. Different shapes of joints have been used over the years, including U-shaped, Z-shaped, or other shaped joints. This technique has been used long before the filing of the '604 Patent and essentially joins two substantially uniform pieces edge-to-edge without visible fasteners.

120. The '551 Patent to Cooley discloses a variation of a tongue and groove connection. The connects include ends with “rectangular-shaped slots 314 and rectangular-shaped ridges 312” as shown in Figure 3 or a “serrated geometry” as shown in Figures 2D and 2E. *See supra*, ¶62 in my declaration. The use of

different shaped bearing segments is useful for, among other things, minimizing fluid loss between adjacent bearing segments.

XI. PRIOR ART COMPARED TO PATENT CLAIMS

121. Below I discuss several of the different combinations of prior art compared to the patent claims. I understand these are sometimes referred to as “grounds” for a request or a petition to invalidate patent claims. I will therefore refer to them as “grounds” herein.

A. GROUND 1 - GB384 and DE364 - Claims 1-5, 7, 10-15, 17, 20-22 and 25-26

122. Claim 1 of the '604 Patent is broken into subparts and discussed below:

1a. *A bearing assembly for supporting a journal of a grinding mill body, comprising a frame and a plurality of fluid bearings,*

1b. *said fluid bearings each comprising a polymer bearing pad mounted to a base, said polymer bearing pad comprising an outer surface,*

1c. *at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and mounting element for securely mounting said polymer bearing pad to said base,*

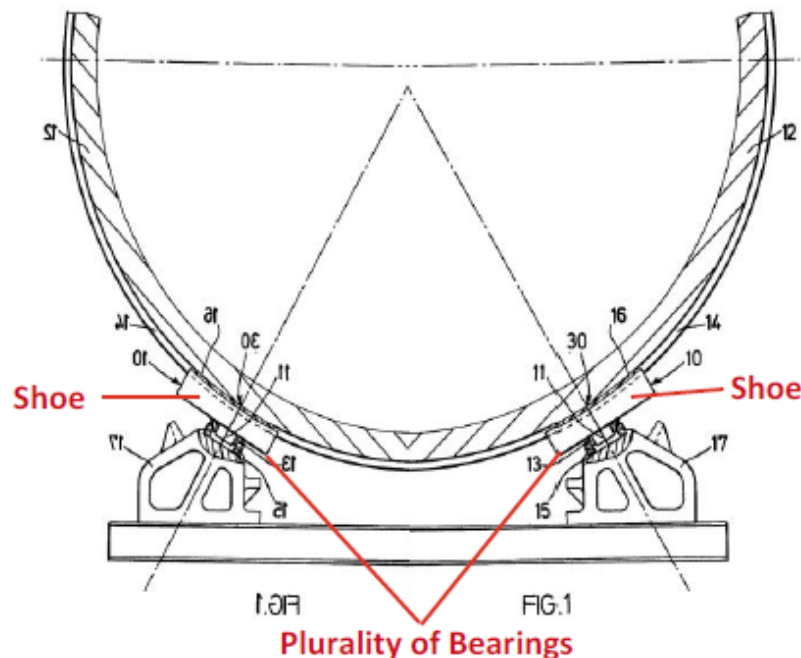
1d. *said base also comprising at least one lubricating fluid supply port in fluid communication with said at least one passage,*

1e. *wherein said base is mounted to said frame so that said fluid bearings self adjust to changes in the angular position of the journal during operation of said grinding mill body.*

[1a and 1b] A bearing assembly for supporting a journal of a grinding mill body, comprising a frame and a plurality of fluid bearings a frame and a plurality of fluid bearings, said fluid bearings each comprising a polymer bearing pad mounted to a base, said polymer bearing pad comprising an outer surface,

123. GB384 discloses a plurality of bearings 10 coupled to a frame 17 for use with a “tubular grinding mill.” Ex. 1003, 3:25-27. While a plurality of individual bearings are not explicitly shown in the figures, it is apparent from Figure 1, that another bearing would be required to support an opposing side of the rotating body 12 in order to properly support the rotating body 12. The specification further describes that “a supporting device shown in Figure 1 is intended to support a rotating body 12 of large diameter; an identical device is arranged symmetrically relatively to a vertical plane containing the axis of the rotating body 12.” Ex. 1003, 2:33-38.

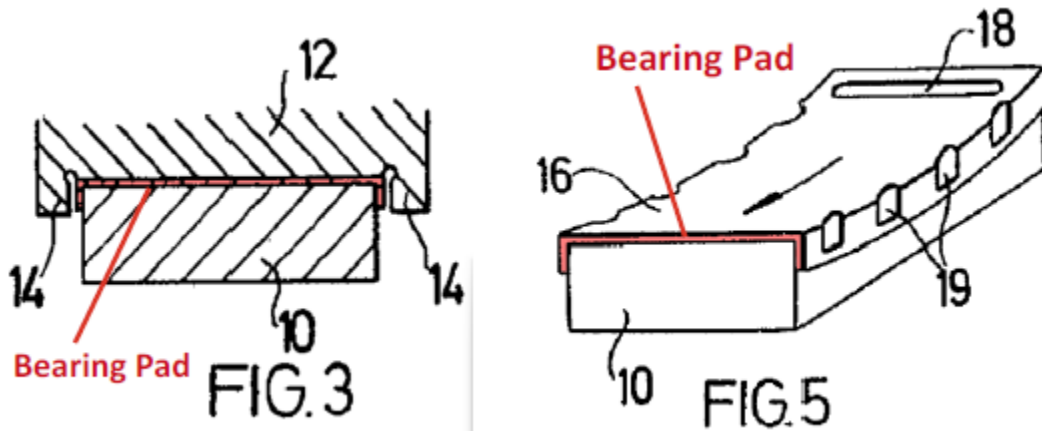
124. A mirror image of Figure 1 placed next to the original Figure 1 below to illustrate that principle.



125. The device illustrated is constituted by a shoe 10 on which the body 10 slides when the device for supporting the rotating body 12 is in use.” 2:33-42. “The shoe 10 comprises an extending portion 11 fitted into a central bore of an annular member 13 forming a ball joint. The member 13 has a part-spherical lower surface and a centre 30 situated on the sliding surface of the shoe 10. The lower surface of the member 13 bears on an upper, part-spherical surface of a seat 15 of annular cross-section fitted on to the frame 17.” 2:45-54.

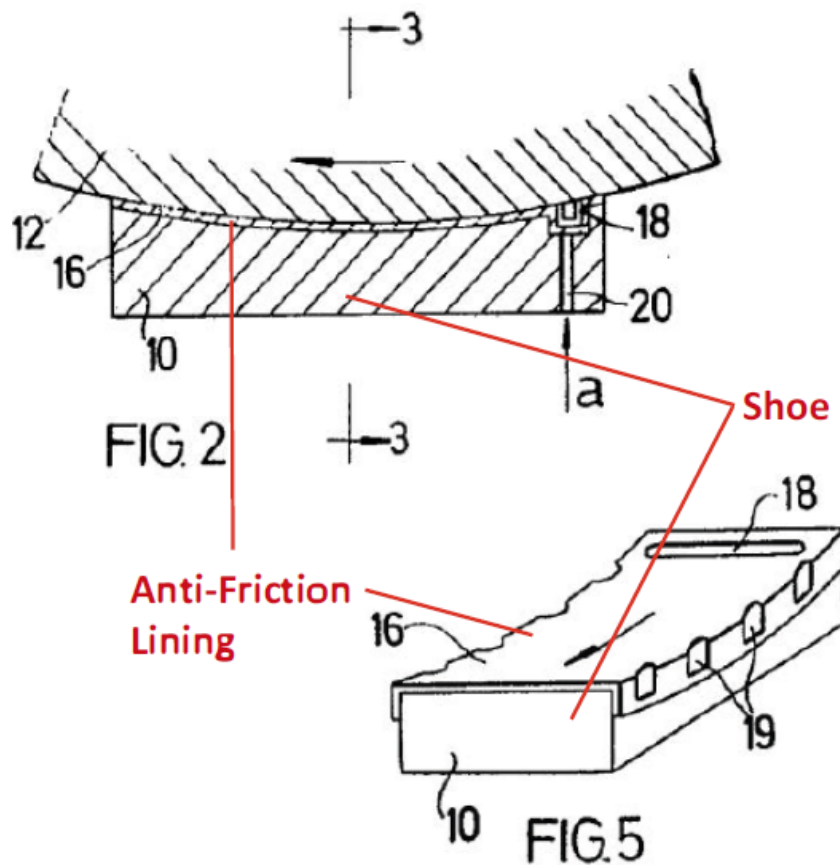
126. Additionally, it is common knowledge to use a plurality of bearings to support a rotating body, including mills. *See, e.g., supra*, ¶¶ 107-108 (discussing well-known principles common to fundamental engineering, including a plurality of supports having their own bearings).

127. In addition to the use of two bearings, GB384 shows a bearing pad (i.e., the anti-friction liner 16) used in connection with axial and radial loads. Meaning, it covers an upper surface of the shoe 10 receiving a radial load and side surfaces of the shoe 10 receiving axial loads. Annotated Figures 3 and 5 illustrate this principle:



128. GB384 specifically states “[a]n upper face of the shoe 10 and an upper portion of the sides thereof are covered with a lining 16 of anti-friction material. Recesses 19 (Figure 5) forming containers for oil are formed in the sides of the shoe 10.” Ex. 1003, 2:69-74. “Axial movements of part 12 are limited by two flanges 14 arranged to be integral with said body 12 the flanges 14 are arranged with a small clearance at each respective side of the shoe 10.” Ex. 1003, 2:64- 69. “[R]ecesses 22 allow the oil to flow from the channel 18 into the groove 24 and then into the lateral containers 19 for oil, to provide lubrication for the sides of shoe 10.” Ex. 1003, 2:114-117.

129. GB384 shows a bearing pad (referred to as anti-friction lining 16) on a surface of a base (i.e., the shoe 10). The anti-friction lining 16 has an outer surface (i.e., the top and side surfaces where oil is distributed). Annotated Figures 2 and 5 of GB384, below, illustrate the use of the bearing pad (anti-friction lining 16) on the surface of a base (the shoe 10) of a fluid bearing.



130. GB384 does not specifically identify the composition of its bearing pad. Rather, it simply states it is an “anti-frictional lining 16.” GB384 states that the bearing pad (i.e., the anti-friction lining 16) can help avoid an undesired “shearing stress on a film of oil formed between the shoe and rotating body,” which is “harmful to the stability of said film and may consequently have been detrimental to lubrication of the sliding surfaces.” Ex. 1003, 1:26-32.

131. The use of a polymer as the anti-frictional lining 16 in GB384 is within the general knowledge of one skilled in the art. One of ordinary skill in the art would have known that the anti-frictional properties of polymers are a known substitute for general “anti-friction” liners in fluid bearing applications and a POSITA would have had a reasonable expectation of success in making that

substitution. *See supra*, ¶¶ 55, 77 (explaining properties of polymers as anti-friction surfaces and applicability to fluid bearings). Among the many references, however, DE364 teaches that the “preferred material” for the bearing is “an advanced engineering plastic, for example polyether ketone (PEEK) polyamide-imide (PAI) or polyimide (PI), which is preferably supplemented with a small amount of polytetrafluoroethene (PTFE) and/or graphite to improve the sliding properties.” Ex. 1005, ¶ [0011].

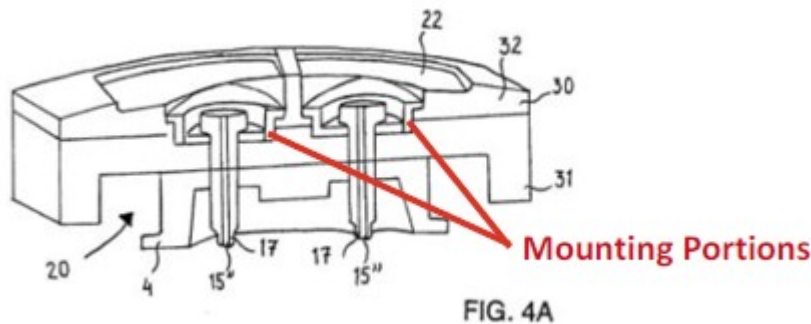
132. The POSITA would have had a reasonable expectation of success in using a polymer as the anti-frictional lining 16 of GB384. As I explained above in ¶¶ 55, 77, 80 and 94, a designer (i.e., one of ordinary skill) would have known that using a polymer as the pad or lining of a fluid bearing was one of the many options available and would have had a reasonable expectation of success using a polymer. The designer would have known that polymers “exhibit favourable stability and stiffness, are lightweight, have low coefficients of friction, and can be immersed in oil without damage. Use of such a material as an inner surface of the bearing can be advantageous, since a polymer with these properties will deform slightly while under pressure, so that the bearing has more ‘give’. This allows a better fluid film thickness to be built up during hydrodynamic operation.” *Supra*, ¶ 94 (quoting the ’993 publication).

[1c and 1d] at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and mounting element for securely mounting said polymer bearing pad to said base, said base also comprising at least one lubricating fluid supply port in fluid communication with said at least one passage

133. The base (i.e., the shoe 10) of GB364 has at least one passage (i.e., the duct 20) and the bearing pad (the anti-friction lining 16) has at least one recess (the channel 18/oil containers 19) that receives lubricating fluid from the at least

one passage (duct 20) and is disposed on the outer surface of the lining 16. Ex. 1003, 1:20-32. The upper surface of the shoe 10 has a surface (i.e., a mounting element) whereon the anti-friction lining 16 is mounted. While a fluid supply port in communication with the duct 20 is not specifically called out, it is shown in Figure 2 at the bottom of the shoe 10 as shown below.

134. DE364 also discloses mounting portions that assist in mounting the polymer bearing pad 30 from moving about the base 31. That mounting portion is a downward protrusion extending from the bottom of the pad 31 for placement within the recesses on the top of the base 31 as shown below in Figure 4A. Generally speaking, the POSITA would understand that the mounting portion helps reduce sheer stress on the fasteners during operation as the journal moves across the surface of the bearing.



[1e] wherein said base is mounted to said frame so that said fluid bearings self adjust to changes in the angular position of the journal during operation of said grinding mill body.

135. Element 1e is found in GB384. Figure 1 from GB384, shown below, shows the bearing in use with a rotating body 12. That rotating body is equivalent to a journal mill. It is mounted on a frame 17 in a manner that allows for self-adjustment. Specifically, GB384 notes “[t]he shoe comprises an extending portion 11 fitted into a central bore of an annular member 13 forming a ball joint. The

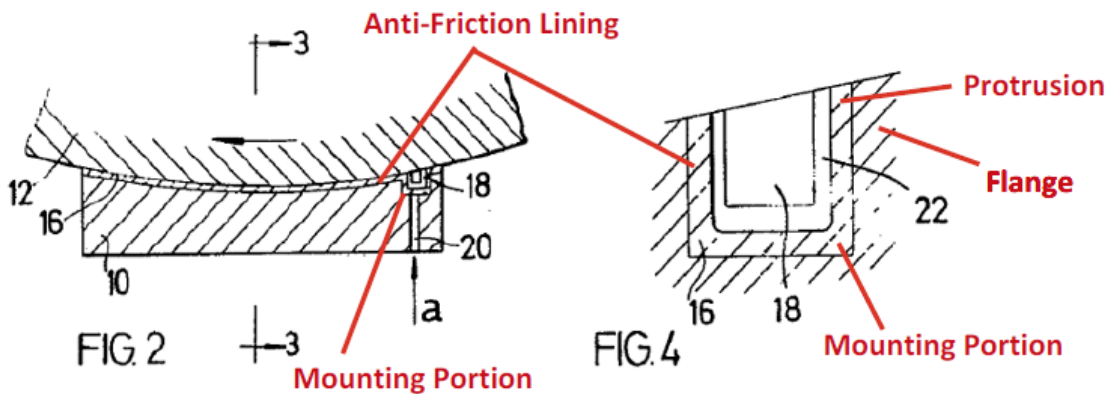
member 13 has a part-spherical lower surface and a centre 30 situated on the sliding surface of the shoe 10.” Ex. 1003, 3:45-51. By mounting the shoe 10 atop a member 13 having a part-spherical lower surface, shoe 10 “self adjusts” to angular movements of the rotating body 12. The shoe 10 “self-adjusts” by virtue of the layer of lubricating oil deposited on the outer surface of the anti-friction lining 16 (i.e., the pad) in connection with the part-spherical annular member formed in the ball joint. In other words, the part-spherical lower surface is seated in a ball joint. That lower surface provides a limited radial degree of freedom for the shoe 10 to move within the joint. The weight of the body 12 is supported by the shoe 10 but when the weight has a shift in an angular direction, the shoe 10 moves within the ball joint to accommodate for the weight shift.

136. It is not uncommon for the weight to shift while a journal mill is in use and different sized pieces of mineral are being processed through the mill. The person of ordinary skill in the art could use self-adjusting or fixed bearings depending on the load being processed. *See* my discussion in general knowledge above at ¶ 107 for additional information.

[Dependent Claim 2] *The bearing assembly of claim 1, wherein said mounting element comprises a mounting portion extending from said polymer bearing pad, said mounting portion comprising a protrusion from a mounting surface opposite to said outer surface for engaging a flange of said base, said flange being located at an outer edge of said base.*

137. The term mounting element is not used in the '604 Patent except in the claims. To the extent, this claim is referring to a “mounting portion” which is noted in the '604 Patent, GB384 discloses a mounting portion. Figure 2 of GB384 is shown below. Figure 4 is a close up of the recess 18 shown in Figure 2 along with the mounting portion. The mounting portion has a protrusion extending up

from the anti-friction liner 16. It is opposite the outer surface of the liner and engages a flange of the shoe 10. The flange is on the outer edge of the shoe 10.



[Dependent Claim 3] *The bearing assembly of claim 1, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base; said at least one recess comprises a locking tab for retaining a head portion of said fastener within said at least one recess and said at least one fastener comprises a bore for conveying lubricating fluid from said at least one passage to said at least one recess.*

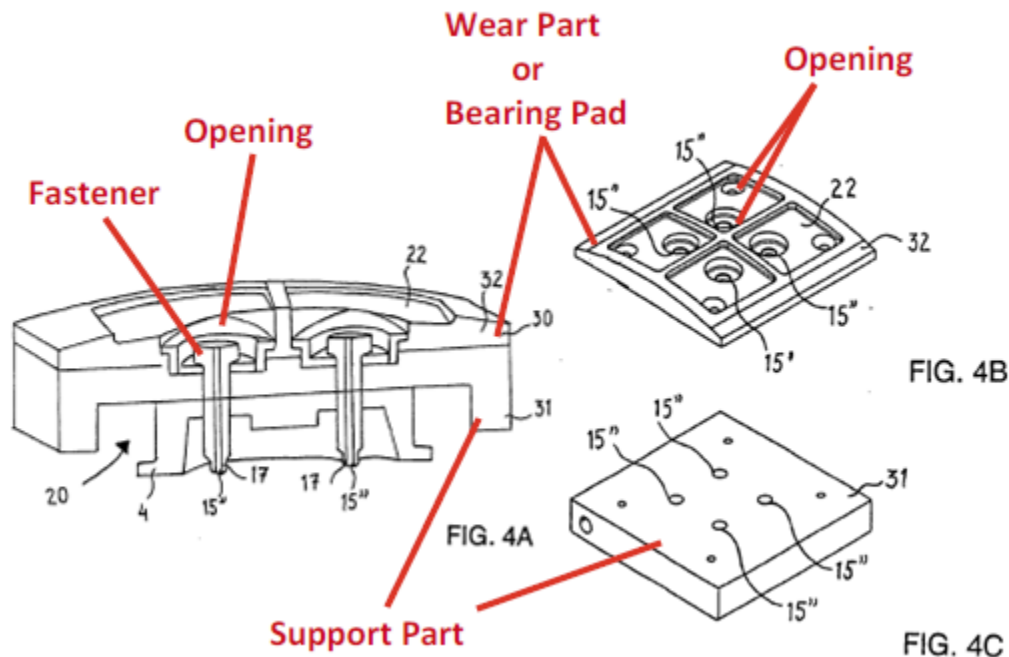
138. It is within the general knowledge of one of ordinary skill in the art to have an opening for receiving a fastener and a recess for having a locking tab to secure the head of the fasteners in place. *See supra*, ¶¶ 99-100. Moreover, the use of hollow bolts or “fastener comprises a bore for conveying lubricating fluid” were within the general knowledge of one of ordinary skill in the art. *See supra*, ¶¶ 86, 96.

139. That said, DE364 specifically discloses at least one opening for receiving at least one fastener for mounting a pad to a base. The fastener in DE364 comprises a bore for conveying lubricating fluid from a fluid passage to a recess on the pad for lubrication of the bearing.

140. DE364 notes that the “support element 20 comprises a surface part 32, i.e., a bearing part, and a support part 31. The support element 20 is attached to

the loading piston 4 via the nozzles 17, in which the medium channels, i.e., the capillaries 15", run. The surface part 30 of the support element 20 acts as a bearing." Ex. 1005, ¶ [0025]. "The replaceable wear part 30 thus consists of the part 32 acting as a bearing material which, together with its support part 31, is removably attached to the remainder of the shoe structure, for example by means of the nozzles 17." *Id.*

141. Figures 4A, 4B, and 4C are shown and annotated below showing these features.



142. In sum, fasteners (i.e., the nozzles 17) are placed in an opening within recess 22 of the polymeric bearing pad 20. The fasteners have a bore (described as a capillary 15") that provide oil to the polymeric bearing pad for lubrication.

143. There is no locking tab shown in DE364. However, it would be a simple and predictable modification with a predictable outcome for one of ordinary skill (*see supra*, ¶¶ 99-100) to provide a locking tab if any extra locking mechanism was desired. Further, a POSITA would have been motivated to utilize a

locking tab for the fastener so that it did not back out due to vibration as the mill rotated, and made contact with the mill journal causing damage and requiring expensive maintenance.

[Dependent Claim 4] *The bearing assembly of claim 1, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base, said bearing assembly further comprising a locking element for retaining said at least one fastener within said at least one recess.*

144. It is within the general knowledge of one of ordinary skill in the art to have an opening for receiving a fastener and locking elements for securing fasteners in place. *See supra*, ¶¶ 86, 96. That said, DE364 specifically discloses a bearing with plurality of openings that are countersunk to receive “screws” to fasten the pad onto the mounting surface 31 as well as the nozzles 17. Adding a locking element such as a “liquid thread locker” or some other “element” to secure the fastener is well within the general knowledge of the skilled artisan.

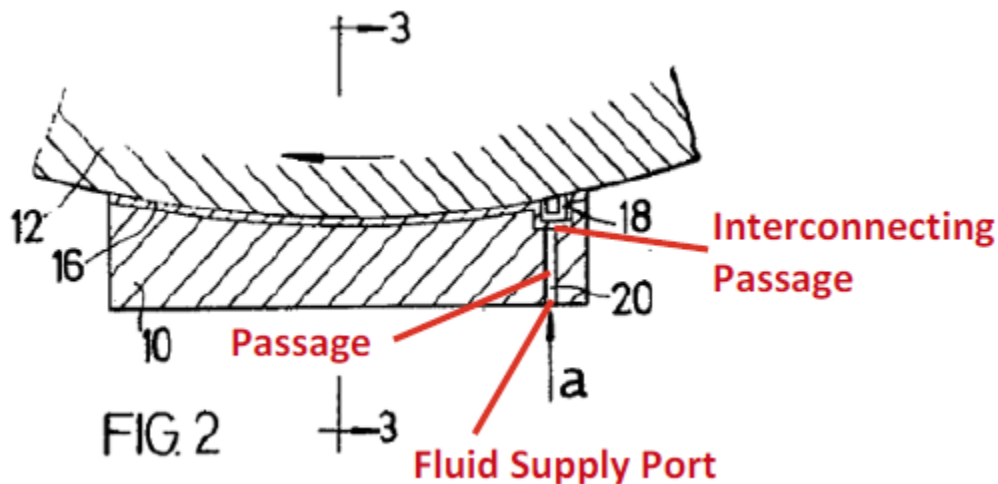
[Dependent Claim 5] *The bearing assembly of claim 1, wherein said polymer bearing pad substantially covers an outer surface of said base to create a fluid seal between said polymer bearing pad and said base.*

145. The anti-friction lining 16 (i.e., the bearing pad) of GB384 covers the entire upper surface of the shoe 10 and creates a fluid seal between the pad and the base. Specifically, GB384 notes that “[a]n upper face of the shoe 10 and an upper portion of sides thereof are covered with a lining 16 of anti-friction material.” Ex. 1003, 2:69-71. Figure 2 and 5 of GB384 shows the lining fully covering the upper surface of shoe 10 including the recess 18. The shoe 10 is a hydrostatic bearing, using oil as a lubricant. The ’604 Patent itself notes in the Background section that “typical” hydrostatic bearings have a “bearing pad” that can “form a seal with the base.” Ex. 1001, 2:35-41. The formation of the fluid seal is important to help keep the oil or fluid where it is designed to be, and to keep it out of places where it is not

supposed to be. This affects the cleanliness, minimizes fluid loss, and decreases the required maintenance.

[Dependent Claim 7] *The bearing assembly of claim 1, said at least one recess of said polymer bearing pad comprises at least one interconnecting passage for fluidly connecting said at least one recess to said at least one passage of said base.*

146. GB384 discloses an interconnecting passage from recess 18 in the anti-frictional liner 16 (i.e., the bearing pad) to at least one passage 20 in the base 10. While the “interconnecting passage” is not called out in the figures, it is necessarily present at the end of passage 20 where it connects with the liner 16. The interconnecting passage is what allows fluid to move from the passage 20 into the recess 18. If it was not present, there would be no way for fluid to get into the recess 18.



