

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CATERPILLAR INC.
Petitioner,

v.

ERNIE BROOKINS,
Patent Owner.

Case IPR2017-01020
Patent 7,824,290 B1

Before JILL D. HILL, BEVERLY M. BUNTING, and
TIMOTHY J. GOODSON, *Administrative Patent Judges*.

HILL, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

Caterpillar Inc. (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–10 (“the challenged claims”) of U.S. Patent No. 7,824,290 B1 (Ex. 1001, “the ’290 patent”). Paper 1 (“Pet.”). Ernie Brookins (“Patent Owner”) filed a Preliminary Response. Paper 29. We instituted *inter partes* review of all grounds and all claims challenged in the Petition. Paper 30, 7, 25 (Dec. on Inst.”). After institution, Patent Owner filed a Patent Owner’s Response (Paper 32, “PO Resp.”), and Petitioner filed a Reply (Paper 34, “Reply”). An oral hearing was held on June 5, 2018, and a copy of the transcript was entered into the record. Paper 37 (“Tr.”).

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 regarding the patentability of claims 1–10. For the reasons set forth below, we conclude Petitioner has shown, by a preponderance of the evidence, that claims 1–10 are unpatentable.

A. Related Matters

The parties indicate that the ’290 patent has been asserted in *Ernie Brookins v. Caterpillar Inc.*, 3:16-cv-00291 (D.N.D.). Pet. 3; Paper 28, 2. Additionally, Patent Owner states that the ’290 patent has also been asserted in: *Brookins Hybrid Drive Systems, LLC v. M.A.C., Inc.*, 3:12-cv-00101 (D.N.D.); *Warp Speed Torque Drive, LLC v. M.A.C., Inc.*, 3:13-cv-00045 (D.N.D.); and *Brookins v. Parker-Hannifin Corp.*, 3:15-cv-00065 (D.N.D.). Paper 28, 2–3.

B. The ’290 Patent (Ex. 1001)

The ’290 patent is directed to a rotational power distribution and control system including a hydrostatic pump/motor, the system being

operable to function “similarly to a typical automotive manual clutch” or as a “continuously or infinitely variable transmission[.]” Ex. 1001, Abstract. The ’290 patent is also directed to methods related thereto. *Id.*

Figure 1 is reproduced below.

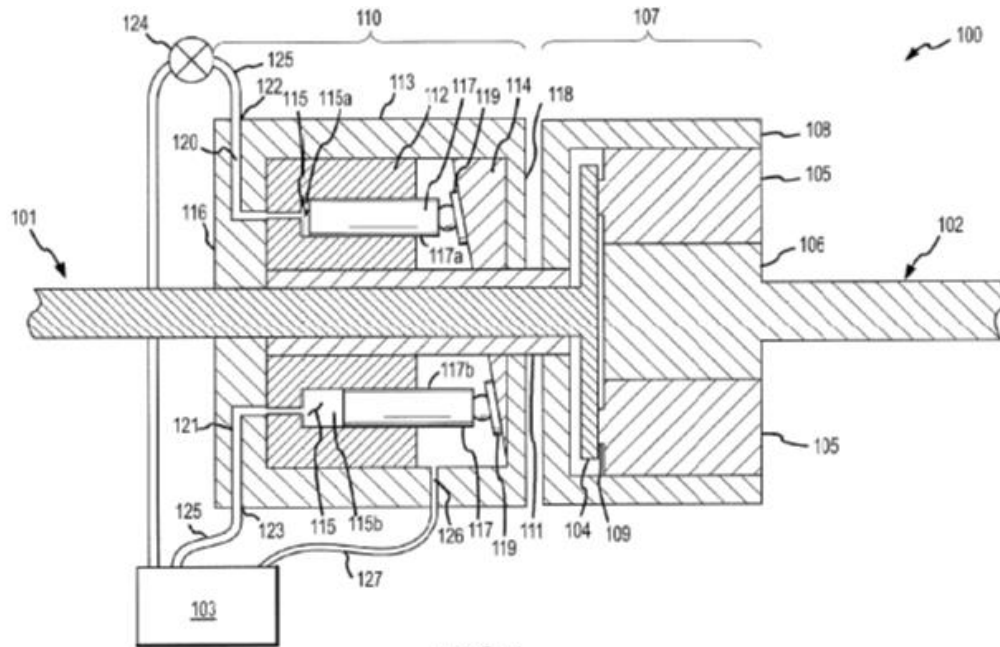


FIG. 1

Figure 1 is a cross-sectional schematic view of an embodiment of a rotational power distribution and control system configured as a hydraulic clutch. *Id.* at 8:59–61.