[Dependent Claim 10] *The bearing assembly of claim 1, wherein said polymer bearing pad is removably mounted to said base.*

147. Removable bearing pads are well within the general knowledge of a person skilled in the art. *See supra*, ¶ 82. It is not uncommon to make a part of a device that is “disposable” meaning intended to wear out over time, or “sacrificial”

meaning a less expensive part designed to fail first, preventing failure of other more expensive parts. Both disposable and sacrificial parts are designed to be removable. This reduces the need for costly repairs. In this instance specifically, DE364 discloses a polymer bearing pad that is secured to a base by a “dovetail connection, screws or other fit” to enable replacement. Ex. 1005, ¶ [0025]. The polymer bearing pad of DE364 is in fact referred to as a “wear part 30.” *Id.* “The replaceable wear part 30 thus consists of the part 32 acting as bearing material, which, together with its support part 31, is removably attached of the remainder of the shoe structure, for example by means of the nozzles 17.” *Id.*

148. Independent claim 11 is broken into subparts and discussed below.

[11a] *A bearing assembly for supporting a journal of a grinding mill body, comprising*

[11b] *a frame and a plurality of fluid bearings,*

[11c] *said fluid bearings each comprising a polymer bearing pad mounted to a base, said polymer bearing pad comprising an outer surface,*

[11d] *at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and*

[11e] *mounting element for securely mounting said polymer bearing pad to said base,*

[11f] *said base also comprising at least one lubricating fluid supply port in fluid communication with said at least one passage,*

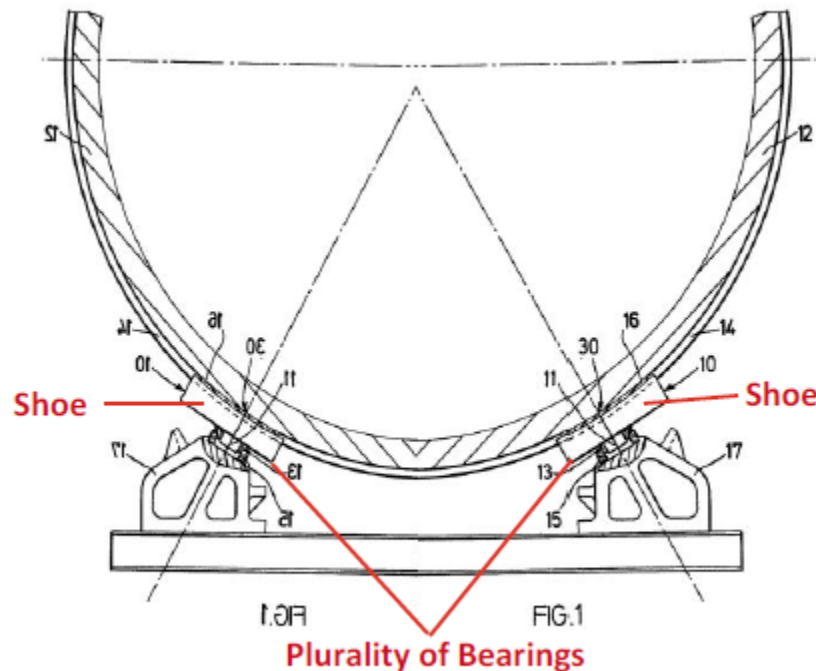
[11g] *wherein said base is fixedly mounted to said frame.*

[11a] *A bearing assembly for supporting a journal of a grinding mill body, comprising*

149. GB384 discloses a bearing assembly for supporting a journal of a rotating body and “more particularly, for example, bearings of tubular grinding mills and bearings supporting rotary oven wheels.” Ex. 1003, 3:25-27.

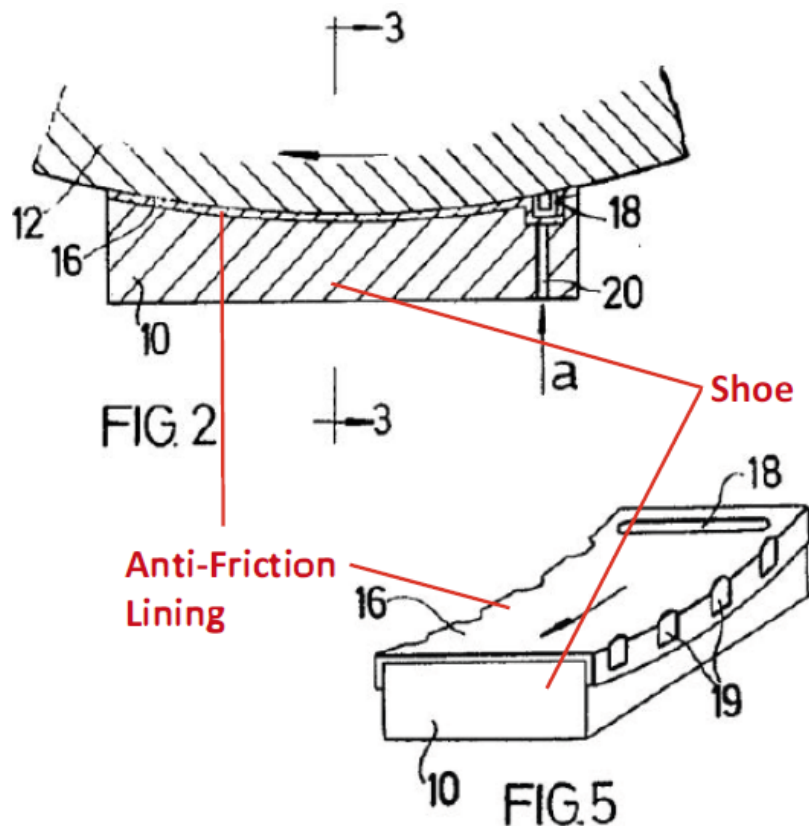
[11b] *a frame and a plurality of fluid bearings,*

150. GB384 discloses a plurality of bearings 10 coupled to a frame 17. While a plurality of individual bearings are not explicitly shown in the figures, it is apparent from Figure 1 that another bearing would be required to support an opposing side of the rotating body 12 in order to properly support the rotating body 12. The specification states that “a supporting device shown in Figure 1 is intended to support a rotating body 12 of large diameter; an identical device is arranged symmetrically relatively to a vertical plane containing the axis of the rotating body 12.” Ex. 1003, 2:33-38. As I stated above in paragraphs 123-124, a mirror image of Figure 1 placed next to the original Figure 1 below to illustrate that principle. See addition to claim 1 above, where it says that another bearing is symmetric.



That said, it is common knowledge to use a plurality of bearings to support a rotating body, including mills. See, e.g., *supra*, ¶107 (discussing well-known principles common to fundamental engineering, including a plurality of supports having their own bearings).

151. In addition to the described use of multiple bearings, GB384 shows a bearing pad (i.e., the anti-friction liner 16) used in connection with axial and radial loads; an upper surface of the shoe 10 receiving a radial load, and side surfaces of the shoe 10 receiving axial loads. Annotated Figures 3 and 5 illustrate this principle:

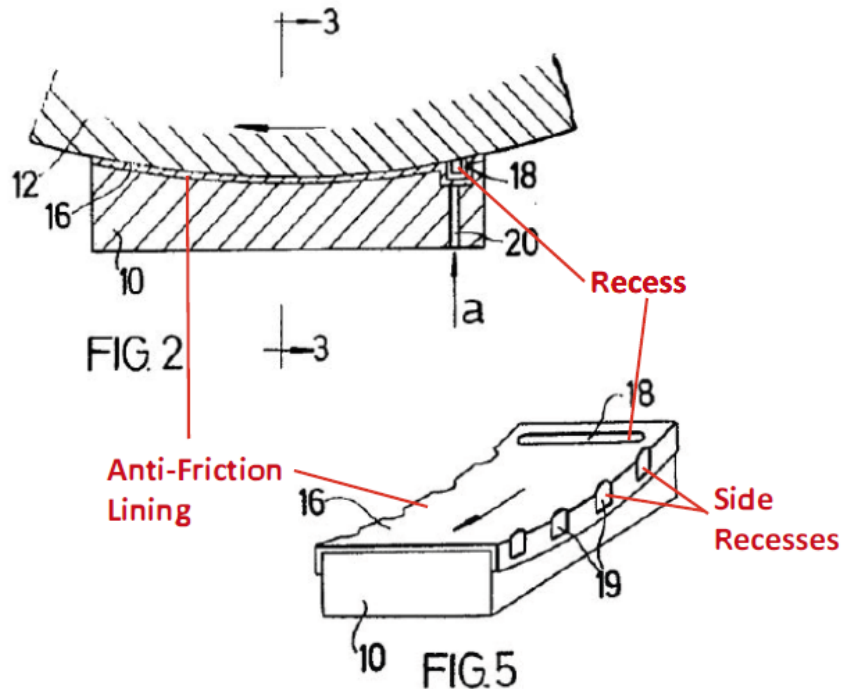


152. GB384 specifically states “[a]n upper face of the shoe 10 and an upper portion of the sides thereof are covered with a lining 16 of anti-friction material. Recesses 19 (Figure 5) forming containers for oil are formed in the sides of the shoe 10.” Ex. 1003, 2 :69-74. “Axial movements of part 12 are limited by two flanges 14 arranged to be integral with said body 12 the flanges 14 are arranged with a small clearance at each respective side of the shoe 10.” Ex. 1003, 2:64-69. “[R]ecesses 22 allow the oil to flow from the channel 18 into the groove 24 and then into the lateral containers 19 for oil, to provide lubrication for the sides of shoe 10.” Ex. 1003, 2:114-117.

[11c] said fluid bearings each comprising a polymer bearing pad mounted to a base, said polymer bearing pad comprising an outer surface,

153. GB384 shows a bearing pad (referred to as anti-friction lining 16) on a surface of a base (shoe 10). The anti-friction lining 16 has an outer surface (i.e.,

the top and side surfaces where oil is distributed). Annotated Figures 2 and 5 of GB384, below, illustrate the use of the bearing pad (anti-friction lining 16) on the surface of a base (shoe 10) of a fluid bearing.



154. GB384 does not specifically identify the composition of its bearing pad. Rather, it simply states it is an “anti-frictional lining 16.” GB384 states that the bearing pad (i.e., the anti-friction lining 16) can help avoid an undesired “shearing stress on a film of oil formed between the shoe and rotating body,” which is “harmful to the stability of said film and may consequently have been detrimental to lubrication of the sliding surfaces.” Ex. 1003, 1:20-32. The use of a polymer as the anti-frictional lining 16 in GB384 is within the general knowledge of one skilled in the art.

155. One of ordinary skill in the art would have known that the anti-frictional properties of polymers are substitute for general “anti-friction” liners in fluid bearing applications and would have had a reasonable expectation of success

in making that substitution. *See supra*, ¶¶55, 77 (explaining properties of polymers as anti-friction surfaces). Among the many references, however, DE364 teaches that the “preferred material” for the bearing is “an advanced engineering plastic, for example polyether ketone (PEEK) polyamide-imide (PAI) or polyimide (PI), which is preferably supplemented with a small amount of polytetrafluoroethene (PTFE) and / or graphite to improve the sliding properties.” Ex. 1005, ¶ [0011].

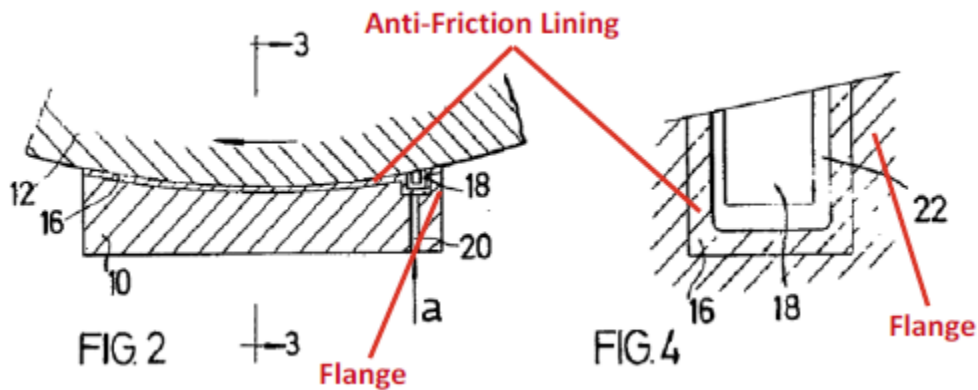
156. As I explained above in ¶¶55, 77, 80 and 94, a designer (i.e., one of ordinary skill) would have known that using a polymer as the pad or lining of a hydrodynamic fluid bearing was one of the many options available and would have had a reasonable expectation of success using a polymer. The designer would have known that polymers “exhibit favourable stability and stiffness, are lightweight, have low coefficients of friction, and can be immersed in oil without damage. Use of such a material as an inner surface of the bearing can be advantageous, since a polymer with these properties will deform slightly while under pressure, so that the bearing has more ‘give’. This allows a better fluid film thickness to be built up during hydrodynamic operation.” *Supra*, ¶94 (quoting the ’993 publication).

[11d-11f] at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and

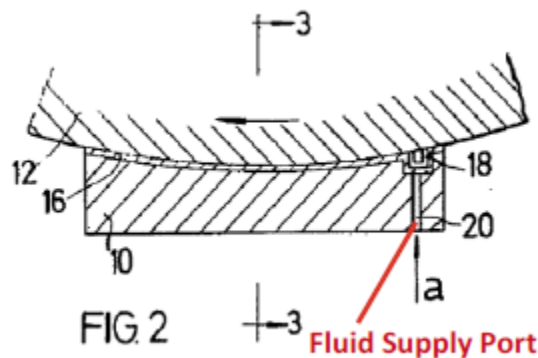
mounting element for securely mounting said polymer bearing pad to said base said base also comprising at least one lubricating fluid supply port in fluid communication with said at least one passage,

157. The base (shoe 10) has at least one passage (duct 20) and that the bearing pad (anti-friction lining 16) has at least one recess (channel 18/oil containers 19) that receives lubricating fluid from at least one passage (duct 20) and is disposed on the outer surface of the lining 16. Ex. 1003, 1:20-32. The upper surface of the shoe 10 has a surface (i.e., a mounting element) whereon the anti-friction lining 16 is mounted. While the term mounting element is not used in the

specification, the '604 Patent describes how the bearing pad is abutted against a flange that helps keep the bearing pad from being pushed off of the surface on which it is mounted. Ex. 1001, 1:15-25. GB384 shows a similar arrangement where the anti-friction surface lining 16 (i.e., the bearing pad) is abutted against a flange.



158. While a fluid supply port in communication with the duct 20 is not specifically called out, it is shown in Figure 2 at the bottom of the shoe 10 as shown below.



[11g] wherein said base is fixedly mounted to said frame.

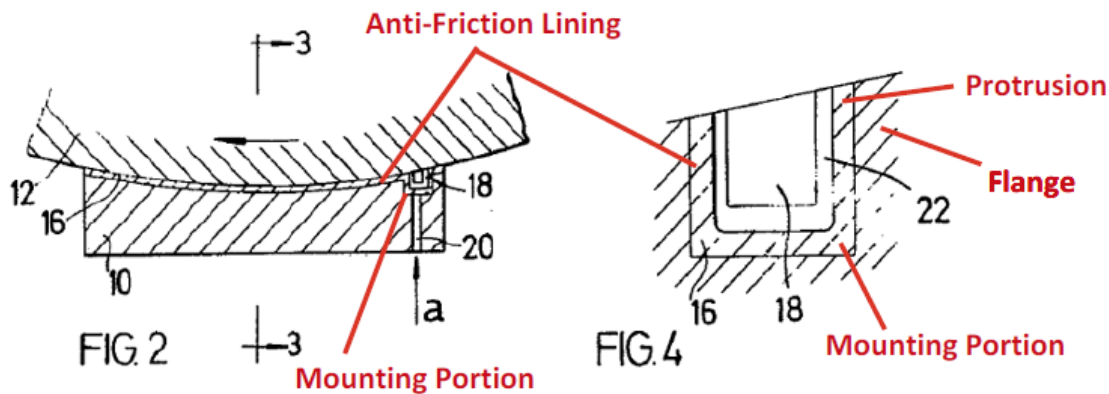
159. The fluid bearing in GB384 is not a “fixed” bearing. Rather, as discussed above in paragraph 129, it is mounted on a frame 17 in a manner that allows for self-adjustment. However, it is well within the general knowledge of a

person of ordinary skill in the art to fix the bearing depending on the particular desire of the designer. *See supra*, ¶¶108-109. Specifically, the person of ordinary skill in the art may use a fixed or “self-aligning” bearing depending on a specific engineering need. Both are well known in the art, and it comes down to a simple design choice. For example, if the rotating system is encountering relatively low-weight loads, or a system that did not encounter changes in axial, radial, or circumferential loads, the use of a fixed fluid bearing might be desirable over a self-aligning. The self-aligning bearing typically introduces another component to the system. That is another component that costs more money, could fail, or requires maintenance. However, in a system with relatively heavy loads or uneven loads (i.e., one where changes in axial, radial, or circumferential loads is anticipated), a self-aligning system might be desirable. Heavier rolling loads can have asymmetric weight distribution during operation causing variable radial and circumferential loads on the fluid bearing. Those variable loads can cause fixed fluid bearings to fail. The person of ordinary skill in the art would look to understand engineering needs and then apply the proper known engineering solution to that need.

[Dependent Claim 12] *The bearing assembly of claim 11, wherein said mounting element comprises a mounting portion extending from said polymer bearing pad, said mounting portion comprising a protrusion from a mounting surface opposite to said outer surface for engaging a flange of said base, said flange being located at an outer edge of said base.*

160. As noted above, the term mounting element is not used in the '604 Patent except in the claims. To the extent, this claim is referring to a “mounting portion” which is noted in the '604 Patent, GB384 discloses a mounting portion. Figure 2 is shown below. Figure 4 is a close up of the recess 18 shown in Figure 2 along with the mounting portion. The mounting portion has a protrusion extending

down from the anti-friction liner 16. It is opposite the outer surface of the liner and engages a flange of the shoe 10. The flange is on the outer edge of the shoe 10.



[Dependent Claim 13] *The bearing assembly of claim 11, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base; said at least one recess comprises a locking tab for retaining a head portion of said fastener within said at least one recess and said at least one fastener comprising a bore for conveying lubricating fluid from said at least one passage to said at least one recess.*

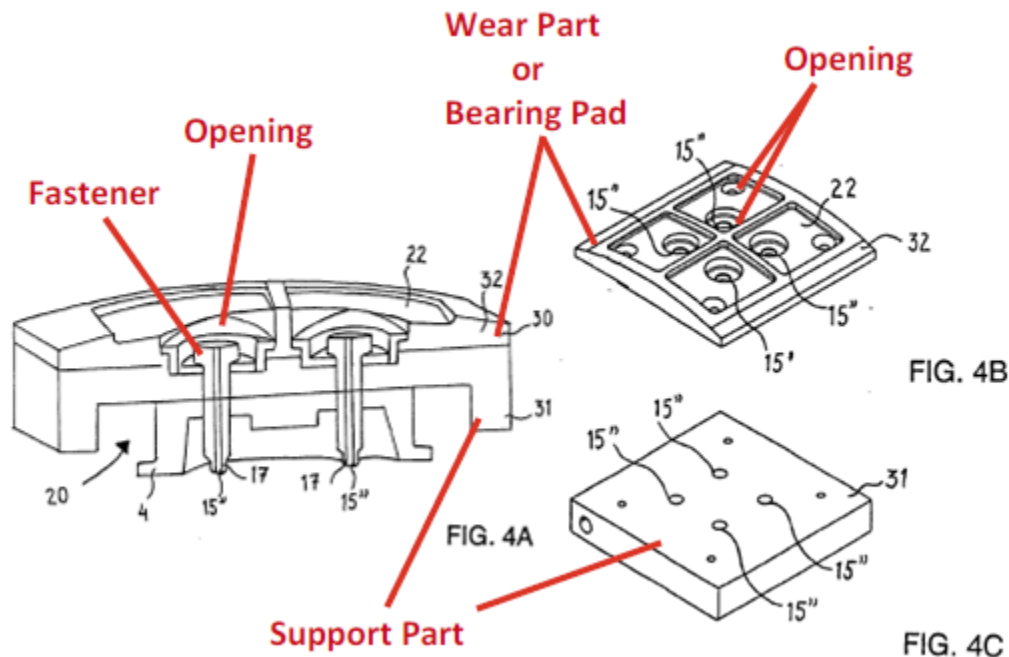
161. It is within the general knowledge of one of ordinary skill in the art to have an opening for receiving a fastener and a recess for having a locking tab to secure the head of the fasteners in place. *See supra*, ¶¶99-100. Moreover, the use of hollow bolts or “fastener comprises a bore for conveying lubricating fluid” were within the general knowledge of one of ordinary skill in the art. *See supra*, ¶¶86, 96.

162. That said, DE364 specifically discloses at least one opening for receiving at least one fastener for mounting a pad to a base. The fastener in DE364 comprises a bore for conveying lubricating fluid from a fluid passage to a recess on the pad for lubrication of the bearing.

163. DE364 notes that the “support element 20 comprises a surface part 32, i.e., a bearing part, and a support part 31. The support element 20 is attached to

the loading piston 4 via the nozzles 17, in which the medium channels, i.e., the capillaries 15", run. The surface part 30 of the support element 20 acts as a bearing." Ex. 1005, ¶ [0025]. "The replaceable wear part 30 thus consists of the part 32 acting as a bearing material which, together with its support part 31, is removably attached to the remainder of the shoe structure, for example by means of the nozzles 17." *Id.*

164. Figures 4A, 4B, and 4C are shown and annotated below showing these features.



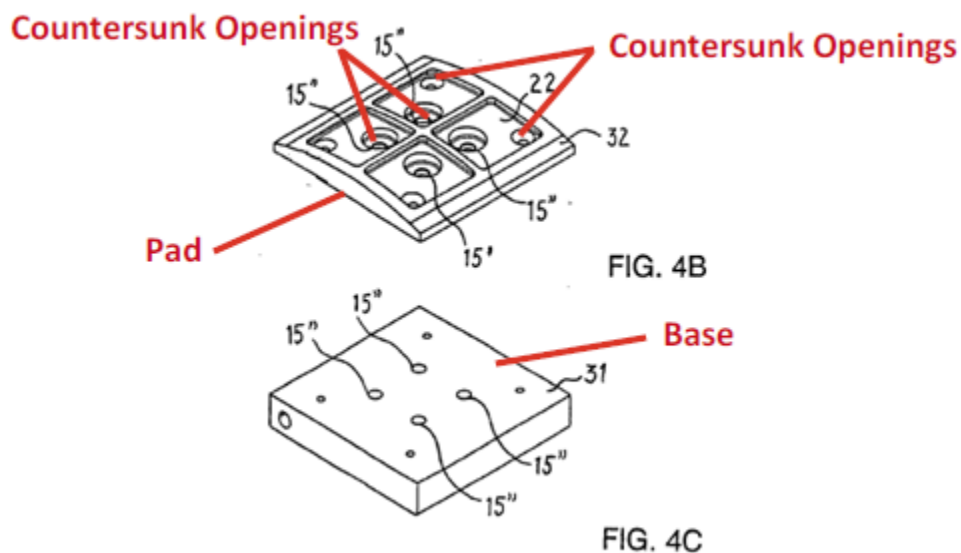
165. In sum, fasteners (i.e., the nozzles 17) are placed in an opening within recess 22 of the polymeric bearing pad 20. The fasteners have a bore (described as a capillary 15") that provide oil to the polymeric bearing pad for lubrication.

166. There is no locking tab shown in DE364. However, it would be a simple and predictable modification with a predictable outcome for one of ordinary skill (*see supra*, ¶¶ 99-100) to provide a locking tab if any extra locking mechanism was desired. Further, a POSITA would have been motivated to utilize a

locking tab for the fastener so that it did not back out due to vibration as the mill rotated and made contact with the mill journal causing damage and requiring expensive maintenance.

[Dependent Claim 14] *The bearing assembly of claim 11, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base, said bearing assembly further comprising a locking element for retaining said at least one fastener within said at least one recess.*

167. It is within the general knowledge of one of ordinary skill in the art to have an opening for receiving a fastener and locking elements for securing fasteners in place. *See supra*, ¶¶86, 96, 99-100. That said, DE364 specifically discloses a bearing with plurality of openings that are countersunk to receive “screws” to fasten the pad onto the mounting surface 31 as well as the nozzles 17. Adding a locking element such as a “liquid thread locker” or some other “element” to secure the fastener is well within the general knowledge of the skilled artisan.

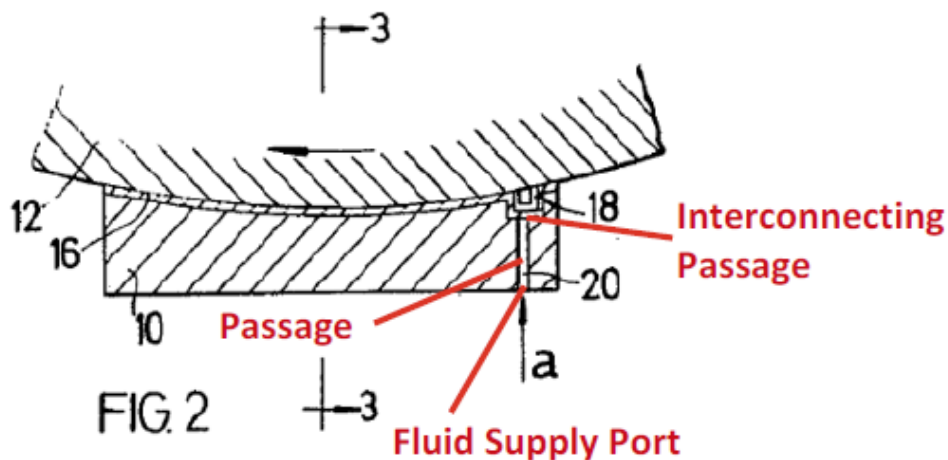


[Dependent Claim 15] *The bearing assembly of claim 11, wherein said polymer bearing pad substantially covers an outer surface of said base to create a fluid seal between said polymer bearing pad and said base.*

168. The anti-friction lining 16 (i.e., the bearing pad) of GB384 covers the entire upper surface of the shoe 10 and creates a fluid seal between the pad and the base. Specifically, GB384 notes that “[a]n upper face of the shoe 10 and an upper portion of sides thereof are covered with a lining 16 of anti-friction material.” Ex. 1003, 2:69-71. Figure 2 and 5 of GB384 shows the lining fully covering the upper surface of shoe 10 including the recess 18. The shoe 10 is a hydrostatic bearing, using oil as a lubricant. The ’604 Patent itself notes in the Background section that “typical” hydrostatic bearings have a “bearing pad” that can “form a seal with the base.” Ex. 1001, 2:38-41.

[Dependent Claim 17] *The bearing assembly of claim 11, said at least one recess of said polymer bearing pad comprises at least one interconnecting passage for fluidly connecting said at least one recess to said at least one passage of said base.*

169. GB384 discloses an interconnecting passage from recess 18 in the anti-frictional liner 16 (i.e., the bearing pad) to at least one passage 20 in the base 10.



[Dependent Claim 20] *The bearing assembly of claim 11, wherein said polymer bearing pad is removably mounted to said base.*

170. Removable bearing pads are well within the general knowledge of a person skilled in the art. *See supra*, ¶¶82, 106. It is not uncommon to make a part of a device that is “disposable” meaning intended to wear out over time, or “sacrificial” meaning a less expensive part designed to fail first, preventing failure of other more expensive parts. Both disposable and sacrificial parts are designed to be removable. This reduces the need for costly repairs. In this instance specifically, DE364 discloses a polymer bearing pad that is secured to a base by a “dovetail connection, screws or other fit” to enable replacement. Ex. 1005, ¶ [0025].

171. Claim 21 is broken down below into subparts for analysis.

[21a] *A multidirectional fluid bearing for a journal, comprising:*

[21b] *a base having a first surface orthogonal to a second surface, one or more lubricating fluid supply ports and a plurality of passages in fluid communication with said lubricating fluid supply ports, said first surface and said second surface,*

[21c] *a first polymer bearing pad mountable to said first surface, said polymer bearing pad having a first outer surface and at least one recess for receiving lubricating fluid from at least one of said plurality of passages and distributing said lubricating fluid to said first outer surface, and*

[21d] *a second polymer bearing pad mountable to said second surface, said second polymer bearing pad having a second outer surface and at least one recess for receiving lubricating fluid at least one of said plurality of passages and distributing said lubricating fluid to said second outer surface,*

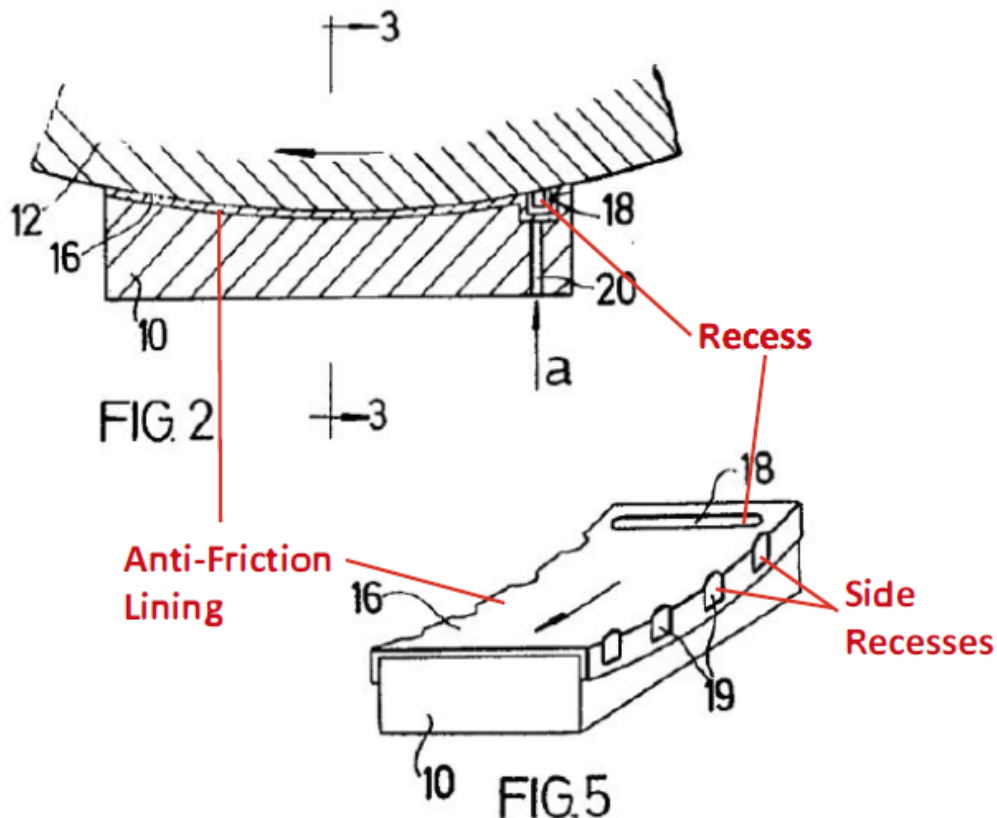
[21e] wherein at least one of said first and second polymer bearing pads comprises at least one opening for receiving at least one fastener for mounting said at least one polymer bearing pad to said base,

[21f] wherein said at least one recess comprises a locking tab for retaining a head portion of said fastener within said at least one recess, said head portion being tapered to facilitate retention of said at least one fastener within said at least one recess by said locking tab,

[21g] and wherein said at least one fastener comprises a bore for conveying lubricating fluid from said at least one passage to said at least one recess, said at least one fastener being partially received in said at least one passage.

[21a and b] A multidirectional fluid bearing for a journal, comprising: a base having a first surface orthogonal to a second surface, one or more lubricating fluid supply ports and a plurality of passages in fluid communication with said lubricating fluid supply ports, said first surface and said second surface,

172. GB384 discloses a multidirectional fluid bearing for a journal having a base with a first surface orthogonal to a second surface.



173. GB384 discloses an anti-friction lining 16 on a top surface of the shoe 10 and on the orthogonal side surfaces of the shoe 10. Recesses 19 “form[] containers for oil...in the sides of the shoe 10.” Ex. 1003, 2:73-74. The upper portion of each of the plurality of recesses 19 are fluid supply ports (i.e., they act as an entrance to the “container” formed by the recess 19. They are referred to as “orifices” in GB384. Ex. 1003, 2:109). Sloping recesses 22 act as a plurality of passages in fluid communication with the supply ports.

174. “Sloping recesses 22 (Figures 4, 6, and 7) are formed in two end walls of the channel 18...These recesses 22 provide communication between the channel 18 and two circumferential grooves 24 formed at the junction of the flanges 14 with the rotating body 12.” Ex. 1003, 2:83-90. “These recesses 22 allow oil to move from the channel 18 into the groove 24 and then into the lateral

containers 19, to provide lubrication for the sides of the shoe 10.” Ex. 1003, 2:114-119. “An advantage of such an arrangement consists in that a flow of oil towards each side of the shoe 10 is larger in proportion as the corresponding flange 14 is nearer to this side...Therefore, this cross-sectional area is larger in proportion as that side of the shoe 10 is nearer to the flange 14, and lubrication must be more effective. Thus means are provided for bringing a lubricant in between the sides of the shoe 10 and the respective flanges 14.” Ex. 1003, 2:119-3:8.

175. To the extent this part of the patent claim is read to mean that “passages” are enclosed vessels contained within the shoe, one passageway 20 is shown in GB384 which connects directly with recess 18. If the person of ordinary skill desired to add more enclosed vessels to accommodate a particular need, one of ordinary skill would have predictably added more passageways. Meaning, multiple passageways to multiple openings is within the general knowledge of one of ordinary skill in the art. *See, e.g. supra*, ¶¶110-111.

[21c] a first polymer bearing pad mountable to said first surface, said polymer bearing pad having a first outer surface and at least one recess for receiving lubricating fluid from at least one of said plurality of passages and distributing said lubricating fluid to said first outer surface, and

176. GB384 discloses an anti-friction 16 lining mounted on the first surface with a recess 18 for receiving lubricating fluid from passageway 20 and distributing oil to the surface. As noted in other parts of my declaration, GB384 does not disclose that its anti-friction lining is a polymer. But one of ordinary skill would have had general knowledge that a polymer was one of the many options available for use and would have had a reasonable expectation of success using a polymer as the bearing pad or liner. *See supra*, ¶95.

177. As noted in other locations throughout my declaration, DE364 discloses the use of a polymer bearing liner with at least one recess for receiving fluid from a plurality of passages to a first out surface. *See supra*, ¶¶52-56.

[21d] a second polymer bearing pad mountable to said second surface, said second polymer bearing pad having a second outer surface and at least one recess for receiving lubricating fluid at least one of said plurality of passages and distributing said lubricating fluid to said second outer surface,

178. GB384 discloses an anti-friction lining 16 mounted on a second surface with a plurality of recesses 19 for receiving lubricating fluid from the passageway 20. As noted in other parts of my declaration, GB384 does not disclose that its anti-friction lining is a polymer. But one of ordinary skill would have had general knowledge that a polymer was one of the many options available for use. *See supra*, ¶95.

179. As noted in other locations throughout my declaration, DE364 discloses the use of a polymer bearing liner with at least one recess for receiving fluid from a plurality of passages to a first out surface. *See supra*, ¶¶52-56.

180. The anti-friction liner 16 on the second surface of GB384 does not appear to be separate pad. Rather it is a unitary liner on the top side surfaces of the shoe 10. That said, one of ordinary skill would understand that integrating the pads or having separate pads is a matter of design choice and general knowledge. In some instances, the designer may want a separate pad so that if a first pad wears out before a second pad, you only need to replace the worn out pad. Having a plurality of pads is generally known. However, a designer may also want to have a unitary pad to maintain the continuity of the surface and minimize areas of the shoe that may be subjected to grinding with the journal. A unitary pad can also help with a more evenly distributed oil profile. It just depends on what the designer prefers.

[21e] wherein at least one of said first and second polymer bearing pads comprises at least one opening for receiving at least one fastener for mounting said at least one polymer bearing pad to said base,

181. DE364 discloses a polymer bearing pad with at least one opening for receiving at least one fastener 17 for mounting the bearing pad 30 to the base 31. *See supra*, ¶¶52-56.

[21f] wherein said at least one recess comprises a locking tab for retaining a head portion of said fastener within said at least one recess, said head portion being tapered to facilitate retention of said at least one fastener within said at least one recess by said locking tab,

182. As I note above (*see supra*, ¶¶99-100), locking tabs and tapered fastener heads are within the general knowledge of one of ordinary skill. The designer could easily choose to implement this general knowledge to further assist in minimizing bolts from coming loose based on the vibration and operation of the bearing.

[21g] and wherein said at least one fastener comprises a bore for conveying lubricating fluid from said at least one passage to said at least one recess, said at least one fastener being partially received in said at least one passage.

183. As discussed in numerous areas of my declaration, DE364 discloses a fastener (i.e., the nozzle) with a bore 15” for conveying lubricating fluid from a passage to the recess on a polymer bearing pad. In DE364, the fastener is at least partially received in the passage for conveying lubrication. In any event, however, driving a hollow fastener into the passageway is a generally known method of forming a seal between the cavity for receiving the hollow fastener and the passageway. This minimizes the likelihood that lubricating fluid from the passageway will seep past the hollow fastener in the cavity rather than moving through the bore of the fastener. A POSITA would be motivated to utilize a

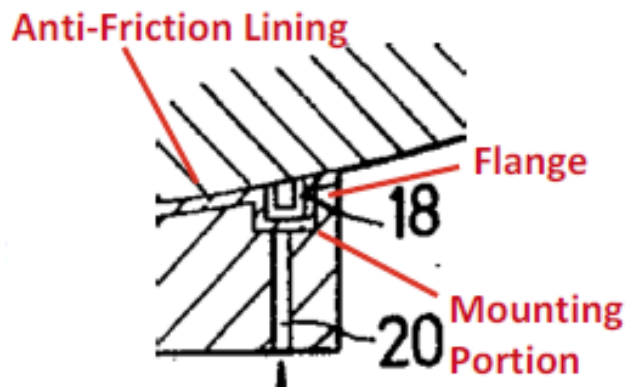
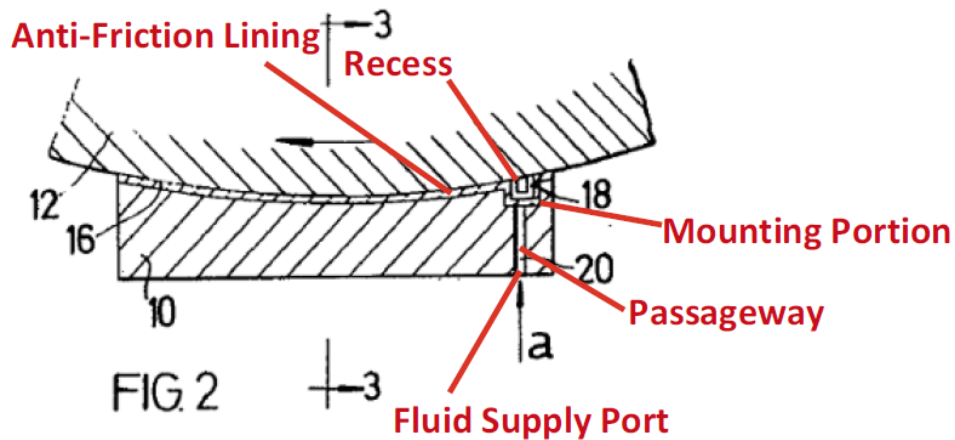
fastener comprising a bore to minimize the number of holes needed to be manufactured in the base and the polymer bearing pad, reducing manufacturing and maintenance costs.

[22.] The multidirectional fluid bearing of claim 21, said first polymer bearing pad substantially covers said first surface and said second polymer bearing pad substantially covers said second surface to respectively create fluid seals between said first and second polymer bearing pads and said base.

184. GB384 discloses that the anti-friction liner 16 covers the first and second surfaces. One of ordinary skill would understand that one of the primary purposes of the liner is to create a fluid seal between the surface of the liner and the surface of the shoe. The fluid seal minimizes the loss of oil which can interfere a hydrostatic bearing in particular as there is no active pressure system maintaining lubricating fluid flow.

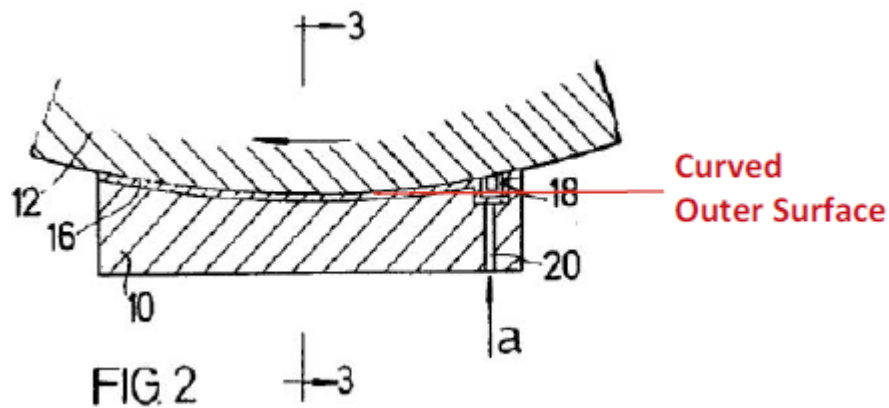
[25.] The multidirectional fluid bearing of claim 21, wherein said base comprises at least one flange for engagement with a mounting portion of at least one of said first and second polymer bearing pads to securely mount said at least one polymer bearing pad to said base, said flange being located at an outer edge of said base.

185. The term mounting element is not used in the '604 Patent except in the claims. To the extent, this claim is referring to a "mounting portion" which is noted in the '604 Patent, GB384 discloses a mounting portion. Figure 2 of GB384 is shown below. Figure 4 is a close up of the recess 18 shown in Figure 2 along with the mounting portion. The mounting portion has a protrusion extending up from the anti-friction liner 16. It is opposite the outer surface of the liner and engages a flange of the shoe 10. The flange is on the outer edge of the shoe 10.

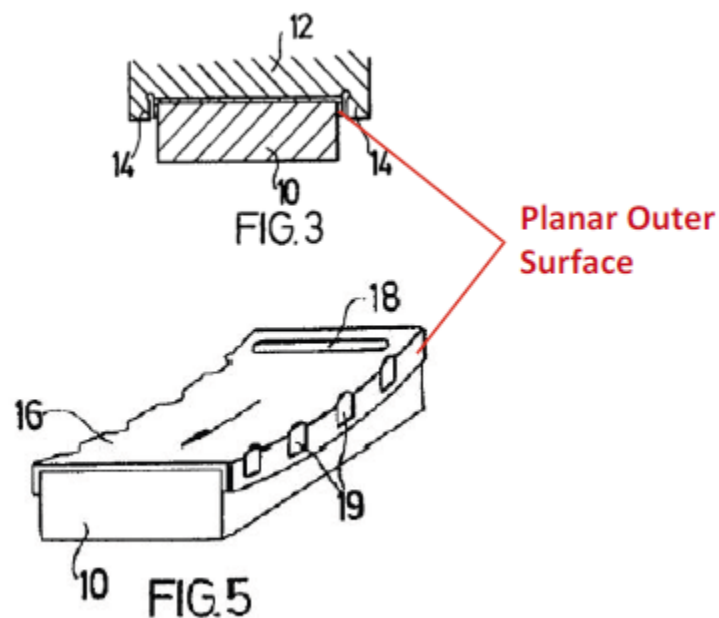


[26.] *The multidirectional fluid bearing of claim 21, wherein said first outer surface is partially curved such that said first polymer bearing pad acts as a radial hydrostatic bearing and said second outer surface is substantially planar such that said second polymer bearing pad acts as an axial bearing.*

186. You can plainly see from Figure 2 that the first outer surface of the lining 16 is curved and acts as a radial hydrostatic bearing. GB384 notes that the bearing is “for supporting a rotating body [and] is applicable to all supporting and thrust-bearing devices for rotating parts sliding on shoes by means of a hydrostatic or hydrodynamic film of oil and more particularly, for example, bearings of tubular grinding mills and bearings supporting rotary oven wheels.” Ex. 1003, 3:20-27.



187. It is also evident from Figures 3 and 5, that the side surface of the shoe is a second surface that is substantially planar and acts as an axial bearing. GB384 notes, that “[a]xial movements of the part 12 are limited by two flanges 14 arranged to be integral with said body 12 [and] the flanges 14 are arranged with a small clearance at each respective side of the shoe 10.” Ex. 1003, 2:64-69. It also states that “[t]o take up axial forces, flanges or collars may, if desired, be provided on the rotating body.” Ex. 1003, 1:67-70.



B. Motivation to Combine GB483 and DE364

188. GB384 teaches that the disclosed device “is applicable to all supporting and thrust-bearing devices for rotating parts sliding on shoes by means of a hydrostatic or hydrodynamic film of oil.” Ex. 1003, 3:20-24. It is particularly applicable to “bearings of tubular grinding mills and bearings supporting rotary oven wheels.” Ex. 1003, 3:25-27. DE364 discloses a rotary thrust bearing device for a press machine. Ex. 1005, ¶¶ [0002] and [0003].

189. The bearing pad (i.e., the anti-friction lining 16) helps avoid an undesired “shearing stress on a film of oil formed between the shoe and rotating body,” which is “harmful to the stability of said film and may consequently have been detrimental to lubrication of the sliding surfaces.” Ex. 1003, 1:20-32. The use of a polymer as that anti-friction lining is expressly discussed in DE364 which states its bearing pad is a polymer that helps improve “sliding properties.” Ex. 1005, ¶ [0011]. In other words, the use of a polymer as a bearing pad was a known solution to a known technical problem (i.e., that of helping decrease friction and improve the sliding properties of the bearing.) Thus, the person of ordinary skill in the art would have been able to predict with a reasonable degree of success that one could use the polymer bearing pad disclosed in DE364 as the “anti-friction” pad in GB384.

190. In addition, DE364 recognizes the problem associated with wear and the need to replace bearing pads that have worn out. DE364 notes that having a replaceable bearing pad is a known solution to that problem and allows for one or more sections of the bearing pad to be temporarily fastened to the bearing shoe using hollow bolts disposed within recesses on the face of the bearing pad. The person of ordinary skill in the art would have been able to predict with a reasonable

degree of success, that one could use temporary fasteners to fasten a bearing pad onto a shoe.

191. Likewise, a POSITA would be motivated to utilize the fastener in the recess of DE364 with a locking tab with the liner of GB384. It is well known that fasteners can be used to hold components, like bearing pads, in place. As the journal rides on the bearing pad, it is detrimental to have stationary metal contact the rotating metal of the journal. Thus, it is well known and common to provide a recess or countersink in the pad, in combination with the hole, for the head of the bolt or fastener such that the head is below the top surface of the pad. In this fashion, the bolt can hold the pad in place without contacting the rotating journal and causing damage. Further, a locking tab, such as those well known in the art can be incorporated to further secure the bolt in place, again preventing the head of the bolt from contacting the rotating surface of the journal.

192. A POSITA would further be motivated to include a through hole in the bolt or fastener to minimize the number of holes needed to be manufactured in the base and the polymer bearing pad, reducing manufacturing and maintenance costs. In this way, the same holes that are used for the fluid passage can be used for securing the polymer bearing pad in place as shown in DE364.

193. The formation of the polymer bearing pad, whether in a single piece or in multiple sections is nothing more than a design choice for a person of ordinary skill. The DE364 reference teaches that pads can be made in a single piece or in multiple connecting pieces. A POSITA would be motivated to use multiple pieces so that if only a small portion of the pad is damaged, only one piece needs to be replaced.

**C. GROUND 2 – GB384 in view of DE364 and the '799 Patent –
Claims 6, 16 and 23**

[Dependent Claim 6] *The bearing assembly of claim 1, further comprising a chamfer at an outer edge for retaining lubricating fluid at said outer edge and transferring said lubricating fluid to a journal, wherein said chamfer has an outer edge that is displaced from a journal when said journal engages said polymer pad.*

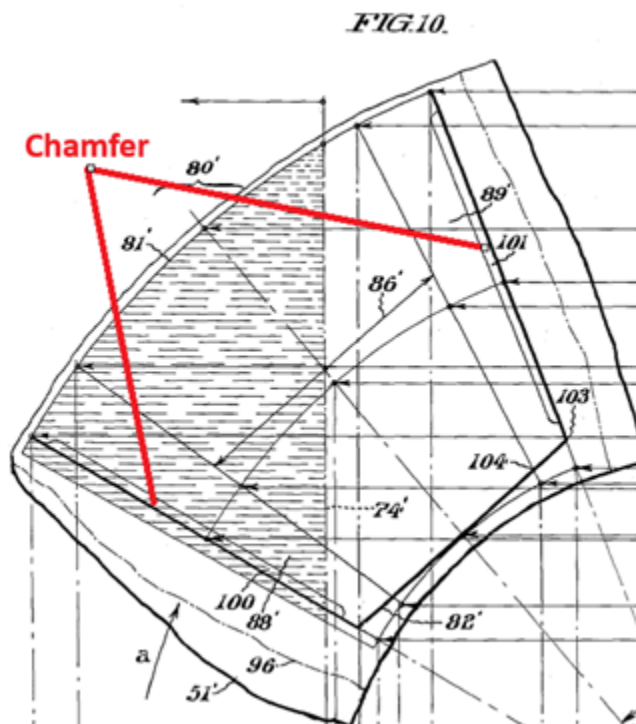
194. Dependent claims 6, 16 and 23 are virtually identical. The primary difference is that claim 6 depends from claim 1, claim 16 depends from claim 11 and claim 23 depends from claim 21. For purposes of brevity, I refer to paragraphs ¶¶117-181 above which discuss the application of GB384 and DE364 to both claims.

195. The use of a chamfer at an outer edge of a bearing pad to retain lubricating fluid at the outer edge and transfer lubricating fluid to the journal was within the general knowledge of one of ordinary skill at the time the '604 Patent was filed. As general principle of mechanical engineering, a chamfer is well-understood to be a transitional surface or edge between two faces of an object. For example, a side surface and a top surface may typically adjoin at an edge that forms a right angle. A chamfer may instead provide a sloped edge or corner transition, for example at 45 degrees, between the side surface and the top surface.

196. In the context of a bearing pad for use with rolling bodies, one of ordinary skill would understand that at least two edges of the bearing pad may include a chamfer: the leading edge, or the edge of the pad first encountered by a point on the rotating surface (e.g., of a mill), and a trailing edge, or the opposite edge of the pad that is last touched by the point on the rotating surface of the mill. A right angle on either the leading or trailing edge of a bearing pad will contribute to lubricating fluid or oil being “scraped” off by the sharp edge of the right angle.

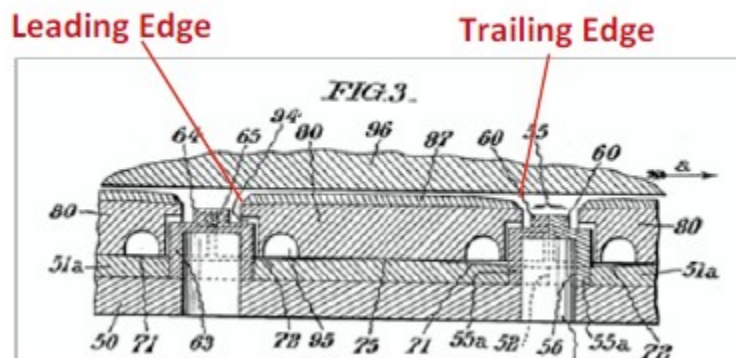
Those of ordinary skill at the time the '604 Patent was filed, would understand that a chamfered edge helps minimize the amount of lubricating fluid that is removed from the journal, while also providing additional space for the film of lubricating fluid to build up and be distributed across, or pulled onto the bearing pad as the journal rotates.