Figures 1–3 are described in the ’290 patent as illustrating “hydraulic clutch system” embodiments of a rotational power distribution and control system. *Id.* at 8:59–67. Figures 4A and 4B are described as illustrating a “continuously variable transmission drive system[.]” embodiment of the rotational power distribution and control system. *Id.* at 9:1–4. Figures 5–7 and 8A–8G are described as illustrating a “pump/motor hybrid drive system” embodiment of the rotational power distribution and control system. *Id.* at 9:5–17.

The embodiment of the rotational power and control device 100 illustrated in Figure 1 includes planetary gear set 107, hydrostatic (or other hydraulic) pump 110, a first rotational interface in the form of first shaft 101, a second rotational interface in the form of second shaft 102, and hydraulic circuit 103. *Id.* at 10:42–48, 12:12–15. First shaft 101, second shaft 102, and hydrostatic pump 110 each interface with a different one of the three main components (i.e., sun gear 106, planet carrier 104, and ring gear 108) of planetary gear set 107. *Id.* at 10:52–58.

In a planetary gear set, a direct mechanical interconnection can be achieved between any two of the three main components by holding the third main component stationary. *Id.* at 11:40–43. For example, if hydrostatic pump 110 holds ring gear 108 stationary, rotation of planetary carrier 104 by first shaft 101 will result in rotation of sun gear 106 and second shaft 102. *Id.* at 11:43–45. However, if ring gear 108 is allowed to rotate freely, rotation of planetary carrier 104 by first shaft 101 will not result in rotation of sun gear 106 and second shaft 102. *Id.* at 11:54–61.

Hydrostatic pump 110 has housing 113 and cylinder block 112 with axial bores 115 in which pistons 117 are slidably disposed. *Id.* at 12:27–40. Housing 113 includes stationary angled swash plate 114 that slidably interfaces with each of pistons 117 as the pistons rotate with their cylinder block 112 relative to housing 113 and swash plate 114. *Id.* at 12:33–44. As pistons 117 rotate relative to housing 113 and swash plate 114, the inclination of swash plate 114 causes the rotating pistons to be compressed in their bores as they rotate along certain portions of swash plate 114, which causes fluid to flow from the cylinder block via first port 122 of hydrostatic pump 110. *Id.* at 12:63–13:41.

Planetary gear set 107 has a “free-wheeling mode” where the input is effectively disconnected from the output by letting the third component of planetary gear set 107 (i.e., ring gear 108 in the embodiment of Figure 1) free wheel. In a second, “locked mode,” the third component of planetary gear set 107 is held stationary, allowing the other two components (i.e., sun gear 106 and planetary carrier 104 in the embodiment of Figure 1) to be interconnected and transfer rotational force therebetween. *Id.* at 13:42–49. Additionally, in a “third mode,” by selectively applying a variable resistance to the third component, the ratio of rotation of the other two components can be continuously varied between the free-wheeling mode and the locked mode. *Id.* at 13:49–53.

Such variable resistance is attained using a valve 124 that restricts fluid flow from first port 122 of the hydrostatic pump 110. *Id.* at 13:54–57. This flow restriction prevents fluid from leaving the bore of pistons 117 as they are compressed via swash plate 114, and the resultant friction within hydrostatic pump 110 thereby prevents relative rotation of cylinder block 112 and housing 113, such that rotation of ring gear 108 is prevented, causing rotational force to be transmitted from first shaft 101 and planetary carrier 104 to second shaft 102 and sun gear 106. *Id.* at 13:54–14:3, 14:7–17. “[B]y regulating the flow through valve 124, the ratio of the rotational rate of the first shaft 101 with respect to the rotational rate of the second shaft 102 may be continuously varied.” *Id.* at 14:3–7.

C. Prosecution History of the '290 Patent (Ex. 1003)

Patent Owner, Mr. Brookins, makes certain arguments based on a restriction requirement and subsequent election that occurred during

prosecution of U.S. Patent Application No. 11/830,067 (“the Application”), which issued as the ’290 patent. *See* PO Resp. 7–8. We provide a detailed summary of the restriction and election here. On December 1, 2009, the Examiner issued a restriction requirement (“the Restriction”), finding that the Application contained claims directed to three patentably distinct species: (1) a fluid valved controlled resistance brake for a planetary gearing as shown in Figures 1–3; (2) a hydromechanical continuously variable transmission (CVT) with planetary gearing as shown in Figures 4A, 4B, 6, and 10; and (3) a hydrostatic pump/motor acting as a brake or a drive source for a planetary gearing as shown in Figure 5. Ex. 1003, 84. The Examiner indicated that the three species were “not obvious variants of each other,” and that the claims “shall be restricted if no generic claim is finally held to be allowable.” *Id.* The Examiner stated that “no claim appears to be generic.” *Id.*