197. The '799 Patent to Howarth demonstrates that a chamfer used in connection with bearing pads is within the knowledge of one of ordinary skill. Ex. 1016, cover page. As shown in annotated Figure 10, below, the '799 Patent discloses a bearing with a leading-edge chamfer (100) and a trailing edge chamfer (101). Ex. 1016, 7:26-34.



198. The chamfer of the '799 Patent is further described as forming "a face angled about 45 degree" and configured "to receive the impact pressure of lubricant in a high speed bearing." Ex. 1016, 7:26-31. As shown below, where the

“runner” 96 is moving in the direction pointed by arrow “a,” the cross-sectional view of the pad of the ’799 Patent further illustrates the leading edge chamfer and the trailing edge chamfer.



199. The ’799 Patent is directed to a flat bearing. The ’799 Patent describes a flat horizontal hydrostatic bearing, rather than a curved bearing surface fitted to a journal. The ’799 Patent also discloses that the outside edges of the bearing pads are chamfered. Thus, the outside edge of the polymer bearing pad is displaced from the sliding surface. It would have been within the skill of an ordinary artisan to modify the flat bearing pad of the ’799 Patent with the curved bearing of GB384, resulting in the outside edge of the bearing pad being displaced from the journal. A POSITA would have been motivated to include the chamfer on a journal bearing pad to reduce the impact pressure on the lubricant as it came back into contact with the bearing pad as taught in the ’799 Patent.

D. Motivation to Combine the ’799 Patent and General Knowledge

200. GB384 teaches that the disclosed device “is applicable to all supporting and thrust-bearing devices for rotating parts sliding on shoes by means of a hydrostatic or hydrodynamic film of oil.” Ex. 1003, 3:20-24. The ’799 Patent

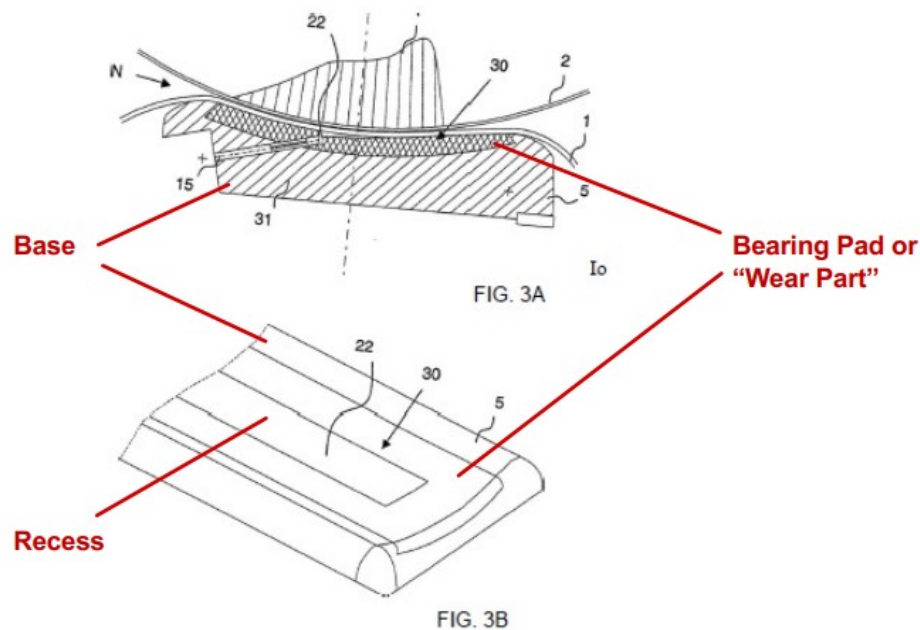
discloses that “[w]hile the invention is widely applicable to thrust bearings having flat faced pivoted shoes, it is also applicable to journal bearings.” Ex. 1016, 1:30-32.

201. The bearing pad (i.e., the anti-friction lining 16) helps avoid an undesired “shearing stress on a film of oil formed between the shoe and rotating body,” which is “harmful to the stability of said film and may consequently have been detrimental to lubrication of the sliding surfaces.” Ex. 1003, 1:20-32. Thus maintaining a consistent thickness and consistency of the lubricating fluid between the journal and bearing surface is important to reduce vibrations and protect the surface of the bearing pad. The ’799 Patent states that one of the objects of invention is “to provide bearing means wherein the shape and thickness of the lubricant film may be predetermined to provide optimum conditions over a wide speed range.” Ex. 1016, 1:55-58. The chamfer on the leading and trailing edges of the bearing pads prevent pressure build up and removes part of the concavity of the film as it traverses across the bearing surface. This allows a stable, equilibrium condition at greater velocity. *Id.*, 5:57-75. Further, a POSITA would understand that as part of the concavity is removed, a bead of oil forms which can further lubricate the portion of the bearing pad between the leading edge and the recess in the pad where additional oil is supplied. As such, the POSITA would have been motivated to combine the chamfer in the ’779 Patent with GB384 and DE364 to optimize the shape and thickness of the lubrication film on the face of the bearings.

**E. GROUND 3 – GB384 in view of DE364 and the '551 Patent –
Claims 8, 18, and 24**

[Dependent Claim 8] *The bearing assembly of claim 1, further comprising a plurality of said polymer bearing pads, wherein said respective outer surfaces of said polymer pads form a substantially uniform bearing surface for said journal, wherein each of said polymer bearing pads comprises at least one lateral connecting portion for mutual engagement with a corresponding lateral connecting portion of an adjacent polymer bearing pad.*

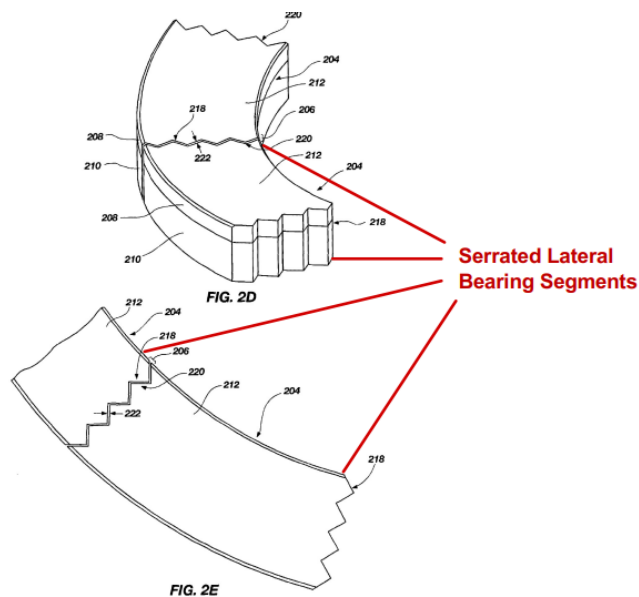
202. DE364 discloses bearing pad, referred to as a “wear part 30” that has a substantially uniform upper surface as shown in Figures 3A and 3B below:



203. DE364 discloses a plurality of separate pads. DE364 states that “[t]he wear part 30 can extend in one piece over the entire length of the shoe 5 (in the CD direction) or be made of sections, in which case only the damages section needs to be replaced in the event of damage.” Ex. 1005, ¶ [0024].

204. As I noted above (*see supra*, ¶¶119-120), it was within the general knowledge of one skilled in the art to use lateral connecting members to couple a plurality of adjacent bearing segments together to, at least, minimize leakage of oil from the outer surface of the bearing between adjacent pads. A person of ordinary skill would have had a reasonable expectation of success forming lateral members (using rectangular or serrated geometries, for example) to couple adjacent bearing segments together. The person of ordinary skill would have a reasonable expectation of success in configuring adjacent bearing pads together using such lateral members.

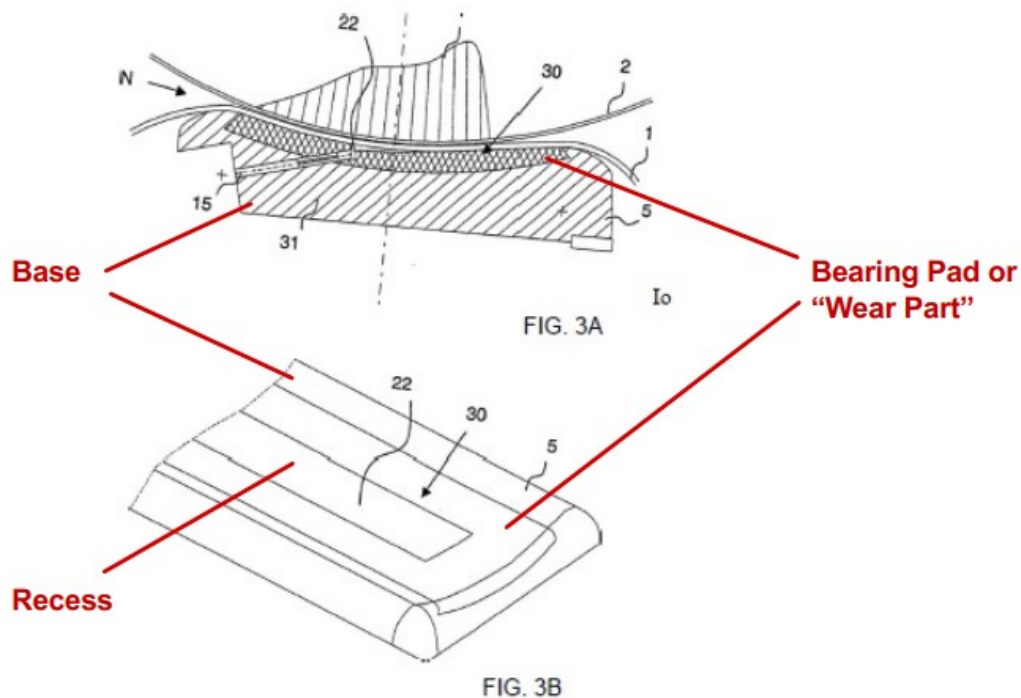
205. In addition, the '551 Patent discloses lateral connecting members used to couple adjacent bearing segments together. *See supra*, ¶¶63-64. The POSITA would have known from the '551 Patent that lateral connecting members were useful to combine adjacent segments together to minimize fluid leakage between adjacent members.



[Dependent Claim 18] *The bearing assembly of claim 11, further comprising a plurality of said polymer bearing pads, wherein said respective outer surfaces of*

said polymer pads form a substantially uniform bearing surface for said journal, wherein each of said polymer bearing pads comprises at least one lateral connecting portion for mutual engagement with a corresponding lateral connecting portion of an adjacent polymer bearing pad.

206. DE364 discloses bearing pad, referred to as a “wear part 30” that has a substantially uniform upper surface as shown in Figures 3A and 3B below:

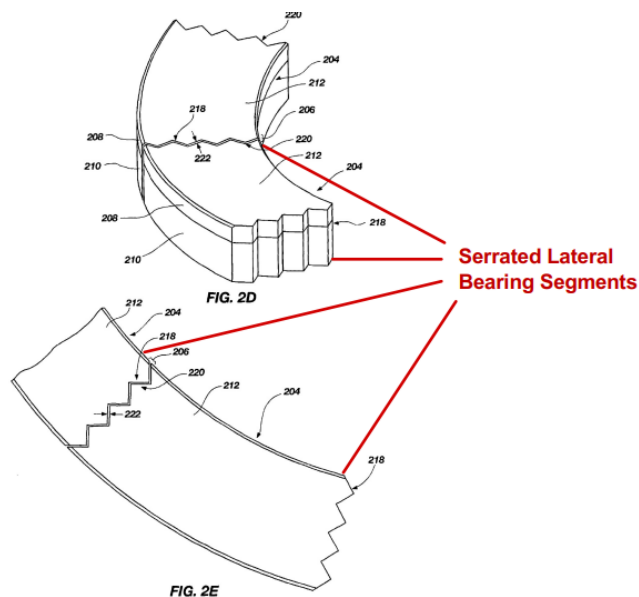


207. DE364 states that “[t]he wear part 30 can extend in one piece over the entire length of the shoe 5 (in the CD direction) or be made of sections, in which case only the damages section needs to be replaced in the event of damage.” Ex. 1005, ¶ [0024].

208. As I noted above (*see supra*, ¶119-120), it was within the general knowledge of one skilled in the art to use lateral connecting members to couple a plurality of adjacent bearing segments together to, at least, minimize leakage of oil from the outer surface of the bearing between adjacent pads. A person of ordinary

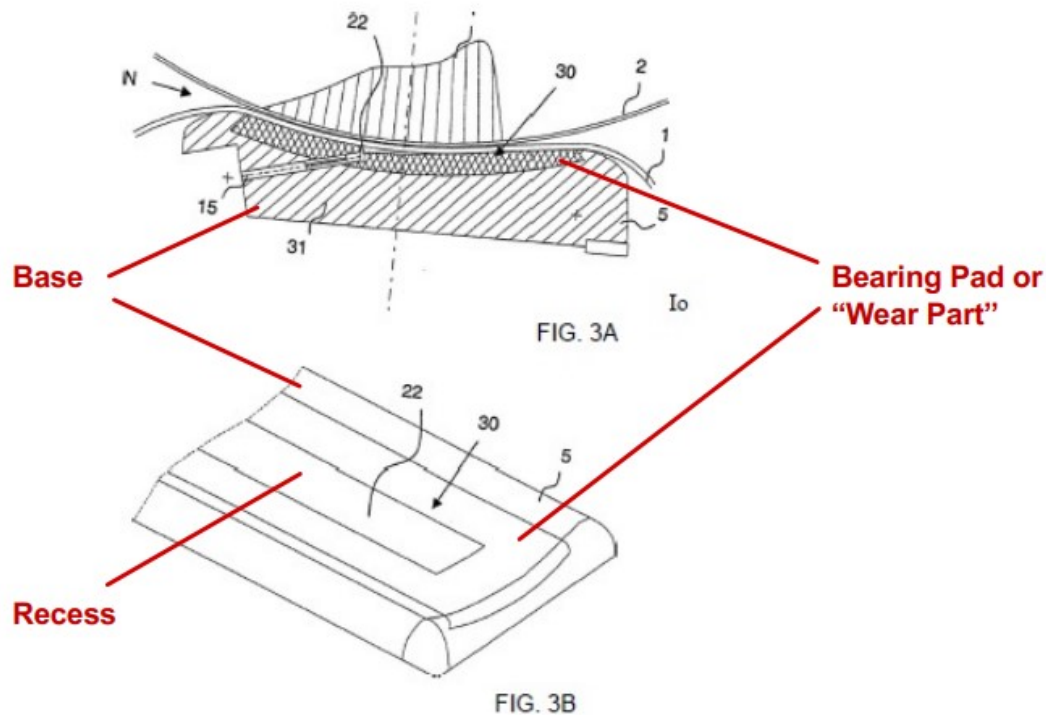
skill would have had a reasonable expectation of success forming lateral members (using rectangular or serrated geometries, for example) to couple the adjacent bearing segments of DE364 together. And the person of ordinary skill would have a reasonable expectation of success in configuring adjacent bearing pads together using such lateral members.

209. In addition, the '551 Patent discloses lateral connecting members used to couple adjacent bearing segments together. *See supra*, ¶¶63-64. The POSITA would have known from the '551 Patent that lateral connecting members were useful to combine adjacent segments together to minimize fluid leakage between adjacent members.



[24.] *The multidirectional fluid bearing of claim 21, wherein there is a plurality of at least one of said first and second polymer bearing pads, wherein said respective outer surfaces of said plurality of at least one of said first and second polymer pads form a substantially uniform bearing surface for said journal, wherein each of said plurality of at least one of said first and second polymer bearing pads comprises at least one lateral connecting portion for mutual engagement with a corresponding lateral connecting portion of an adjacent polymer bearing pad.*

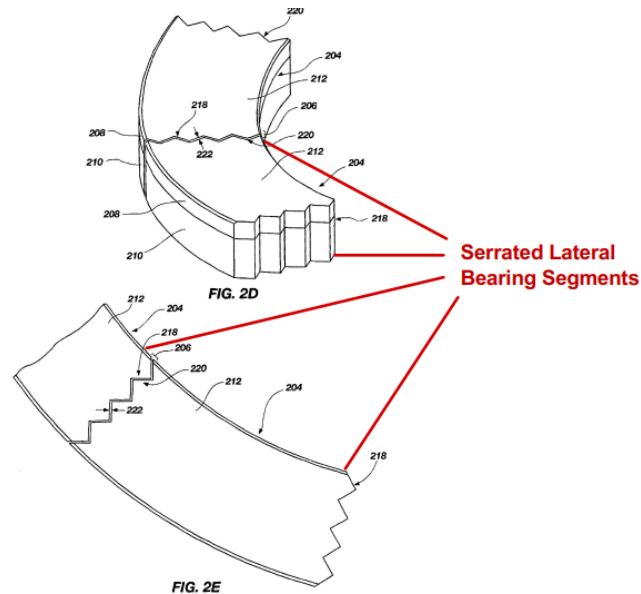
210. DE364 discloses bearing pad, referred to as a “wear part 30” that has a substantially uniform upper surface as shown in Figures 3A and 3B below:



211. DE364 states that “[t]he wear part 30 can extend in one piece over the entire length of the shoe 5 (in the CD direction) or be made of sections, in which case only the damages section needs to be replaced in the event of damage.” Ex. 1005, ¶ [0024]. As I explained above (*see supra*, ¶¶119-120), it was within the general knowledge of one skilled in the art to use lateral connecting members to couple a plurality of adjacent bearing segments together. A designer wishing to couple adjacent bearing segments together would have had a reasonable expectation of success given the knowledge of interconnecting lateral members that was generally known.

212. In addition, the '551 Patent discloses lateral connecting members used to couple adjacent bearing segments together. *See supra*, ¶¶63-64. The

POSITA would have known from the '551 Patent that lateral connecting members were useful to combine adjacent segments together to minimize fluid leakage between adjacent members.



F. Motivation to Combine GB384, DE364 and the '551 Patent

213. Combined with the POSITA's general knowledge regarding known "lateral connecting members" the POSITA would have understood that lateral connecting members provide a "tortuous pathway" between adjacent bearing segments. This pathway limits "fluid leakage radially through the seams" of the connecting lateral members. *See* Ex. 1008, 4:46-63. As such, the POSITA would have been motivated to use this advantage to combine '551 with the multiple bearing segments disclosed in DE364 and further with GB384 in the event multiple bearing segments were desired so that one or more segments could be replaced.

G. GROUND 4 – GB384 in view of DE364 and Trygg – Claims 9 and 19

214. Dependent claim 9 is broken into subparts and discussed below.

[9a] *The bearing assembly of claim 1, wherein said base further comprises a first surface, a second surface, a plurality of said at least one passages and a plurality of said at least one lubricating fluid supply ports, wherein said at least one passages are in fluid communication with said at least one lubricating fluid supply ports, said first surface and said second surface,*

[9b] *wherein there is a plurality of said polymer bearing pads, a first of said polymer bearing pads being mountable to said first surface and a second of said polymer bearing pads being mountable to said second surface*

[9c] *wherein said first polymer bearing pad comprises a first outer surface and at least one recess for receiving lubricating fluid from at least one of said plurality of passages and distributing said lubricating fluid to said first outer surface, and*

[9d] *said second polymer bearing pad comprises a second outer surface and at least one recess for receiving lubricating fluid at least one of said plurality of passages and distributing said lubricating fluid to said second outer surface,*

[9e] *wherein said first outer surface is partially curved such that said first polymer bearing pad acts as a radial hydrostatic bearing and said second outer surface is substantially planar such that said second polymer bearing pad acts as an axial bearing.*

[9a] *The bearing assembly of claim 1, wherein said base further comprises a first surface, a second surface, a plurality of said at least one passages and a plurality of said at least one lubricating fluid supply ports, wherein said at least one passages are in fluid communication with said at least one lubricating fluid supply ports, said first surface and said second surface, and*

215. GB384 discloses a plurality of bearing pad surfaces. More specifically, it discloses an anti-friction lining 16 on a top surface of the shoe 10 and on the side surfaces of the shoe 10. The recesses 19 “form[] containers for

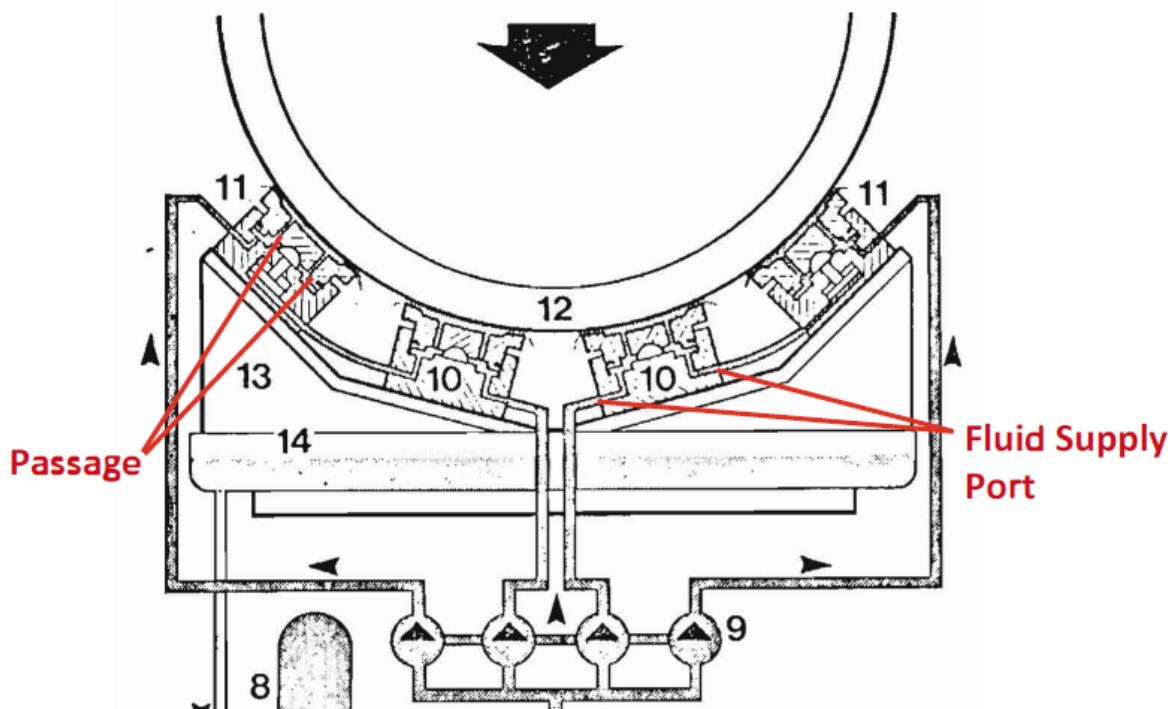
oil...in the sides of the shoe 10.” Ex. 1003, 2:73-74. The upper portion of each of the plurality of recesses 19 are fluid supply ports (i.e., they act as an entrance to the “container” formed by the recess 19. They are referred to as “orifices” in GB384. (see Ex. 1003, 2:109). Sloping recesses 22 act as a plurality of passages in fluid communication with the supply ports.

216. “Sloping recesses 22 (Figures 4, 6, and 7) are formed in two end walls of the channel 18...These recesses 22 provide communication between the channel 18 and two circumferential grooves 24 formed at the junction of the flanges 14 with the rotating body 12.” Ex. 1003, 2:83-90. “These recesses 22 allow oil to from the channel 18 into the groove 24 and then into the lateral containers 19 for oil, to provide lubrication for the sides of the shoe 10.” Ex. 1003, 2:114-119. “An advantage of such an arrangement consists in that a flow of oil towards each side of the shoe 10 is larger in proportion as the corresponding flange 14 is nearer to this side...Therefore, this cross-sectional area is larger in proportion as that side of the shoe 10 is nearer to the flange 14, and lubrication must be more effective. Thus means are provided for bringing a lubricant between the sides of the shoe 10 and the respective flanges 14.” Ex. 1003, 2:119- 3:8.

217. To the extent this part of the patent claim is read to mean that “passages” are enclosed vessels contained within the shoe, passageway 20 is shown in GB384 which connects directly with recess 18. If the person of ordinary skill desired to add more enclosed vessels to accommodate a particular need, one of ordinary skill would have predictably added more passageways. Meaning, multiple passageways to multiple openings is within the general knowledge of one of ordinary skill in the art. See, e.g. ¶¶109-110. Similarly, multiple fluid supply ports or openings in the bearing shoes were within the general knowledge of one of ordinary skill. That person would have had a reasonable expectation of success in

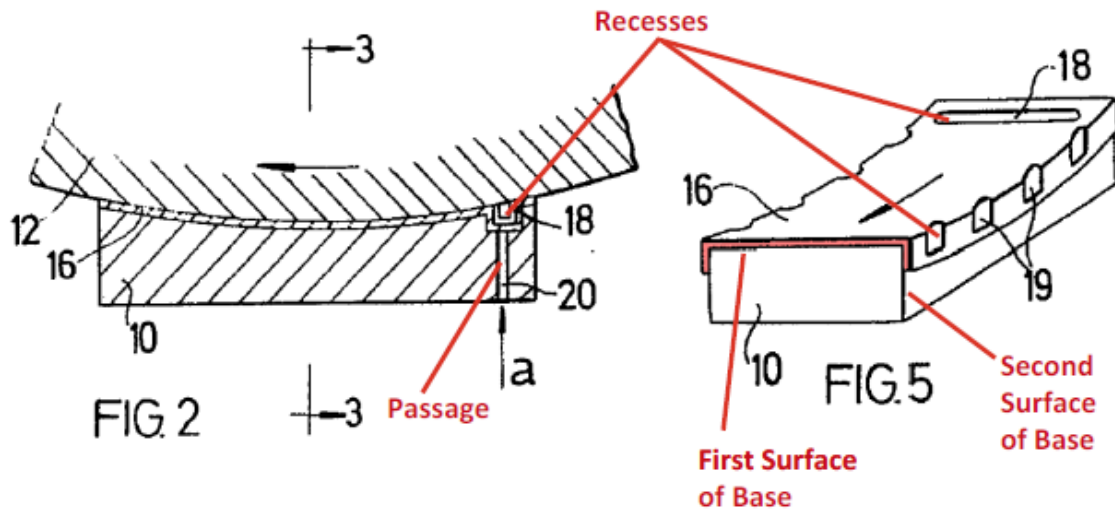
adding multiple passageways and multiple ports to accommodate delivery of lubricating fluid on a plurality of bearing surfaces. *See, e.g.* ¶¶111-112.