In response to the Restriction, Mr. Brookins filed an Election on December 28, 2009 (“the Election” or “Elect.”), electing “Species I: Figures 1–3, Claims 1–14, 20, 26–30, 33,” withdrawing Species II with associated claims 15–19, 31, 32, 34–40, and withdrawing Species III with associated claims 21–25. Ex. 1003, 80. The Restriction was traversed “because Species II & III perform the exact same function as Species I in that they all use hydrostatic means to power a drive wheel and to start a vehicle,” and the elements of “Figures 1–3 are also shown in Figures 4A–B, 5, 6, and 10. . . .” *Id.* at 80. The Election further stated that “the species identified by the examiner are not separate and distinct inventions.” *Id.*

Regarding Patent Owner’s traversal of the Restriction, the Examiner responded that the traversal was not persuasive because — regarding

functionality of the individual species — “Species I is not used to power a drive wheel or start a vehicle;” rather, “[t]he pump of Species I is used solely for the purpose of retarding the rotation of a planetary gear element,” which “is not the case with the pump and motor of” Species II and III. *Id.* at 34.

Patent Owner disagreed with the Examiner’s withdrawal of certain additional claims (i.e., claims 27–30 and 33), arguing that these additionally-withdrawn claims were drawn to a method of using the structure shown in Figures 1–3. *Id.* at 23. In the Notice of Allowability, the Examiner stated that “previously withdrawn claims 27–30 and 33” were reinstated “in response to Applicant’s remarks. . . .” *Id.* at 15.

D. Illustrative Claim

Of challenged claims 1–10, claims 1, 5, and 6 are independent. Claim 1, reproduced below, illustrates the challenged claims.

1. A rotational power distribution and control system comprising:
 - (a) a gear set wherein said gear set comprises:
 - (i) a first rotational interface;
 - (ii) a second rotational interface; and
 - (iii) a third rotational interface;
 - (b) a hydrostatic pump coupled to a selected rotational interface in the form of one of said first rotational interface, said second rotational interface and said third rotational interface; a cylinder block of said hydrostatic pump being coupled to one of said gear set;
 - (c) a hydraulic fluid circuit wherein said hydraulic fluid circuit is interconnected to a first port on said hydrostatic pump, wherein said hydraulic fluid circuit is interconnected to a second port on said hydrostatic pump; and

- (d) a valve to selectively control flow through said first port on said hydrostatic pump.

Ex. 1001, 32:34–51.

E. Evidence Relied Upon

Petitioner relies on the following prior art references (Pet. 5–6):

Reference	Patent/Publication Number	Date	Exhibit No.
Keiser	US 2003/0032517 A1	Feb. 13, 2003	1004
Rush	WO 2004/033906 A1	Apr. 22, 2004	1005
Britt	US 6,634,976 B1	Oct. 21, 2003	1006
Whitaker	US 2004/0187491 A1	Sep. 30, 2004	1007

Petitioner relies on the declaration of Monika Ivantysynova, Ph.D (Ex. 1002). The parties rely on other exhibits as discussed below.

F. Instituted Grounds of Unpatentability

We instituted the instant trial based on the following grounds of unpatentability. Dec. on Inst. 25.

Reference(s)	Basis	Claim(s) Challenged
Keiser	§ 102	1, 2, 6, and 7
Keiser	§ 103	1, 2, 6, and 7
Keiser and Rush	§ 103	1–3 and 6–9
Keiser, Rush, and Britt	§ 103	10
Keiser, Rush, Whitaker	§ 103	4
Keiser, Rush, Britt	§ 103	5

II. ANALYSIS

A. Legal Principles

We analyze the instituted grounds of unpatentability in accordance with the principles stated below.

1. *Burden of Proving Unpatentability*

In *inter partes* reviews, petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to the patent owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail in this proceeding, Petitioner must support its challenges by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). Accordingly, all of our findings and conclusions are based on a preponderance of the evidence.

2. *Anticipation*

A claim is anticipated if each limitation of the claim is disclosed in a single prior art reference arranged as in the claim. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (holding that “it is not enough [for anticipation] that the prior art reference discloses part of the claimed invention, which an ordinary artisan might supplement to make the whole, or that it includes multiple, distinct teachings that the artisan might somehow combine to achieve the claimed invention.”) (citing *In re Arkley*, 455 F.2d 586, 587 (CCPA 1972)). To establish anticipation, Petitioner must demonstrate that a prior art reference shows every element of the claimed invention identically, in the same relationship as in the claim. *In re Bond*, 910 F.2d 831, 832 (Fed. Cir. 1990). All of the elements and limitations of the claim must be shown in a single prior art reference, arranged as in the

claim. *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001). “A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros. Inc., v. Union Oil Co.*, 814 F.2d 628, 631 (Fed. Cir. 1987). Moreover, “[b]ecause the hallmark of anticipation is prior invention, the prior art reference—in order to anticipate under 35 U.S.C. § 102—must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements ‘arranged as in the claim.’” *Net MoneyIN*, 545 F.3d at 1369. Whether a reference anticipates is assessed from the perspective of an ordinarily skilled artisan. *See Dayco Prods., Inc. v. Total Containment, Inc.*, 329 F.3d 1358, 1368 (Fed. Cir. 2003) (“[T]he dispositive question regarding anticipation [i]s whether one skilled in the art would reasonably understand or infer from the [prior art reference’s] teaching that every claim element was disclosed in that single reference.”).