218. Trygg specifically discloses a plurality of fluid supply ports and a plurality of passages.



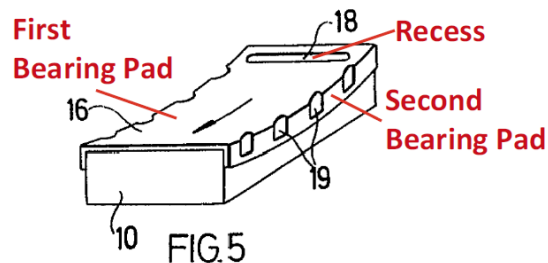
[9b] wherein there is a plurality of said polymer bearing pads, a first of said polymer bearing pads being mountable to said first surface and a second of said polymer bearing pads being mountable to said second surface,

219. GB384 discloses a bearing pad (i.e., the anti-friction liner 16) extending across the first surface and the second surface of the shoe. *See e.g.*, Figure 5 below. *See also supra*, ¶¶65, 106 (discussing general knowledge and Trygg article referencing first and second bearing pads). The bearing pad extending across the two surfaces is functionally equivalent to two separate bearing pads.



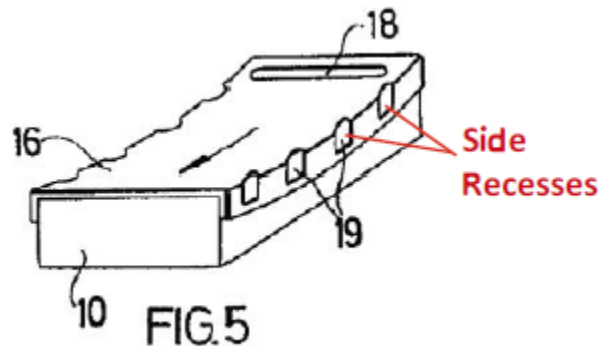
[9c] wherein said first polymer bearing pad comprises a first outer surface and at least one recess for receiving lubricating fluid from at least one of said plurality of passages and distributing said lubricating fluid to said first outer surface, and

220. GB384 discloses a first bearing pad with a first outer surface 16 and at least one recess 18 for receiving lubricating fluid from at least one of the passages 20 and distributing the lubricating fluid to the first outer surface 16.



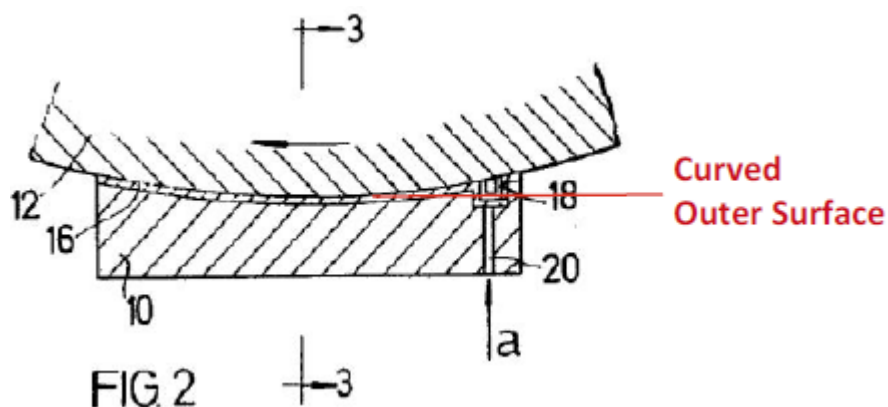
[9d] said second polymer bearing pad comprises a second outer surface and at least one recess for receiving lubricating fluid at least one of said plurality of passages and distributing said lubricating fluid to said second outer surface,

221. GB384 discloses a second bearing pad with a second outer surface and at least one recess 19 for receiving lubricating fluid from at least one of the passages 20 and distributing the lubricating fluid to the second outer surface.

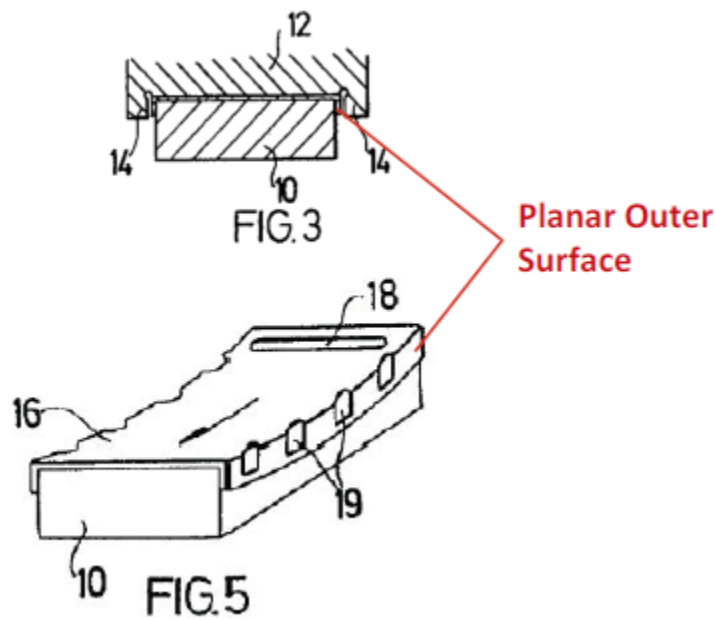


[9e] wherein said first outer surface is partially curved such that said first polymer bearing pad acts as a radial hydrostatic bearing and said second outer surface is substantially planar such that said second polymer bearing pad acts as an axial bearing.

222. You can plainly see from Figure 2 that the first outer surface of the lining 16 is curved and acts as a radial hydrostatic bearing. GB384 notes that the bearing is “for supporting a rotating body [and] is applicable to all supporting and thrust-bearing devices for rotating parts sliding on shoes by means of hydrostatic or hydrodynamic film of oil and more particularly, for example, bearings of tubular grinding mills and bearings supporting rotary oven wheels.” Ex. 1003, 3:20-27.



223. It is also evident from Figures 3 and 5, that the side surface of the shoe is a second surface that is substantially planar and acts as an axial bearing. GB384 notes, that “[a]xial movements of the part 12 are limited by two flanges 14 arranged to be integral with said body 12 and flanges 14 are arranged with a small clearance at each respective side of the shoe 10.” Ex. 1003, 2:64-68. It also states that “[t]o take up axial forces, flanges or collars may, if desired, be provided on the rotating body.” Ex. 1003, 1:67-70.



[Dependent Claim 19]

[19a] *The bearing assembly of claim 11, wherein said base further comprises a first surface, a second surface, a plurality of said at least one passages and a plurality of said at least one lubricating fluid supply ports, wherein said at least one passages are in fluid communication with said at least one lubricating fluid supply ports, said first surface and said second surface, and*

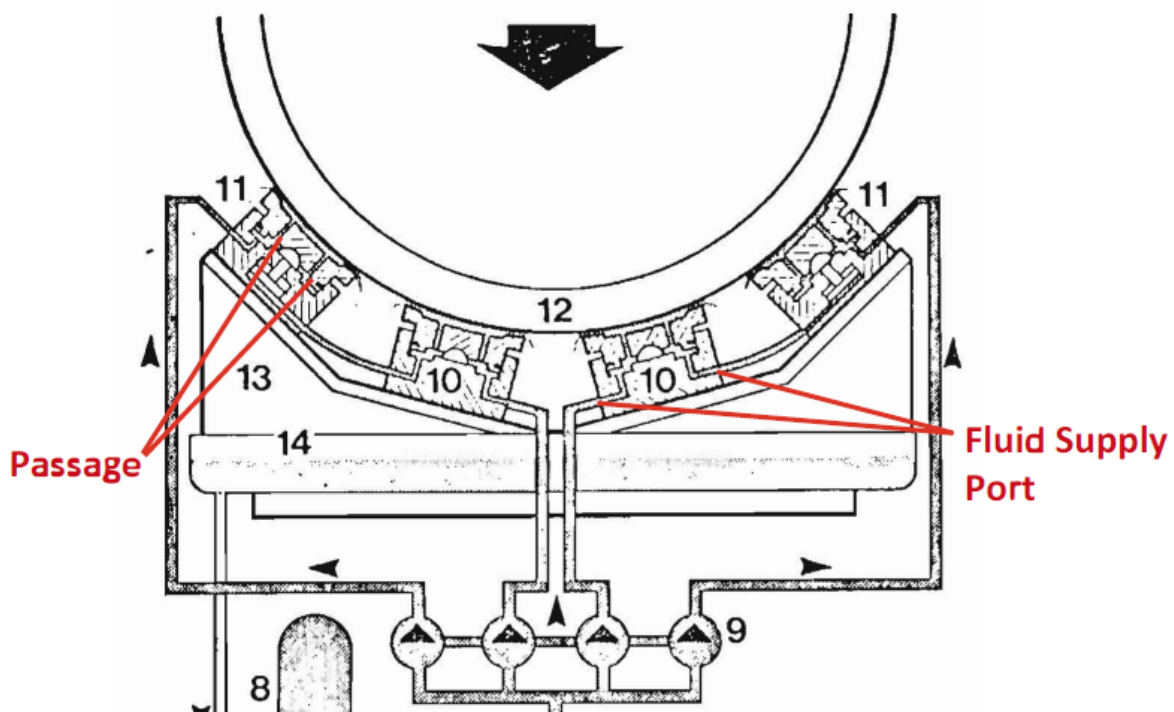
224. GB384 discloses a plurality of bearing pad surfaces. Meaning, it discloses an anti-friction lining 16 on a top surface of the shoe 10 and on the side surfaces of the shoe 10. The recesses 19 “form[] containers for oil...in the sides of

the shoe 10.” Ex. 1003, 2:73-74. The upper portion of each of the plurality of recesses 19 are fluid supply ports. For example, these upper portions act as an entrance to the “container” formed by the recess 19. They are referred to as “orifices” in GB384. Ex. 1003, 2:109. Sloping recesses 22 act as a plurality of passages in fluid communication with the supply ports.

225. “Sloping recesses 22 (Figures 4, 6, and 7) are formed in two end walls of the channel 18...These recesses 22 provide communication between the channel 18 and two circumferential grooves 24 formed at the junction of the flanges 14 with the rotating body 12.” Ex. 1003, 2:83-90. “These recesses 22 allow the oil to flow from the channel 18 into the groove 24 and then into the lateral containers 19 for oil, to provide lubrication for the sides of the shoe 10.” Ex. 1003, 2:114-119. “An advantage of such an arrangement consists in that a flow of oil towards each side of the shoe 10 is larger in proportion as the corresponding flange 14 is nearer to this side...Therefore, this cross-sectional area is larger in proportion as that side of the shoe 10 is nearer to the flange 14, and lubrication must be more effective. Thus means are provided for bringing a lubricant between the sides of the shoe 10 and the respective flanges 14.” Ex. 1003, 2:119- 3:8.

226. To the extent this part of the patent claim is read to mean that “passages” are enclosed vessels contained within the shoe, one passageway 20 is shown in GB384 which connects directly with recess 18. If the person of ordinary skill desired to add more enclosed vessels to accommodate a particular need, one of ordinary skill would have predictably added more passageways. Meaning, multiple passageways to multiple oil recesses is within the general knowledge of one of ordinary skill in the art. *See*, e.g. ¶¶109-110.

227. Trygg specifically discloses a plurality of fluid supply ports and a plurality of passages.

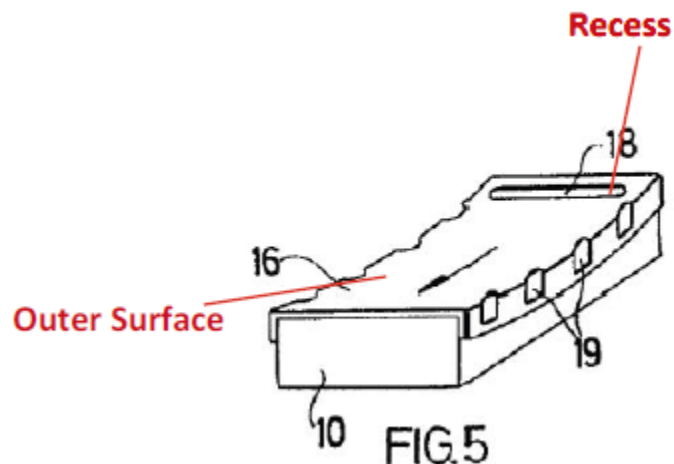


[19b] wherein there is a plurality of said polymer bearing pads, a first of said polymer bearing pads being mountable to said first surface and a second of said polymer bearing pads being mountable to said second surface,

228. GB384 discloses a bearing pad (i.e., the anti-friction liner 16) extending across the first surface and the second surface of the shoe. *See e.g., Figure 5 below. See also supra, ¶¶65, 106 (discussing general knowledge and Trygg article referencing first and second bearing pads).* The bearing pad extending across the two surfaces is functionally equivalent to two separate bearing pads.

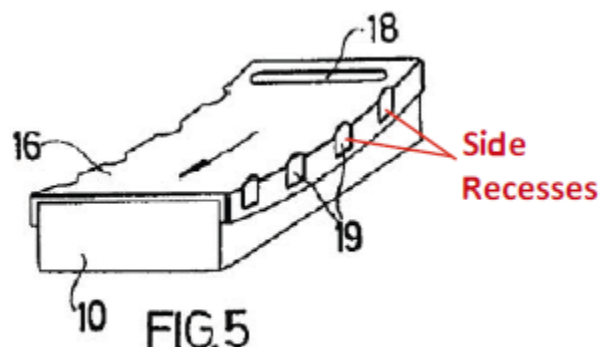
[19c] wherein said first polymer bearing pad comprises a first outer surface and at least one recess for receiving lubricating fluid from at least one of said plurality of passages and distributing said lubricating fluid to said first outer surface, and

229. GB384 discloses a recess on a first outer surface of the bearing pad for receiving lubricating fluid from a passage. Specifically, recess 18 is shown in the figures and receives fluid from passageway 20.



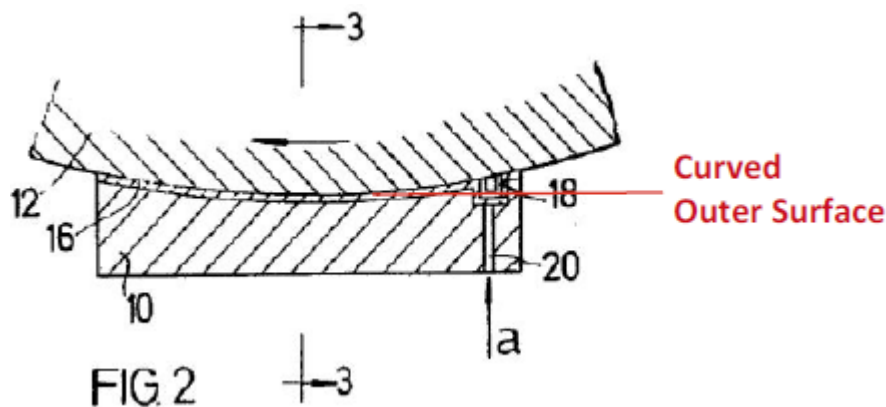
[19d] said second polymer bearing pad comprises a second outer surface and at least one recess for receiving lubricating fluid at least one of said plurality of passages and distributing said lubricating fluid to said second outer surface,

230. GB384 discloses a recess 19 on a second outer surface of the bearing pad for receiving lubricating fluid from a passage. Specifically, recess 19 is shown in the figures on a side of the shoe 10 and receives fluid from passageway 20.

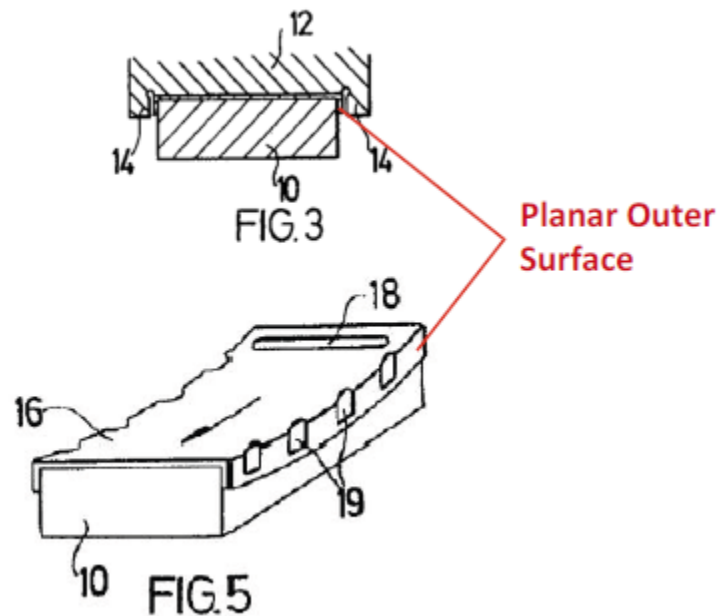


[19e] wherein said first outer surface is partially curved such that said first polymer bearing pad acts as a radial hydrostatic bearing and said second outer surface is substantially planar such that said second polymer bearing pad acts as an axial bearing.

231. GB384 discloses that the first outer surface is partially curved such that the first polymer bearing pad acts as a radial hydrostatic bearing. See annotated Figure. 2 below.



232. GB384 also discloses a second outer surface that is substantially planar such that the second bearing pad acts as an axial bearing. See annotated Figure 4 from GB384 below. See also Ex. 1003, 2:69-74 (“An upper face of the shoe 10 and an upper portion of sides thereof are covered with a lining 16 of anti-friction material.”).



233. GB384 discloses that axial forces can be taken up the arrangement shown in Figures 3 and 5 as shown above. Alternatively, GB384 discloses that instead of the journal 12 comprising flanges 14 that enclose the shoe 10, the shoe 10 may have flanges that enclose the journal. *See* Ex. 1003, 2:3-6 (“By way of a variant, axial forces can be taken up by flanges of the shoes [10] enclosing or bounding the slidable track [i.e., the journal] of the rotating body.”). In other words, instead of flanges located on the journal as shown in FIG.3, GB384 discloses that flanges may be located on the shoe 10 enclosing the sides of the journal 12.

H. Motivation to Combine GB384, DE364 and Trygg

234. Combined with the POSITA’s general knowledge, the POSITA would have understood that adding Trygg to the combination of GB384 and DE364 noted above, would lead to expected results. *See Supra*, ¶¶188-193. Trygg

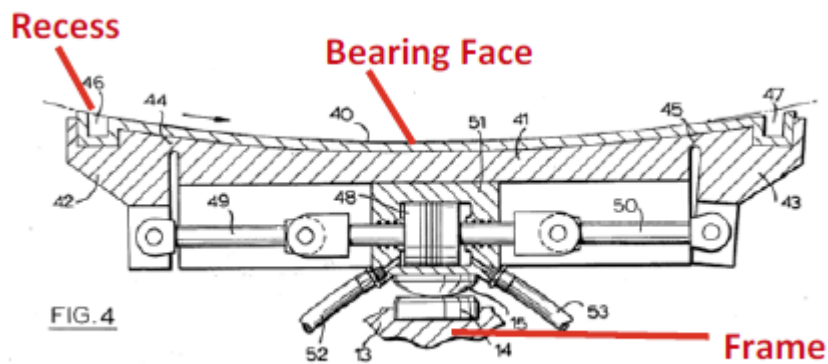
discloses a hydraulic bearing for use with a grinding mill comprising a plurality of internal passageways directed to a plurality of recesses. The POSITA would be motivated to combine the plurality of passageways in Trygg in order to reach the plurality of recesses on different bearing surfaces disclosed in GB384. For similar reasons, the POSITA would be motivated to combine the plurality of fluid supply ports in Trygg to provide lubrication to the plurality of passageways.

I. GROUND 5 – The '133 Patent in view of DE364– Claims 1-5, 7, 10-15, 17 and 20

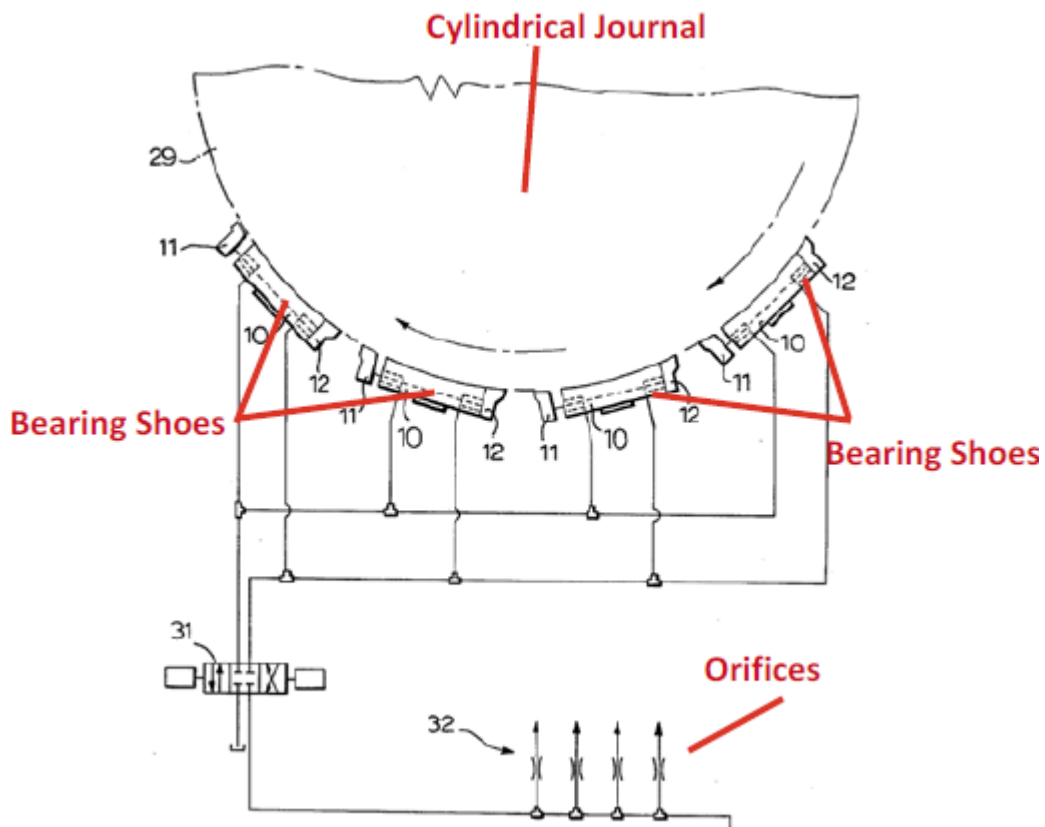
235. Claim 1 of the '604 Patent recites the following:

[1a and 1b] *A bearing assembly for supporting a journal of a grinding mill body, comprising a frame and a plurality of fluid bearings, said fluid bearings each comprising a polymer bearing pad mounted to a base, said*

236. The '133 Patent discloses a plurality of fluid bearings 10 coupled to a frame or “support structure” 13 for supporting a journal 29 of a grinding mill body. Specifically, the “invention relates to bearings of the type comprising a plurality of pivoted bearing shoes positioned to engage a slide member in supporting relation thereto, wherein oil is applied to the bearing faces of the shoes to establish a hydrodynamic wedge of oil created by the motion of the slide member. The invention is applicable to trunnion bearings for cylindrical journals and also to slider bearings in which the slide member has a flat bearing face.” Ex. 1007, 1:5-15. Annotated Figure 4 from the '133 Patent below is illustrative of one embodiment.



237. Figure 3 of the '133 Patent shows how the plurality of fluid bearings 10 positioned about and supporting the cylindrical journal. Specifically, “[i]n the assembly show [sic] in FIG. 3, the cylindrical journal 29 is supported by four bearing shoes...” Ex. 1007, 3:3-4.



238. The '133 Patent discloses in one embodiment that the bearing comprises a lining 40 on the top of the main shoe portion 41 which constitute the “bearing face of the shoe.” Ex. 1007, 2:34-39. The '133 Patent does not specifically identify the composition of the lining of the bearing pad. However, the use of a polymer as the lining 40 (or alternatively 16, 17, 18) in the '133 Patent is within the general knowledge of one skilled in the art. One of ordinary skill in the art would have known that the anti-frictional properties of polymers are substitute for general liners in fluid bearing applications and would have had a reasonable expectation of success in making that substitution. *See supra*, ¶¶55, 77 (explaining properties of polymers as anti-friction surfaces). Among the many references, however, DE364 teaches that the “preferred material” for the bearing is “an advanced engineering plastic, for example polyether ketone (PEEK) polyamide-imide (PAI) or polyimide (PI), which is preferably supplemented with a small amount of polytetrafluoroethene (PTFE) and/or graphite to improve the sliding properties.” Ex. 1005, ¶ [0011].

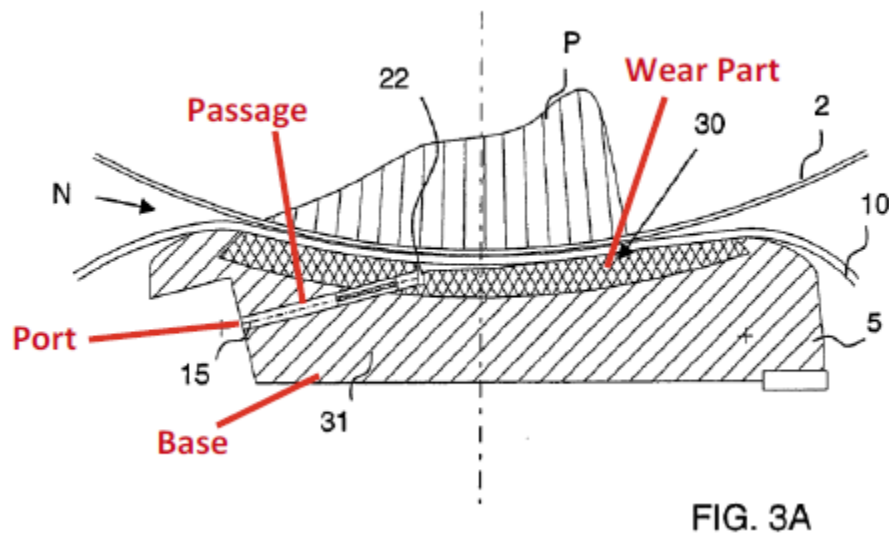
239. As I explained above in ¶¶ 55, 77, 80 and 94, a designer (i.e., one of ordinary skill) would have known that using a polymer as the pad or lining of a hydrodynamic fluid bearing was one of the many options available and would have had a reasonable expectation of success using a polymer. The designer would have known that polymers “exhibit favourable stability and stiffness, are lightweight, have low coefficients of friction, and can be immersed in oil without damage. Use of such a material as an inner surface of the bearing can be advantageous, since a polymer with these properties will deform slightly while under pressure, so that the bearing has more ‘give’. This allows a better fluid film thickness to be built up during hydrodynamic operation.” *See Supra*, ¶ 94 (quoting the '993 publication).

[1c and 1d] at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and mounting element for securely mounting said polymer bearing pad to said base, said base also comprising at least one lubricating fluid supply port in fluid communication with said at least one passage

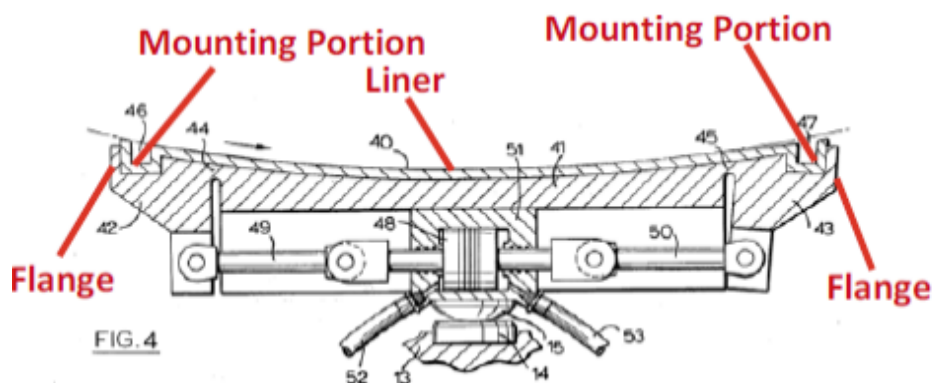
240. The '133 Patent discloses a plurality of recesses, referred to as "oil grooves" 19, 20 (or 46 and 47 in other embodiments) "to which oil is fed in the conventional manner so as to apply an oil film to the bearing face of the shoe to establish a hydrodynamic wedge of oil." Ex. 1007, 2:41-45. "In the assembly show [sic] in FIG. 3, the cylindrical journal 29 is supported by four bearing shoes of the construction illustrated in FIGS. 1 and 2.... Lubricating oil for the bearing faces of the shoes may be derived from the pressure fluid circuit via orifices 32, or alternatively may be derived in any other manner." Ex. 1007, 3:3-15.

241. A fluid supply port in an outer surface of the shoe 10 is necessarily present. That is the location (i.e., the port or opening) on the shoe where lubricating fluid from the orifices 32 is introduced into the passageways within the shoe.

242. That said, DE364 also discloses a fluid supply port in communication with an internal passage that provides lubricating fluid to a bearing surface. *See* FIG. 3A below.

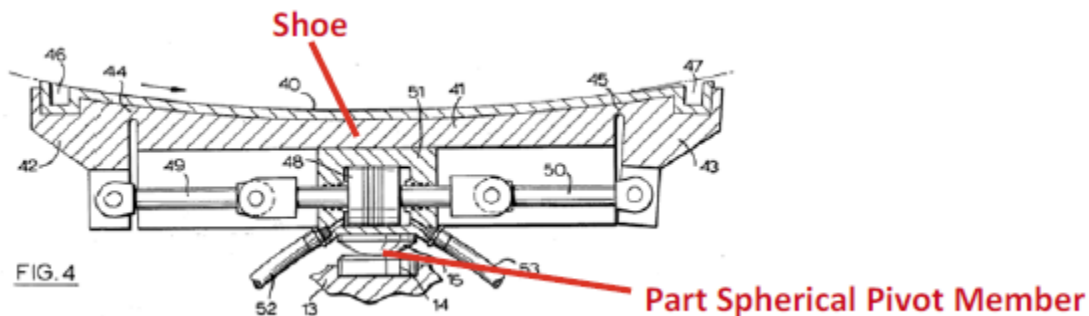


243. As I noted above (*see supra*, ¶¶43(d), 137), the term mounting element is not mentioned in the specification of the '604 Patent. To the extent, this claim is referring to a "mounting portion" which is noted in the '604 Patent, the '133 Patent discloses a mounting portion. Figure 4 is one example that shows liner 40 disposed within a corner of groove 46 abutting an outer flange on the bearing. The mounting portion has a protrusion extending up from the liner 40. It is opposite the outer surface of the liner 40 and engages a flange of the shoe 10. The flange is on the outer edge of the shoe 10.



[1e] wherein said base is mounted to said frame so that said fluid bearings self adjust to changes in the angular position of the journal during operation of said grinding mill body.

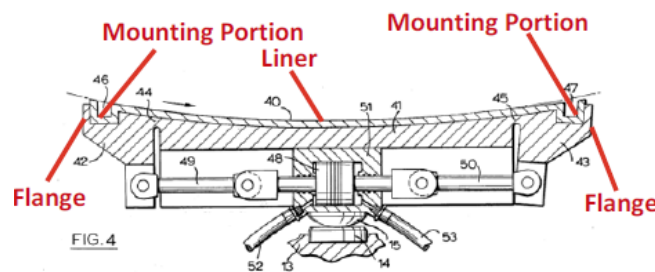
244. The '133 Patent discloses this limitation. "The shoe is mounted on a support structure 13 which provides a universal pivotal mounting formed by a pivot pad 14 and a part-spherical pivot member 15 which is connected to the shoe structure. The bearing shoe is mounted symmetrically with respect to its pivot." *See* Ex. 1007, 2:20-30. In other words, the shoe is intended to pivot about the part-spherical member 15 to self adjust its angular position in response to changes in the direction of the load on the bearing from the journal. *See* Figure 4 below for reference.



245. It is not uncommon for the weight to shift while a journal mill is in use as different sized pieces of material are being processed through the mill. The person of ordinary skill in the art could use self-adjusting or fixed bearings depending on the anticipated load being processed, the size of the mill and the material, etc. *See* my discussion in general knowledge above at ¶108 for additional information. In this instance, the '133 Patent shows a self-adjusting bearing.

[Dependent Claim 2] *The bearing assembly of claim 1, wherein said mounting element comprises a mounting portion extending from said polymer bearing pad, said mounting portion comprising a protrusion from a mounting surface opposite to said outer surface for engaging a flange of said base, said flange being located at an outer edge of said base.*

246. As noted above, the term mounting element is not used in the '604 Patent except in the claims. To the extent, this claim is referring to a "mounting portion" which is noted in the '604 Patent, the '133 Patent discloses a mounting portion. With reference to Figure 4, for example, the mounting portion has a protrusion extending from the liner 40. It is opposite the outer surface of the liner and engages a flange of the shoe 10. The flange is on the outer edge of the shoe 10.



[Dependent Claim 3] *The bearing assembly of claim 1, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base; said at least one recess comprises a locking tab for retaining a head portion of said fastener within said at least one recess and said at least one fastener comprises a bore for conveying lubricating fluid from said at least one passage to said at least one recess.*

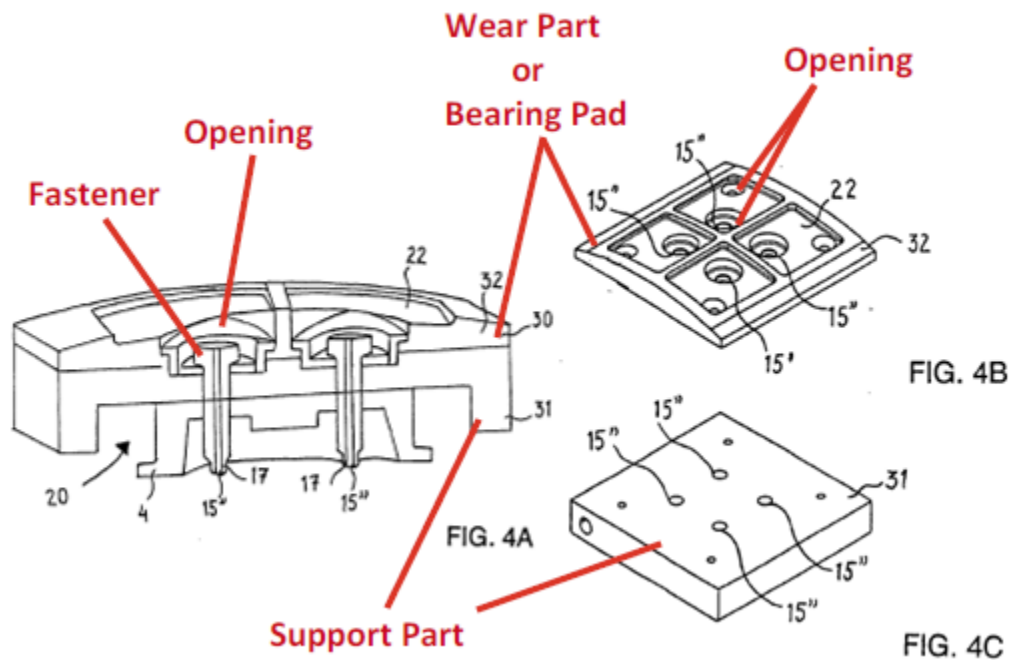
247. It is within the general knowledge of one of ordinary skill in the art to have an opening for receiving a fastener and a recess for having a locking tab to secure the head of the fasteners in place. *See supra*, ¶¶99-100. Moreover, the use of hollow bolts or "fastener comprises a bore for conveying lubricating fluid" were within the general knowledge of one of ordinary skill in the art. *See supra*, ¶¶86, 96. The person of ordinary skill would have had a reasonable expectation of successfully creating a recess for placing a hollow bolt (i.e., a fastener with a bore)

in the pad or liner, particularly if you wanted to have a removable pad or liner. Likewise, the person of ordinary skill would have had a reasonable expectation of success placing a locking tab in the recess to help keep the fastener from loosening or backing out of its cavity due to the vibration or movement of the journal during operation.

248. That said, DE364 specifically discloses a plurality of openings (e.g., at least four) for receiving fasteners for mounting a pad to a base. The fasteners in DE364 comprise a bore for conveying lubricating fluid from a fluid passage to a recess on the pad for lubrication of the bearing.

249. DE364 notes that the “support element 20 comprises a surface part 32, i.e., a bearing part, and a support part 31. The support element 20 is attached to the loading piston 4 via the nozzles 17, in which the medium channels, i.e., the capillaries 15”, run. The surface part 30 of the support element 20 acts as a bearing.” Ex. 1005, ¶ [0025]. “The replaceable wear part 30 thus consists of the part 32 acting as a bearing material which, together with its support part 31, is removably attached to the remainder of the shoe structure, for example by means of the nozzles 17.” *Id.*

250. Figures 4A, 4B, and 4C are shown and annotated below showing these features.



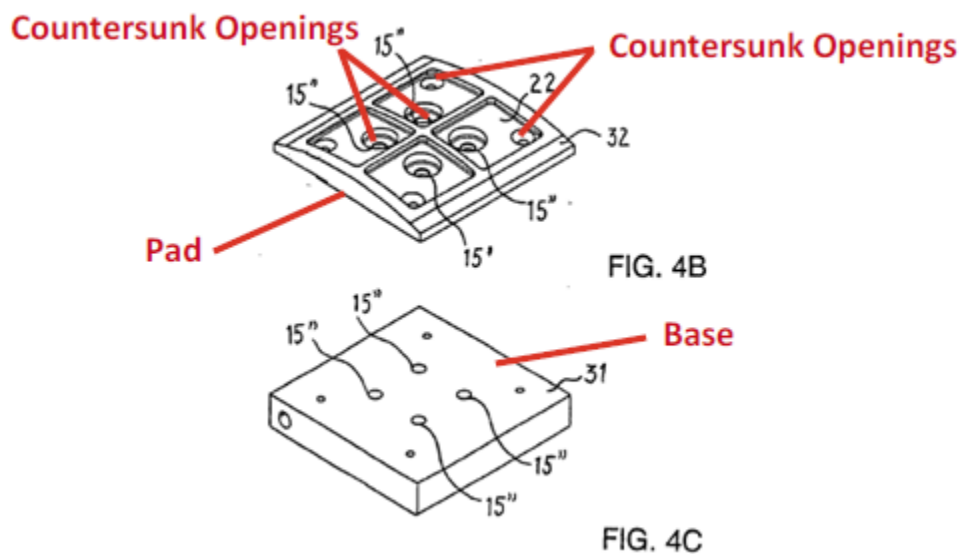
251. In sum, fasteners (described as nozzles 17) are placed in an opening within recess 22 of the polymeric bearing pad 20. The fasteners have a bore (described as a capillary 15'') that provide oil to the polymeric bearing pad for lubrication.

252. In addition to the foregoing, it would be a simple and predictable modification with a predictable outcome for one of ordinary skill (*see supra*, ¶¶99-100) to add a locking tab if any locking tab was desired. Such locking mechanisms are standard components used to minimize the likelihood that a fastener will come loose during operation of a device.

[Dependent Claim 4] *The bearing assembly of claim 1, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base, said bearing assembly further comprising a locking element for retaining said at least one fastener within said at least one recess.*

253. It is within the general knowledge of one of ordinary skill in the art to have an opening for receiving a fastener and locking elements for securing

fasteners in place. *See supra*, ¶¶99-100. That said, DE364 specifically discloses a bearing with plurality of openings (there are four on the pad shown in FIG. 4B) that are countersunk to receive at least “screws” to fasten the pad onto the mounting surface 31. Adding a locking element such as a “liquid thread locker” or some other “element” to secure the fastener is well within the general knowledge of the skilled artisan.



[Dependent Claim 5] *The bearing assembly of claim 1, wherein said polymer bearing pad substantially covers an outer surface of said base to create a fluid seal between said polymer bearing pad and said base.*

254. The '604 Patent itself notes in the Background section that “typical” hydrostatic bearings have a “bearing pad” that can “form a seal with the base.” Ex. 1001, 2:38-41. That said, the lining 40 of the bearing (i.e., the bearing pad) of the '133 Patent covers the entire upper surface of the shoe 10 and creates a fluid seal between the pad and the base. Specifically, Figure 4 of the '133 Patent shows the lining 40 fully covering the upper surface of the shoe 41 including the recesses 46 and 47. The shoe 41 is a hydrostatic bearing, using oil as a lubricant. The person

of ordinary skill would understand that the liner 40 creates a fluid seal between the liner and the base. If for no other reason, the lack of a fluid seal can create a decrease of fluid that maintains the “oil film” on “the bearing face of the shoe to establish a hydrodynamic wedge of oil.” *See, e.g.*, Ex. 1007, 2:42-45 (discussing use of oil grooves to help create oil film).

[Dependent Claim 7] *The bearing assembly of claim 1, said at least one recess of said polymer bearing pad comprises at least one interconnecting passage for fluidly connecting said at least one recess to said at least one passage of said base.*

255. The '133 Patent states that the shoe members 11 and 12 “provides an oil groove 19, 20 to which oil is fed in the conventional manner so as to apply an oil film...” Ex. 1007, 2:41-43. “Lubricating oil for the bearing faces of the shoes may be derived from the pressure fluid circuit via orifices 32, or alternatively may be derived in any other manner.” Ex. 1007, 3:12-15.

256. To communicate lubricating fluid from the passageway in the shoe 10 to the recesses, an “interconnecting passage” is necessarily present in the liner. Otherwise, there would be no way to communicate the lubricating fluid to the recesses.

[Dependent Claim 10] *The bearing assembly of claim 1, wherein said polymer bearing pad is removably mounted to said base.*

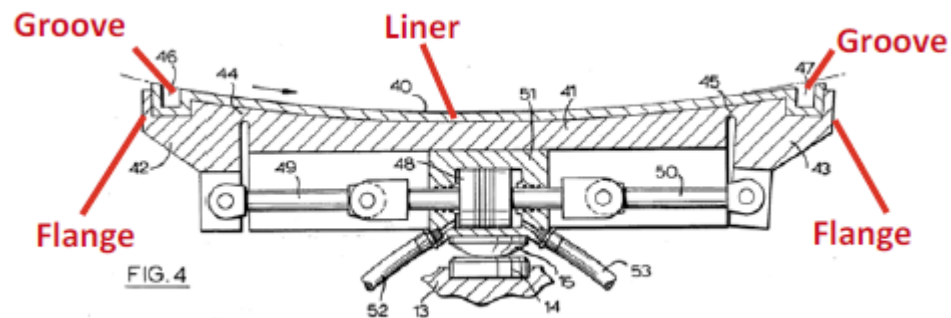
257. Removable bearing pads are well within the general knowledge of a person skilled in the art. *See supra* ¶¶82, 107. It is not uncommon to make a part of a device that is “disposable” (meaning intended to wear out over time) or “sacrificial” (meaning a less expensive part designed to fail first), preventing failure of other more expensive parts. Both disposable and sacrificial parts are designed to be removable. This reduces the need for costly repairs. In this instance specifically, DE364 discloses a polymer bearing pad that is secured to a base by a

“dovetail connection, screws or other fit” to enable replacement. Ex. 1005, ¶ [0024-5]. The polymer bearing pad of DE364 is in fact referred to as a “wear part 30.” *Id.* “The replaceable wear part 30 thus consists of the part 32 acting as bearing material, which, together with its support part 31, is removably attached of the remainder of the shoe structure, for example by means of the nozzles 17.” *Id.* The person of ordinary skill would have had a reasonable expectation of success in implementing this known solution to a known problem.

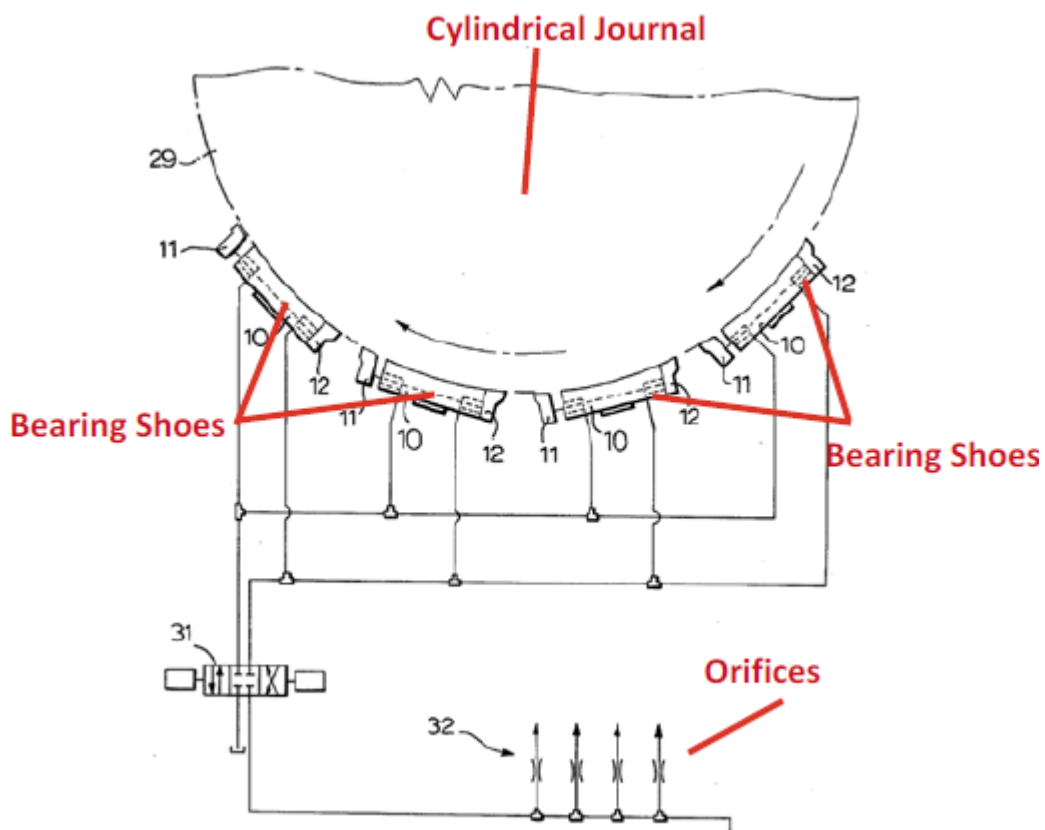
258. Independent claim 11 is broken into subparts and discussed below.

[11a-c] A bearing assembly for supporting a journal of a grinding mill body, comprising a frame and a plurality of fluid bearings, said fluid bearings each comprising a polymer bearing pad mounted to a base, said polymer bearing pad comprising an outer surface,

259. The '133 Patent discloses a plurality of fluid bearings 10 coupled to a frame or “support structure” 13 for supporting a journal 29 of a grinding mill body. Specifically, the “invention relates to bearings of the type comprising a plurality of pivoted bearing shoes positioned to engage a slide member in supporting relation thereto, wherein oil is applied to the bearing faces of the shoes to establish a hydrodynamic wedge of oil created by the motion of the slide member. The invention is applicable to trunnion bearings for cylindrical journals and also to slider bearings in which the slide member has a flat bearing face.” Ex. 1007, 1:5-15. Annotated Figure 4 from the '133 Patent below is illustrative of one embodiment.



260. Figure 3 of the '133 Patent shows how the plurality of fluid bearings 10 are positioned about and supporting the cylindrical journal. Specifically, “[i]n the assembly show [sic] in FIG. 3, the cylindrical journal 29 is supported by four bearing shoes...” Ex. 1007, 3:3-4.



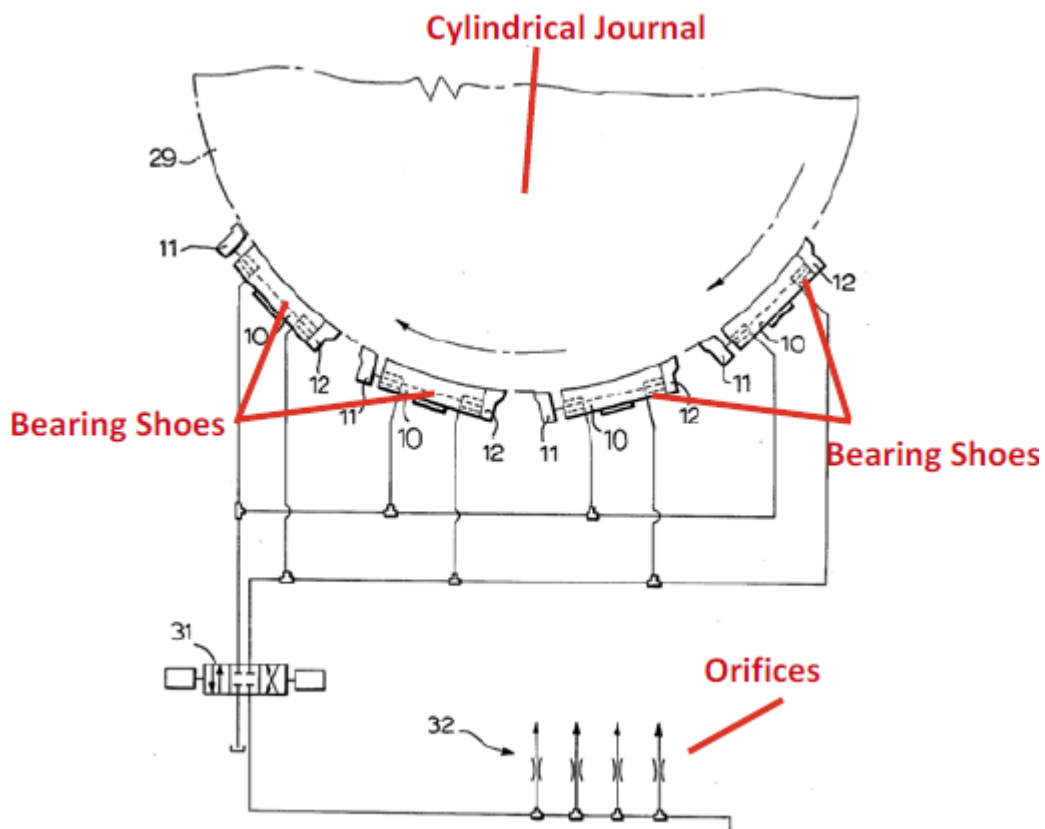
261. The '133 Patent discloses in one embodiment that the bearing comprises a lining 40 on the top of the main shoe portion 41 which constitute the "bearing face of the shoe." Ex. 1007, 2:34-39. The use of a polymer as the lining 40 (or alternatively 16, 17, 18) in the '133 Patent is within the general knowledge of one skilled in the art. One of ordinary skill in the art would have known that the anti-frictional properties of polymers are substitute for general liners in fluid bearing applications and would have had a reasonable expectation of success in making that substitution. *See supra*, ¶¶55, 77 (explaining properties of polymers as anti-friction surfaces). Among the many references, however, DE364 teaches that the "preferred material" for the bearing is "an advanced engineering plastic, for example polyether ketone (PEEK) polyamide-imide (PAI) or polyimide (PI), which is preferably supplemented with a small amount of polytetrafluoroethene (PTFE) and/or graphite to improve the sliding properties." Ex. 1005, ¶ [0011].

262. As I explained above in ¶¶55, 77, 80 and 94, a designer (i.e., one of ordinary skill) would have known that using a polymer as the pad or lining of a hydrodynamic fluid bearing was one of the many options available and would have had a reasonable expectation of success using a polymer. The designer would have known that polymers "exhibit favourable stability and stiffness, are lightweight, have low coefficients of friction, and can be immersed in oil without damage. Use of such a material as an inner surface of the bearing can be advantageous, since a polymer with these properties will deform slightly while under pressure, so that the bearing has more 'give'. This allows a better fluid film thickness to be built up during hydrodynamic operation." *Supra*, ¶94 (quoting the '993 publication).

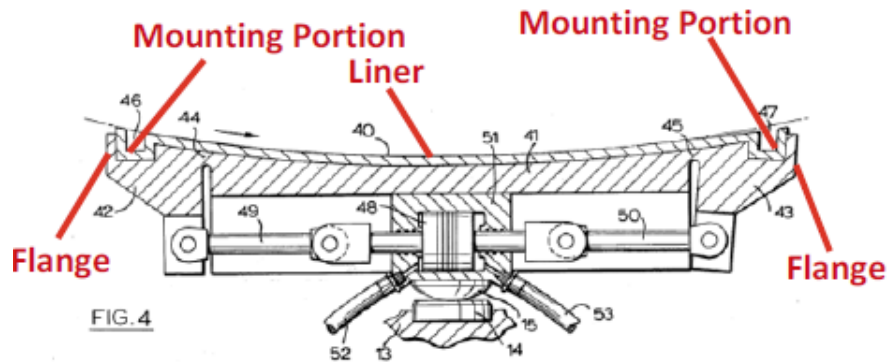
[11d] *at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and mounting element for securely mounting said polymer bearing pad to said base,*

263. The '133 Patent discloses a plurality of recesses, referred to as “oil grooves” 19, 20 (or 46 and 47 in other embodiments) “to which oil is fed in the conventional manner so as to apply an oil film to the bearing face of the shoe to establish a hydrodynamic wedge of oil.” Ex. 1007, 2:41-45. “In the assembly show in FIG. 3, the cylindrical journal 29 is supported by four bearing shoes of the construction illustrated in FIGS. 1 and 2.... Lubricating oil for the bearing faces of the shoes may be derived from the pressure fluid circuit via orifices 32, or alternatively may be derived in any other manner.” Ex. 1007, 3:3-15.

264. A fluid supply port in an outer surface of the shoe 10 is necessarily present. That is the location (i.e., the port or opening) on the shoe where lubricating fluid from the orifices 32 is introduced into the passageways within the shoe. Moreover, DE364 discloses a recess for receiving lubricating fluid from at least one passage, as discussed above. *See supra* ¶¶53-54.



265. As I noted above (*see supra*, ¶¶43(d), 137), the term mounting element is not mentioned in the specification of the '604 Patent. To the extent, this claim term is referring to a "mounting portion" which is noted in the '604 Patent, the '133 Patent discloses a mounting portion. Figure 4 is one example that shows liner 40 disposed within a corner of groove 46 abutting an outer flange on the bearing. The mounting portion has a protrusion extending up from the liner 40. It is opposite the outer surface of the liner 40 and engages a flange of the shoe 10. The flange is on the outer edge of the shoe 10.



[11f] *said base also comprising at least one lubricating fluid supply port in fluid communication with said at least one passage,*

266. An opening (i.e., a port) in the shoe is necessarily present to communicate lubricating fluid from the pressure fluid circuit to the passages within the shoe. This structure is generally known in the art. Meaning, the POSITA would clearly understand that to provide lubricating fluid to the recesses of the bearing pads, which are in fluid communication with the fluid pressure circuit and orifices 32, the fluid supply port is necessarily an opening in the shoe so that fluid from the fluid circuit can enter the passageway and ultimately to the recess on the surface of the bearing.

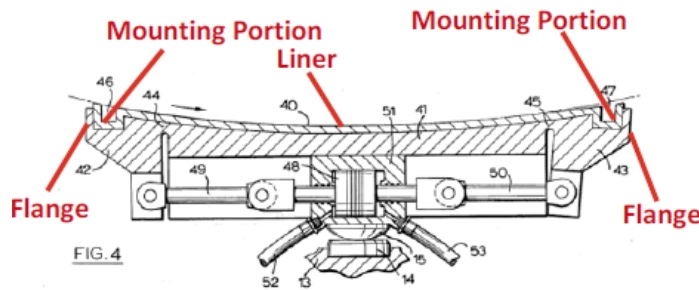
[11g] *wherein said base is fixedly mounted to said frame.*

267. The fluid bearing in the '133 Patent is not a "fixed" bearing. Rather, as discussed above (*supra*, ¶129), it is mounted on a frame 17 in a manner that allows for self-adjustment. However, it is well within the general knowledge of a person of ordinary skill in the art to fix the bearing depending on the particular desire of the user. *See supra*, ¶¶113-114. Specifically, the person of ordinary skill in the art may use a fixed or self-aligning bearing depending on a specific engineering need. For example, if the rotating system is encountering relatively low-weight loads, or a system that did not encounter changes in axial, radial, or

circumferential loads, the use of a fixed fluid bearing might be desirable over a self-aligning. The self-aligning bearing typically introduces another component to the system. That is another component that costs more money, could fail, or requires maintenance. However, in a system with relatively heavy loads or uneven loads (i.e., one where changes in axial, radial, or circumferential loads is anticipated), a self-aligning system might be desirable. Heavier rolling loads can have asymmetric weight distribution during operation causing variable radial and circumferential loads on the fluid bearing. Those variable loads can cause fixed fluid bearings to fail. The person of ordinary skill in the art would look to understand engineering needs and then apply the proper known engineering solution to that need. Hence, the person of ordinary skill would have had a reasonable expectation of success using a fixed bearing in the bearing disclosed in '133 Patent had they so desired.

[Dependent Claim 12] *The bearing assembly of claim 11, wherein said mounting element comprises a mounting portion extending from said polymer bearing pad, said mounting portion comprising a protrusion from a mounting surface opposite to said outer surface for engaging a flange of said base, said flange being located at an outer edge of said base.*

268. As noted above, the term mounting element is not used in the '604 Patent except in the claims. To the extent, this claim is referring to a "mounting portion" which is noted in the '604 Patent, the '133 Patent discloses a mounting portion. With reference to Figure 4, for example, the mounting portion has a protrusion extending from the liner 40. It is opposite the outer surface of the liner and engages a flange of the shoe 10. The flange is on the outer edge of the shoe 10.



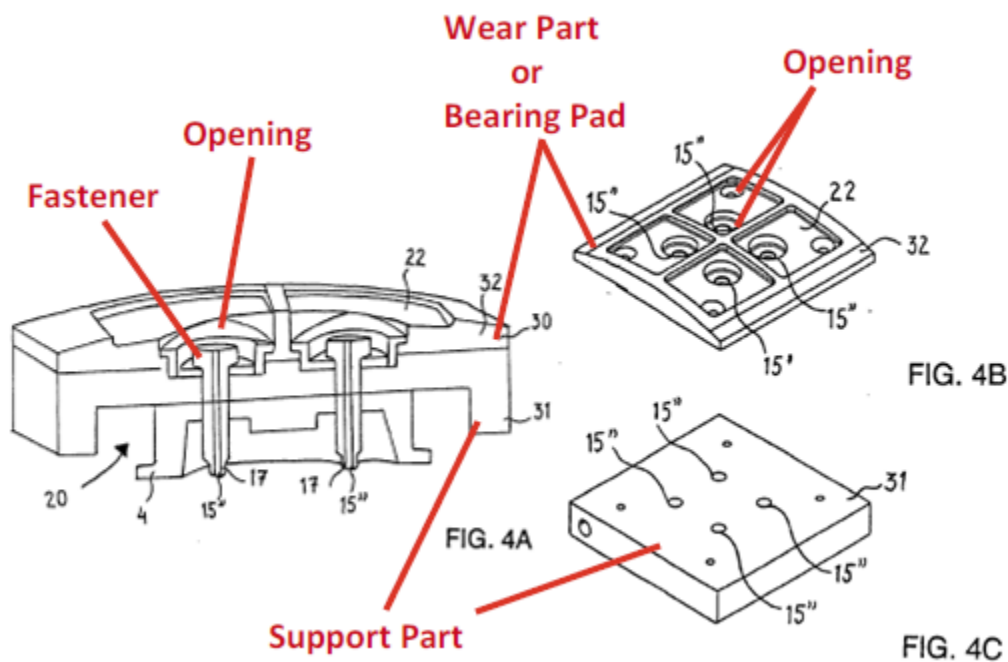
[Dependent Claim 13] *The bearing assembly of claim 11, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base; said at least one recess comprises a locking tab for retaining a head portion of said fastener within said at least one recess and said at least one fastener comprising a bore for conveying lubricating fluid from said at least one passage to said at least one recess.*

269. It is within the general knowledge of one of ordinary skill in the art to have an opening for receiving a fastener and a recess for having a locking tab to secure the head of the fasteners in place. *See supra*, ¶¶99-100. Moreover, the use of hollow bolts or “fastener comprises a bore for conveying lubricating fluid” were within the general knowledge of one of ordinary skill in the art. *See supra*, ¶¶86, 96. The person of ordinary skill would have had a reasonable expectation of successfully creating a recess for placing a hollow bolt (i.e., a fastener with a bore) in the pad or liner, particularly if you wanted to have a removable pad or liner. Likewise, the person of ordinary skill would have had a reasonable expectation of success placing a locking tab in the recess to help keep the fastener from loosening or backing out of its cavity due to the vibration or movement of the journal during operation.

270. DE364 specifically discloses a plurality of openings (e.g., at least four) for receiving fasteners for mounting a pad to a base. The fasteners in DE364 comprise a bore for conveying lubricating fluid from a fluid passage to a recess on the pad for lubrication of the bearing.

271. DE364 notes that the “support element 20 comprises a surface part 32, i.e., a bearing part, and a support part 31. The support element 20 is attached to the loading piston 4 via the nozzles 17, in which the medium channels, i.e., the capillaries 15”, run. The surface part 30 of the support element 20 acts as a bearing.” Ex. 1005, ¶ [0025]. “The replaceable wear part 30 thus consists of the part 32 acting as a bearing material which, together with its support part 31, is removably attached to the remainder of the shoe structure, for example by means of the nozzles 17.” *Id.*

272. Figures 4A, 4B, and 4C are shown and annotated below showing these features.

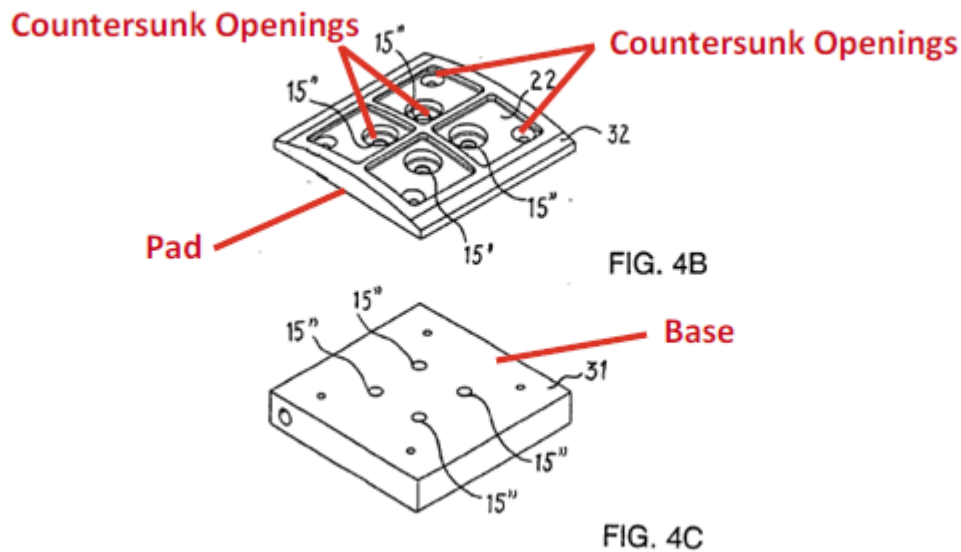


273. In sum, fasteners (described as nozzles 17) are placed in an opening within recess 22 of the polymeric bearing pad 20. The fasteners have a bore (described as a capillary 15") that provide oil to the polymeric bearing pad for lubrication.

274. In addition to the foregoing, it would be a simple and predictable modification with a predictable outcome for one of ordinary skill (*see supra*, ¶¶99-100) to add a locking tab if any locking tab was desired. Such locking mechanisms are standard components used to minimize the likelihood that a fastener will come loose during operation of a device.

[Dependent Claim 14] *The bearing assembly of claim 11, wherein said mounting element comprises at least one opening for receiving at least one fastener for mounting said polymer pad to said base, said bearing assembly further comprising a locking element for retaining said at least one fastener within said at least one recess.*

275. It is within the general knowledge of one of ordinary skill in the art to have an opening for receiving a fastener and locking elements for securing fasteners in place. *See Supra*, ¶¶99-100. That said, DE364 specifically discloses a bearing with plurality of openings (there are four on the pad shown in FIG. 4B) that are countersunk to receive at least “screws” to fasten the pad onto the mounting surface 31. Adding a locking element such as a “liquid thread locker” or some other “element” to secure the fastener is well within the general knowledge of the skilled artisan.



[Dependent Claim 15] *The bearing assembly of claim 11, wherein said polymer bearing pad substantially covers an outer surface of said base to create a fluid seal between said polymer bearing pad and said base.*

276. The '604 Patent itself notes in the Background section that “typical” hydrostatic bearings have a “bearing pad” that can “form a seal with the base.” Ex. 1001, 2:38-41. That said, the lining 40 of the bearing (i.e., the bearing pad) of the '133 Patent covers the entire upper surface of the shoe 10 and creates a fluid seal between the pad and the base. Specifically, Figure 4 of the '133 Patent shows the lining 40 fully covering the upper surface of the shoe 41 including the recesses 46 and 47. The shoe 41 is a hydrostatic bearing, using oil as a lubricant. The person of ordinary skill would understand that the liner 40 creates a fluid seal between the liner and the base. If for no other reason, the lack of a fluid seal can create a decrease of fluid that maintains the “oil film” on “the bearing face of the shoe to establish a hydrodynamic wedge of oil.” See, e.g., Ex. 1007, 2:42-45. (discussing use of oil grooves to help create oil film).

[Dependent Claim 17] *The bearing assembly of claim 11, said at least one recess of said polymer bearing pad comprises at least one interconnecting passage for fluidly connecting said at least one recess to said at least one passage of said base.*

277. The '133 Patent states that the shoe members 11 and 12 “provides an oil groove 19, 20, to which oil is fed in the conventional manner so as to apply an oil film...” Ex. 1007, 2:41-43. “Lubricating oil for the bearing faces of the shoes may be derived from the pressure fluid circuit via orifices 32, or alternatively may be derived in any other manner.” Ex. 1007, 3:12-15.

278. To communicate lubricating fluid from the passageway in the shoe 10 to the recesses, an “interconnecting passage” is necessarily present in the liner. Otherwise, there would be no way to communicate the lubricating fluid to the recesses. Moreover, DE364 discloses a recess for receiving lubricating fluid from at least one passage, as discussed above. *See supra* ¶¶53-54.

[Dependent Claim 20] *The bearing assembly of claim 11, wherein said polymer bearing pad is removably mounted to said base.*

279. Removable bearing pads are well within the general knowledge of a person skilled in the art. *See supra* ¶¶82, 107. It is not uncommon to make a part of a device that is “disposable” (meaning intended to wear out over time) or “sacrificial” (meaning a less expensive part designed to fail first), preventing failure of other more expensive parts. Both disposable and sacrificial parts are designed to be removable. This reduces the need for costly repairs. In this instance specifically, DE364 discloses a polymer bearing pad that is secured to a base by a “dovetail connection, screws or other fit” to enable replacement. Ex. 1005, ¶ [0024-5]. The polymer bearing pad of DE364 is in fact referred to as a “wear part 30.” *Id.* “The replaceable wear part 30 thus consists of the part 32 acting as bearing material, which, together with its support part 31, is removably attached of

the remainder of the shoe structure, for example by means of the nozzles 17.” *Id.* The person of ordinary skill would have had a reasonable expectation of success in implementing this known solution to a known problem.

J. Motivation to Combine ’133 with DE364

280. The ’133 Patent teaches that the disclosed bearing assembly “is applicable to trunnion bearings for cylindrical journals and also to slider bearings in which the slide member has a flat bearing face.” Ex. 1007, 1:11-14. It is particularly applicable to supporting a cylindrical journal or a slide member, stating that each depicted bearing design “can in fact be adapted to suit either” supporting a cylindrical journal or a slide member. Ex. 1007, 4:8-14. DE364 discloses a rotary thrust bearing device for a press machine. Ex. 1005, ¶¶ [0002] and [0003].

281. The bearing design of the ’133 Patent includes a “bearing face” for engaging the journal, which may include a bearing lining for engaging the journal. Ex. 1007, 2:30-37. The use of a polymer as that bearing face or bearing lining is expressly discussed in DE364, which states its bearing pad is a polymer that helps improve “sliding properties.” Ex. 1005, ¶[0011]. In other words, the use of a polymer as a bearing pad was a known solution to a known technical problem (i.e., that of helping decrease friction and improve the sliding properties of the bearing.) Thus, the person of ordinary skill in the art would have been able to predict with a reasonable degree of success that one could use the polymer bearing pad disclosed in DE364. The POSITA would have been motivated to use the improved sliding properties of the polymer bearing pad in DE364 with the bearing liner shown in the ’133 Patent.

282. In addition, DE364 recognizes the problem associated with wear and the need to replace bearing pads that have worn out. DE364 notes that having a

replaceable bearing pad is a known solution to that problem and allows for one or more sections of the bearing pad to be temporarily fastened to the bearing shoe using hollow bolts disposed within recesses on the face of the bearing pad. The person of ordinary skill in the art would have been able to predict with a reasonable degree of success, that one could use temporary fasteners to fasten a bearing pad onto a shoe.

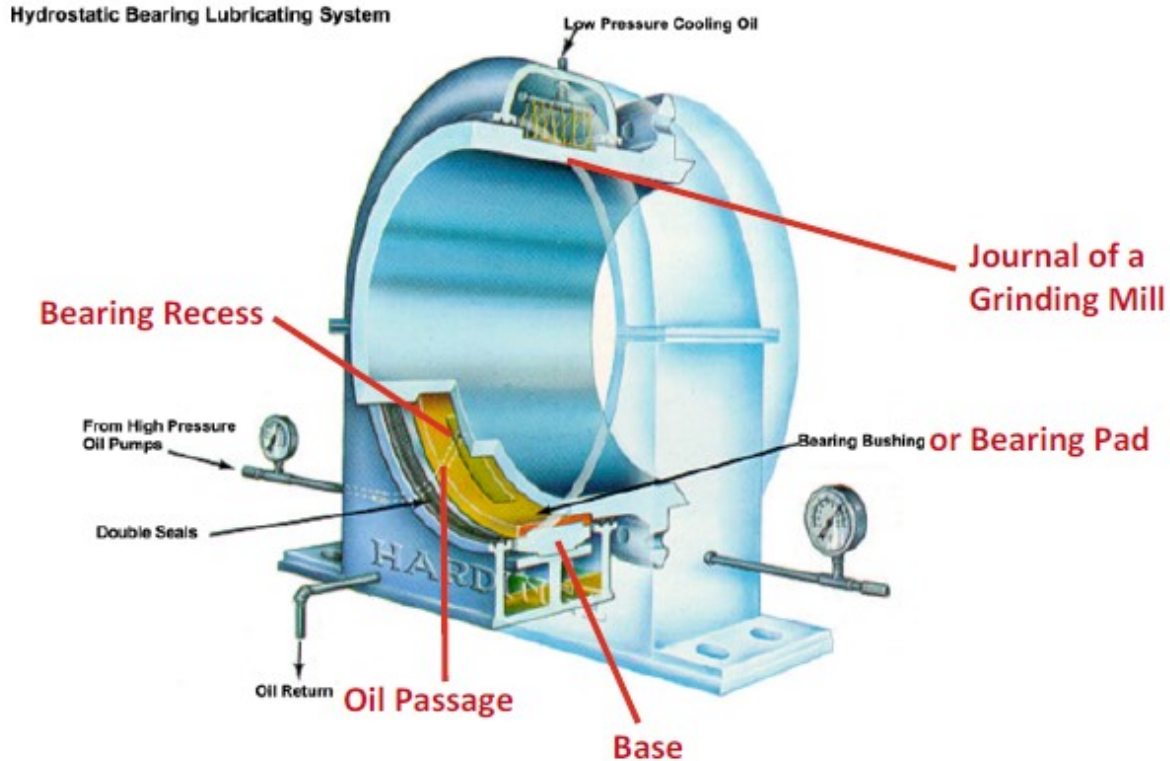
283. Thus, the POSITA would have been motivated to combine the temporary fasteners discussed in DE364 with the bearing assembly of the ‘133 Patent to allow replacement of worn components. DE364 recognizes the problem associated with wear and the need to replace bearing pads that have worn out. DE364 notes that having a replaceable bearing pad is a known solution to that problem and allows for one or more sections of the bearing pad to be temporarily fastened to the bearing shoe using hollow bolts disposed within recesses on the face of the bearing pad. The person of ordinary skill in the art would have been able to predict with a reasonable degree of success, that one could use temporary fasteners to fasten a bearing pad onto a shoe.

K. GROUND 6 – Metso in view of 2012/0099993 to Guerenbourg et al. and Trygg – Claims 1, 11

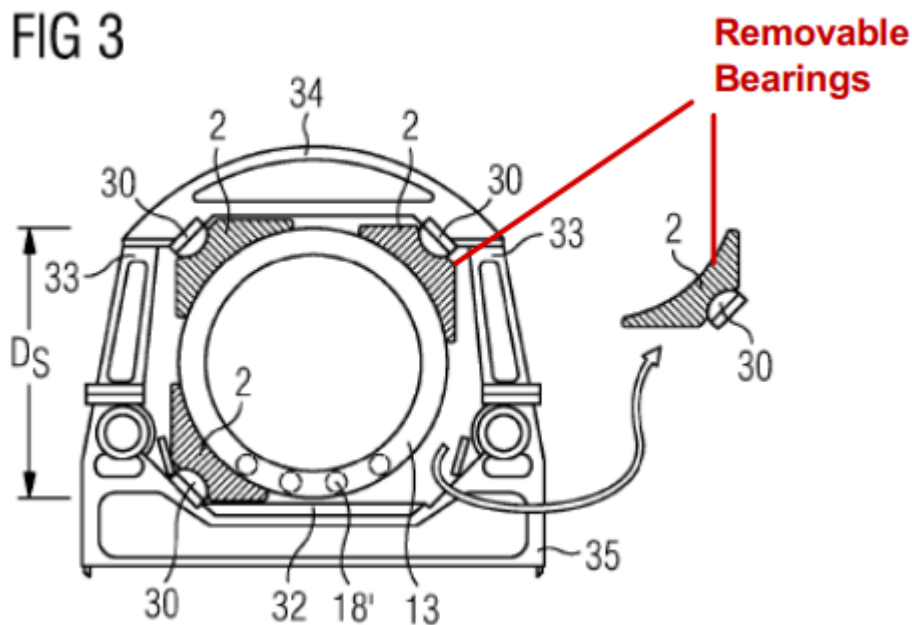
[Independent Claim 1]

[1a and 1b] A bearing assembly for supporting a journal of a grinding mill body, comprising a frame and a plurality of fluid bearings, said fluid bearings each comprising a polymer bearing pad mounted to a base, said

284. The Metso Brochure discloses a bearing assembly for supporting a journal of a grinding mill comprising a frame and a single 120-degree fluid bearing having a bearing pad (referred to as the “Bearing Bushing”) mounted to a base.



285. The '993 publication discloses a plurality of fluid bearings for use about the rotating shaft of a wind turbine. "The pad arrangement of the fluid bearing for a wind turbine can comprise several bearing pads suitably arranged relative to the rotor and held in place by the outer containing structure. Preferably, at least three bearing pads are arranged about the rotor shaft in a ring or annular arrangement." Ex. 1013, ¶ [0031].

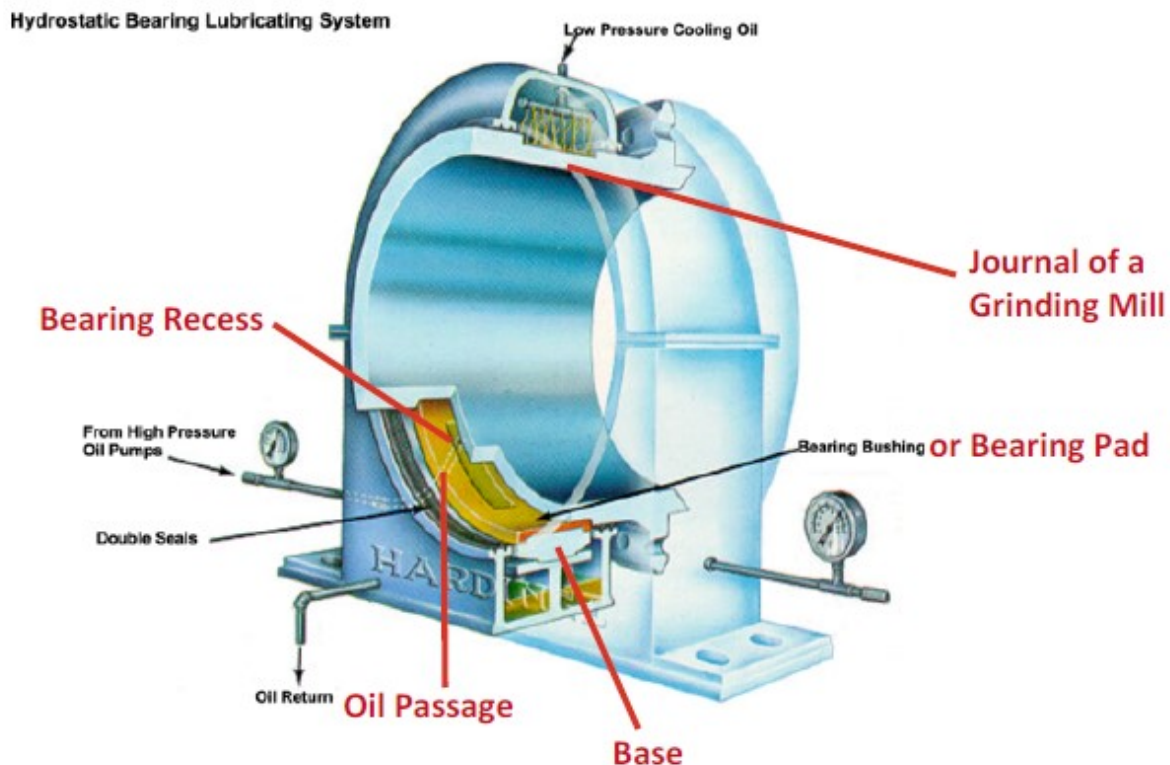


286. The material used for the bearing pad shown in Metso is not identified. However, the POSITA would have had a reasonable expectation of success in using a polymer as the bearing liner shown in Metso. As I explained above in ¶¶55, 77, 80 and 94, a designer (i.e., one of ordinary skill) would have known that using a polymer as the pad or lining of a hydrodynamic fluid bearing was one of the many options available and would have had a reasonable expectation of success using a polymer.

287. The '993 publication specifically notes that polymers “exhibit favourable stability and stiffness, are lightweight, have low coefficients of friction, and can be immersed in oil without damage. Use of such a material as an inner surface of the bearing can be advantageous, since a polymer with these properties will deform slightly while under pressure, so that the bearing has more ‘give’. This allows a better fluid film thickness to be built up during hydrodynamic operation.” See Ex. 1013, ¶ [0030].

[1c and 1d] at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and mounting element for securely mounting said polymer bearing pad to said base, said base also comprising at least one lubricating fluid supply port in fluid communication with said at least one passage

288. Metso discloses a recess for receiving lubricating fluid from at least one passage in the base and distributing the lubricating fluid to the outer surface of the bearing as shown below. The passage (shown in the dotted white lines) is placed through a back side of the bearing and is coupled to a line “From High Pressure Oil Pumps.” The line enters the back of the bearing at a fluid supply port or opening in the back end of the bearing. There is likewise an opening from the oil passage through the bearing liner and into the recess on the top surface of the bearing.



289. The bearing liner shown in Metso covers the full extent of the recess. The recess has a generally rectangular shape with sidewalls on all sides of the recess. The liner's placement in the bottom of the recess against the sidewalls of the recess is a mounting element.

[1e] wherein said base is mounted to said frame so that said fluid bearings self adjust to changes in the angular position of the journal during operation of said grinding mill body.

290. The base of the Metso bearing is mounted to the frame. It was general knowledge that the POSITA could use a fixed bearing mount or a self-adjusting bearing amount depending on the needs of the designer. *See* my discussion at ¶107.

291. That said, the '993 publication specifically notes that "[i]n a preferred embodiment of the invention, a bearing pad of the fluid bearing comprises a pivot bearing to tiltably connect the bearing pad to the bearing housing. The pivot bearing can comprise a ball and socket arrangement for each bearing pad, so that the outer surface of the bearing pad comprises a socket, and the 'ball' or hemisphere is part of the outer containing structure." Ex. 1013, ¶ [0022]. The '993 publication explains that "[u]nder ideal conditions, the blades of a wind energy converter cause the rotor to rotate smoothly about its central longitudinal axis. However, some lateral forces may also be exerted on the rotor shaft, which may move and bend to some extent due to the large dynamic loads, and the bearing pads of the fluid bearing should preferably be able to adjust to these movements. Therefore, a fluid bearing according to the invention is preferably realized such that the bearing pad is tiltably to accommodate a deflection of the shaft." *Id.* ¶ [0021].

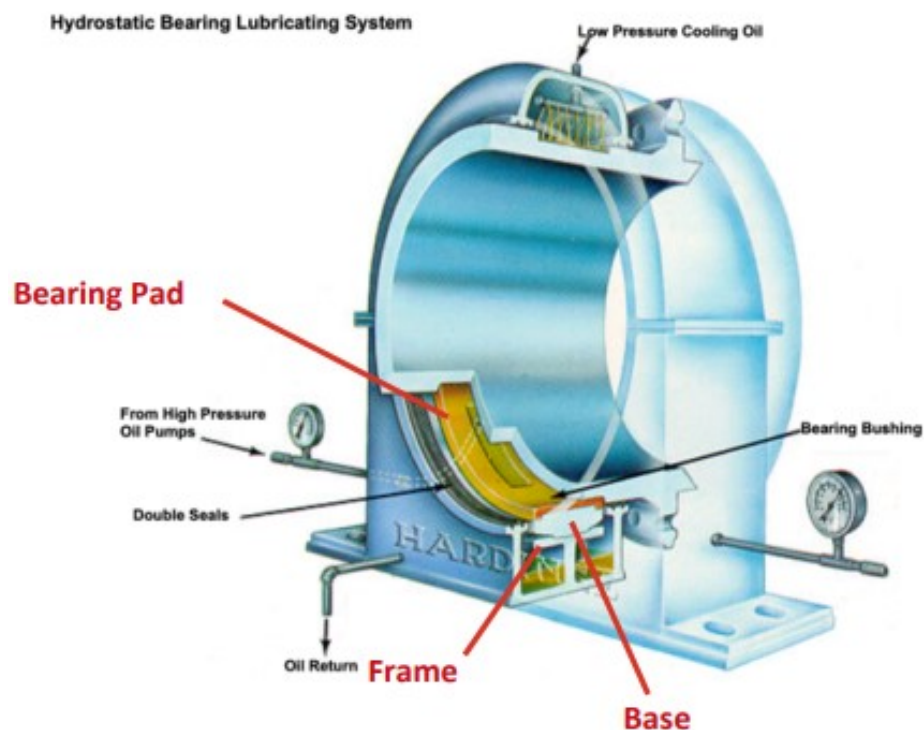
292. Here, depending on the type of load that the designer would anticipate from the milling operation, the POSITA would have had a reasonable expectation

of success in adopting a self-adjusting bearing in connection with the disclosure of the Metso Brochure.

[Independent Claim 11]

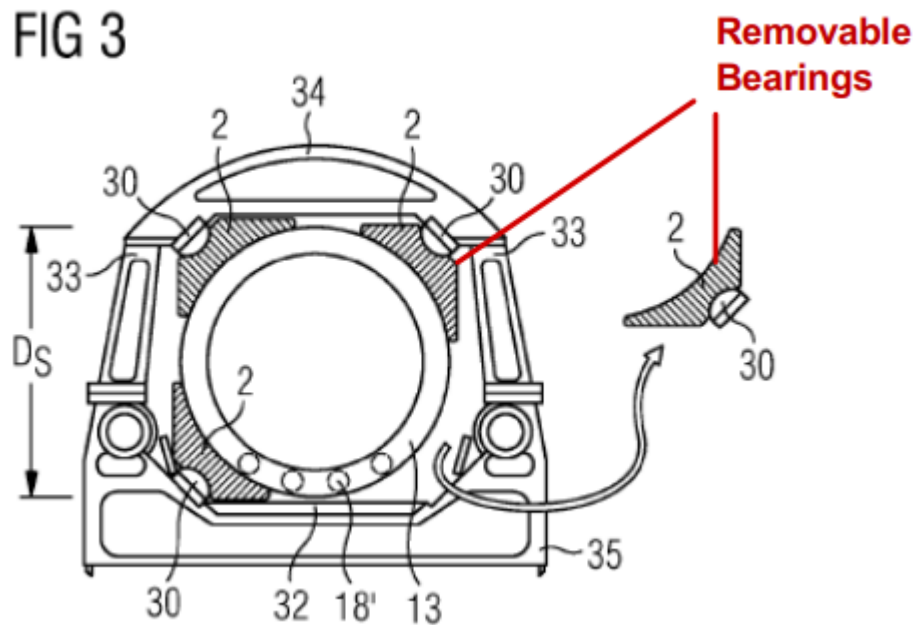
[11a-c] *A bearing assembly for supporting a journal of a grinding mill a frame and a plurality of fluid bearings, said fluid bearings each comprising a polymer bearing pad mounted to a base, said polymer bearing pad comprising an outer surface,*

293. The Metso Brochure discloses a bearing assembly for supporting a journal of a grinding mill comprising a frame and a single 120-degree fluid bearing having a bearing pad (referred to as the “Bearing Bushing”) mounted to a base.



294. The '993 publication discloses a plurality of fluid bearings for use about the rotating shaft of a wind turbine. “The pad arrangement of the fluid bearing for a wind turbine can comprise several bearing pads suitably arranged

relative to the rotor and held in place by the outer containing structure. Preferably, at least three bearing pads are arranged about the rotor shaft in a ring or annular arrangement.” Ex. 1013, ¶ [0031].

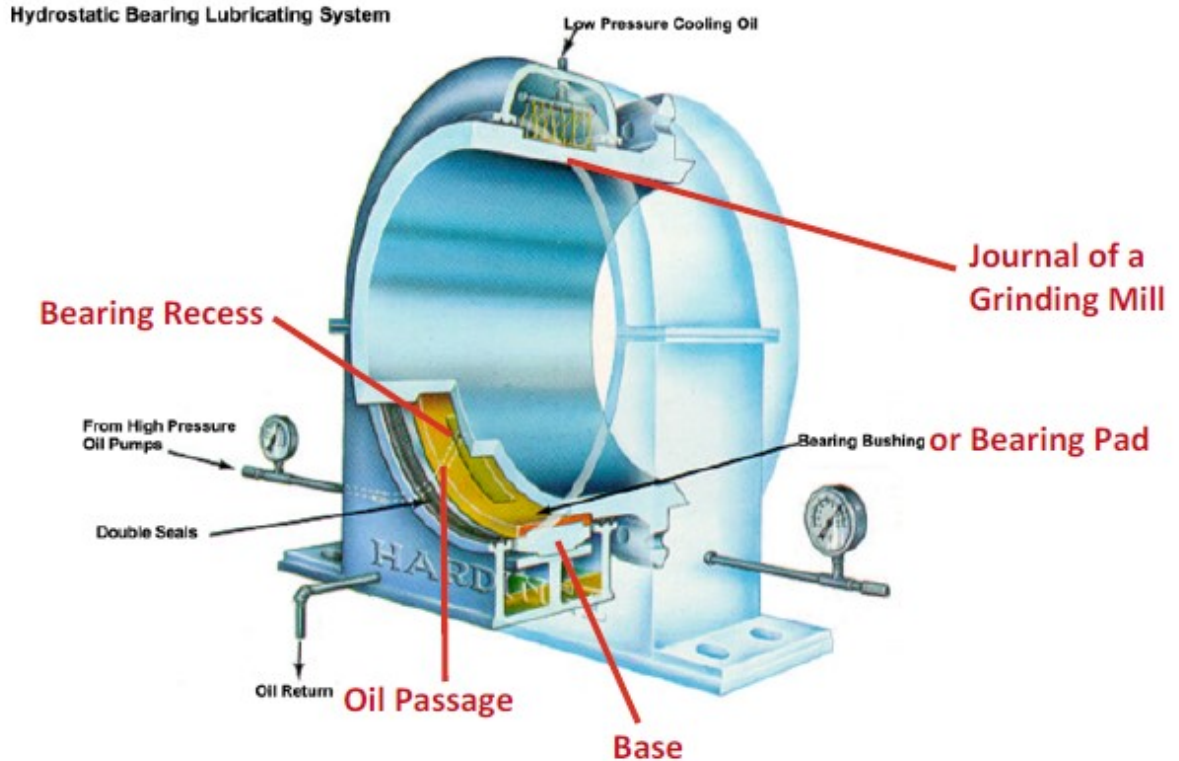


295. The material used for the bearing pad shown in Metso is not identified. However, the POSITA would have had a reasonable expectation of success in using a polymer as the bearing liner shown in Metso. As I explained above in ¶¶55, 77, 80 and 94, a designer (i.e., one of ordinary skill) would have known that using a polymer as the pad or lining of a hydrodynamic fluid bearing was one of the many options available and would have had a reasonable expectation of success using a polymer. As taught in the '993 publication, it was generally known that polymers “exhibit favourable stability and stiffness, are lightweight, have low coefficients of friction, and can be immersed in oil without damage. Use of such a material as an inner surface of the bearing can be advantageous, since a polymer with these properties will deform slightly while

under pressure, so that the bearing has more ‘give’. This allows a better fluid film thickness to be built up during hydrodynamic operation.” See Ex. 1013, ¶ [0030].

[11d-f] at least one recess for receiving lubricating fluid from at least one passage of said base and distributing said lubricating fluid to said outer surface and mounting element for securely mounting said polymer bearing pad to said base, said base also comprising at least one lubricating fluid supply port in fluid communication with said at least one passage,

296. Metso discloses a recess for receiving lubricating fluid from at least one passage in the base and distributing the lubricating fluid to the outer surface of the bearing as shown below. The passage (shown in the dotted white lines) is placed through a back side of the bearing and is coupled to a line “From High Pressure Oil Pumps.” The line enters the back of the bearing at a fluid supply port or opening in the back end of the bearing. There is likewise an opening from the oil passage through the bearing liner and into the recess on the top surface of the bearing.



297. The bearing liner shown in Metso covers the full extent of the recess. The recess has a generally rectangular shape with sidewalls on all sides of the recess. The liner's placement in the bottom of the recess against the sidewalls of the recess is a mounting element.

[11g] *wherein said base is fixedly mounted to said frame.*

298. It was generally known to the person of ordinary skill, that one could use a fixed mount or a self-adjusting mount for fluid bearings depending on the particular engineering principles applied to the particular needs of the design. *See* my discussion at ¶107. The person of ordinary skill therefore would have had a reasonable expectation of success using this known solution to a known problem.

299. Moreover, Trygg discloses a fixed fluid bearing used in connection with a hydrostatic shoe bearing in a mill. *See supra*, ¶¶64-72.

L. Motivation to Combine Metso with '993 Publication and Trygg

300. The Metso brochure discloses a tubular grinding mill with a hydraulic fluid bearing coupled to a high pressure oil source. The surface of the fluid bearing has a liner for covering the bearing and distributing oil across the liner forming an oil film thereon. The bearing provides a lubricated surface which engages and supports the journal of the grinding mill.

301. The '993 publication discloses a hydraulic fluid bearing for use in connection with the rotating shaft of a wind turbine. The bearings in the '993 publication likewise provide a lubricated surface which engages and supports the rotating body of the shaft. *See* Ex. 1013, ¶ [0026] (discussing the use and benefits of bearing pads with hydraulic fluid bearings).

302. The '993 publication discloses the benefits and advantages of using a polymer bearing pad in connection with hydraulic bearing pads. *See* Ex. 1013, ¶ [0030] (discussing material properties of polymers for use as a bearing pad and the advantages including, for example, stability, stiffness while being lightweight, low coefficients of friction, immersible in oil without damage, deformability, etc.)

303. The person of ordinary skill would have understood these advantages and uses of polymers as a bearing pad and would have had a reasonable expectation of success using a polymer bearing pad as the bearing pad shown in Metso.

304. In addition, Metso shows that its bearing is coupled to the frame. One of ordinary skill would have understood that self-adjusting bearings could be used when uneven loads were anticipated and been motivated to combine '993 with Metso. The '993 publication discloses that “[u]nder ideal conditions, the blades of a wind energy converter cause the rotor to rotate smoothly about its central longitudinal axis.” *See* Ex. 1013, ¶ [0021]. In other words, under ideal conditions

there is not an uneven load placed on the rotating body. The '993 publication goes on to state that “some lateral forces may also be exerted on the rotor shaft, which may move and bend to some extent due to the large dynamic loads, and the bearing pads of the fluid bearing should preferably be able to adjust to these movements. Therefore, a fluid bearing according to the invention is preferably realized such that the bearing pad is tiltable to accommodate a deflection of the shaft.” *See* Ex. 1013, ¶ [0021].

305. The POSITA would have understood these advantages and would have had a reasonable expectation of success in combining the solution of using “tiltable” or self-adjusting bearings or a fixed bearing in connection with the Metso disclosure and would have been motivated to take advantage of these benefits.

306. Trygg discloses the use of both fixed and self-adjusting fluid bearings. The POSITA would understand from Trygg that the “hydrostatic shoe bearing has been developed specially for use in the heavy machine industry, with the requirements for high loadings and large support diameters which this market demands...” Ex. 1009, p. 105. However, “[i]rrespective of the area of machine construction within which the hydrostatic shoe bearing is to operate, the same basic principles still apply to its function; i.e., the sliding surfaces are completely separated by means of oil under pressure.” *Id.* Meaning, all of the fundamental principles applicable to the use of hydraulic bearings known to the POSITA are applicable to the bearings shown in Trygg. The POSITA would be motivated to combine the teachings of Trygg with the basic principles applicable to all hydraulic bearings to use either a fixed bearing or a self-adjusting bearing as determined by the engineer.

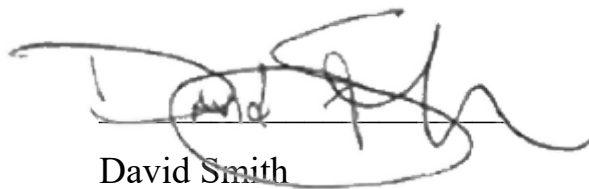
In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the

Declaration of David Smith
Patent 9,518,604 B2

United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination may take place within the United States. If cross-examination is required of me, I will appear during a designated time allotted for such.

I hereby 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 further that these statements were made with the 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.

Executed this 6th day of May 2025.



David Smith

Exhibit A



CURRICULUM VITAE
DAVID G. SMITH

☎ 801-763-8484

✉ dsmith@alpineeng.com

🌐 www.alpineeng.com

PROFILE

Experienced mechanical engineer (MS, PE) with seven issued patents. Award winning inventor. President of Alpine Engineering and Design, a mechanical engineering consulting company with clients around the United States ranging from individual inventors to Fortune 500 companies. Worked on the development of multiple successful products including among other things: forklifts, forklift attachments, conveyors, aerial lifts, garbage trucks, thrill rides, ziplines, trailers, oil and gas equipment, exercise equipment, manufacturing equipment and multiple consumer products.

Graduated Cum Laude with a bachelor's degree in mechanical engineering. Completed a master's of science degree in mechanical engineering and an MBA with an emphasis in product development. Licensed professional engineer (PE) and a certified safety professional in comprehensive practice (CSP). Certified trainer for boom lifts, scissor lifts, rough terrain and counterbalanced forklifts. Nearly two decades of experience in product development, patents, equipment safety and risk assessments.

Experienced expert witness having drafted hundreds of reports/declarations in patent and personal injury cases. Designed and built multiple custom testing devices to obtain data and evaluate opinions. Created multiple demonstratives to explain the mechanics and circumstances of accident sequences and patented devices. Testified in deposition 30+ times and multiple times in trial.

CERTIFICATIONS

- Professional Mechanical Engineer (PE)
 - Utah License # 8645497-2202
 - Idaho License #19657
- Certified Safety Professional (CSP)
 - Comprehensive Practice License #CSP-30707
- Certified Forklift Operator
- Certified Counterbalanced Forklift Operator Trainer
- Certified Rough Terrain Forklift Operator Trainer
- Certified Aerial Boom Lift Operator Trainer
- Certified Aerial Work Platform (Scissor Lift) Operator Trainer

EDUCATION

Master of Business Administration (MBA) 2009-2011
Marriott School of business | Brigham Young University
Emphasis in Product Development

Masters of Science - Mechanical Engineering 2008-2011
Ira A. Fulton College of Engineering | Brigham Young University
Emphasis - Product Design, Mechanism Design,
Compliant Mechanisms, MEMS

Bachelor's of Science - Mechanical Engineering 2002-2007
Brigham Young University - Idaho
Cum Laude Graduate
Academic Scholarship
Boy Scouts of America Scholarship

CONSULTING FOCUS

Involved in hundreds of consulting projects. Major areas of focus and expertise include: aerial lifts, boom lifts, bucket trucks, cherry pickers, scissor lifts, trailers, end dumps, side dumps, belly dumps, flat beds, goose neck trailers, 5th wheel trailers, trailer safety chains, towing systems, tarping systems, refuse trucks, recycling trucks, rear loaders, side loaders, automated trucks, front loaders, automated side loaders, fall protection, exercise equipment, forklifts, forklift attachments, powered industrial trucks, and telehandlers, rough terrain forklifts, drilling equipment, oil and gas equipment, heavy equipment, construction equipment, conveyors, roller conveyors, belt conveyors, screw conveyors, auger conveyors, hydraulic equipment, manufacturing equipment, consumer products, chairs and seating, stability and tipping, plastic design, zip lines, thrill rides, designing to standards, and design for safety.

PATENTS

During his time at Alpine Engineering and Design, Inc., Mr. Smith has become familiar with patent prosecution and patent litigation. He has written multiple provisional patent applications, and has worked with attorneys in writing the specifications, creating drawings and drafting claims for utility patents on products he has helped design. As part of the product development process, he has performed patent searches, both for informational purposes and to lessen the likelihood that new developments would infringe other's intellectual property. Mr. Smith is listed as an inventor on seven issued patents.

- 9,387,788 - Combination Trailer
- 9,616,799 - Pneumatic Tank Trailer
- 9,758,083 – Pneumatic Tank Trailer
- 9,789,916 - Pneumatic Tank Trailer
- 10,206,495 - Vehicle Receiver Hitch-Supported Cargo Rack
Transformable into a Picnic Table with Benches
- 10,683,176 – Material Placer
- 11,013,391 – Scraper Apparatus

EXPERT WITNESS

Mr. Smith has been retained as an expert on over 100 patent, and personal injury cases and has testified in a number of these. Mr. Smith has attended SEAK expert witness training and has experience and competency in the following areas:

Patent Invalidity/Non-infringement	Product Liability
Patent Infringement/Validity	Personal Injury
Prior Art Searching	Failure Reconstruction
Claim Construction	Safety

Mr. Smith has also been involved in multiple aspects of patent litigation including claim construction, prior art and patent searches, infringement/validity analyses and non-infringement/invalidity analyses on over 50 cases. Mr. Smith has worked on district court cases, IPR’s, EPR’s, and cases in the ITC. The following are a few of the categories of patent issues Mr. Smith has consulted on:

Trailers	Office Supplies
Agricultural Equipment	Food Processors
Trailer Tarping Systems	Blenders
Oil/Gas Drilling Equipment	Coffee and Tea makers
Weight Machines	Vacuum Cleaners
Athletic Equipment	Hospital Equipment
Archery Equipment	Cleaning Systems
Hinges	Car seat gap fillers
Seating/Chairs	Baby bottle warmers
Hand Tools	Cooler Latching Systems
Springs	Grills and Smokers

**PEER REVIEWED
PUBLICATIONS**

- Off-axis Stiffness and Piezoresistive Sensing in Large-displacement Linear-motion MEMS (Brigham Young University, Master’s Thesis, 2009)
- Piezoresistive Encoders for Ratcheting Actuation Systems (Sensors and Actuators A: Physical, Volume 165, Issue 2, February 2011)
- Design Optimization of a Linear-motion Large-displacement Micro Mechanism for High Off-axis Stiffness (ASME International Design Engineering Technical Conferences IDETC/CIE 2009)
- Metrics for Evaluation and Design of Large-displacement Linear-motion Compliant Mechanisms (Journal of Mechanical Design, 2012)

**MAGAZINE AND
WHITE PAPER
PUBLICATIONS**

- An Engineering Guide for Trailer Safety Chain Installation, Attachment and Use (White Paper, Linklock.net)
- Your Rear Impact Guard Questions Answered (Tracks Magazine, National Association of Trailer Manufacturers, September/October 2019)
- The Nuances of Advising on Product Liability Cases (Lawyer Monthly, January 2021)
- Community Highlights: Meet David Smith of Alpine Engineering and Design (Voyage Utah Magazine February 2022)

**PODCASTS,
BLOG ARTICLES,
AND OTHER
PUBLICATIONS**

- Host of The Expert Witness Podcast
- 9 Ways Engineering Analysis Adds Value to Your Manufacturing Operations
- 100% Defense Verdict in Forklift Case – Reviewed by a Mechanical Engineering Expert Witness
- The Safety Cliff
- Take the Handcuffs Off of Your Safety Managers
- What is a Provisional Patent Application?
- 7 Unexpected Lessons from Preparing to Launch a Product on Kickstarter
- 9 Ways to Find Your Next Expert Witness on a Single Cup of Coffee
- How to Make Money Inventing... Without Going Broke First
- Expert Opinion: Improper Forklift Operation Kills Delivery Driver
- Expert Opinion: Efficiency Improvements Result in Tractor Operator's Death
- Expert Opinion: No, Ma'am! The Swing Set Was NOT Vandalized
- Expert Opinion: Defective Auger Conveyor Amputates Employees Arm
- Expert Opinion: Improper Forklift Operation Kills Deliver Driver
- Expert Opinion: Just Because it Can Be Done Without Injury Does Not Mean it is Safe
- Expert Opinion: Engineering Standards Buckling Under American's Ever Increasing Weight Gain
- Expert Opinion: Auger Conveyor Design Defect Amputates Employees Arm
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