3. Obviousness

A claim is unpatentable under § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations.

Graham v. John Deere Co., 383 U.S. 1, 17–18 (1966). We analyze obviousness in accordance with the above-stated principles.

B. Claim Construction

The Board interprets claims using the broadest reasonable interpretation in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., v. Lee*, 136 S. Ct. 2131, 2142–46 (2016). Under the broadest reasonable interpretation standard, and absent any special definitions, we generally give claim terms their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech. Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definitions for claim terms or phrases must be set forth with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). In the absence of such a definition, limitations are not to be read from the specification into the claims. *See In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993). We address below the parties’ contentions.

1. “Cylinder Block”

Petitioner proposes an explicit construction for the term “cylinder block of said hydrostatic pump” of “a rigid casing in which the cylinders of a pump are bored.” Pet. 13. Patent Owner does not challenge Petitioner’s proposed construction, nor does Patent Owner address whether express construction of any term is necessary in its Patent Owner Response. *See generally* PO Resp.

2. “*Gear Set*”

In our Decision on Institution, we preliminarily construed the term “gear set” as “a set of gears.”¹ Dec. on Inst. 9–10. Neither party disputes this proposed construction. *See generally* PO Resp.; Reply. Now, with the trial record fully developed, our determination regarding the patentability of the challenged claims does not turn on the interpretation of “gear set.” As such, we construe the term “gear set” as “a set of gears” for the reasons provided in our Decision on Institution. Dec. on Inst. 9–10.

3. “*Rotational Power Distribution and Control System*”

Patent Owner repeats the same unsuccessful argument made in its Patent Owner Preliminary Response concerning limiting the phrase “rotational power distribution and control system” to a “fluid controlled resistance brake” because of the restriction requirement during prosecution. PO Resp. 3, 7–11. Patent Owner specifically argues that “[t]he patent application was restricted by the examiner to that of a ‘fluid controlled resistance brake’ (a hydraulic clutch) that takes the place of a standard clutch or torque converter and does not change gear ratio.” PO Resp. 8. Petitioner counters that Patent Owner does not cite to any authority that supports its novel proposition that election of a species during prosecution necessarily limits the scope of the claims, and that Patent Owner fails to “address the Board’s prior determination in any manner.” Reply 4. We agree. In our Decision on Institution, we preliminarily declined to limit the scope of

¹ Patent Owner notes a claim construction ruling by a District Court in another proceeding involving the ’290 patent, construing “gear set” to mean “a gear set with three rotational interfaces.” Prelim. Resp. 14; Ex. 2001 at 15.

claims 1–10 narrowly to include only the hydraulic clutch embodiment of Figures 1–3, or a “fluid controlled resistance brake” as argued by the Patent Owner. See PO Resp. 3, 7–8. Dec. on Inst. 11–12. Based on further review of the record, including the prosecution history and details of the restriction and election, we decline to limit the phrase “rotational power distribution and control system” to a “fluid controlled resistance brake” for the reasons provided in the Decision on Institution.

As to other terms or limitations recited in the claims, we determine that express construction of these terms or limitations is not necessary. See *Vivid Techs.*, 200 F.3d at 803.

B. Level of Skill in the Art

In determining the level of skill in the art, various factors may be considered, including the type of problems encountered in the art, the prior art solutions to those problems, the rapidity with which innovations are made, and the sophistication of the technology. *Custom Accessories, Inc. v. Jeffrey-Allan Indus. Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986).

Petitioner, relying on the testimony of its declarant, contends that “[a] person of ordinary skill in the art at the time of the invention (“POSITA”) of the ’290 patent would have a degree in mechanical engineering or equivalent, and 3–5 years’ experience in the research, development, or application of hydraulic systems.” Pet. 12 (citing Ex. 1002 ¶¶ 14–17). According to Petitioner, “[t]his level of skill is approximate and more experience would compensate for less formal education, and vice versa.” *Id.* (citing Ex. 1002 ¶¶ 14–17). Although Patent Owner disagreed with

Petitioner’s proposed definition in its Patent Owner Preliminary Response,² Patent Owner does not dispute this contention directly in its Patent Owner Response. *See, generally*, PO Resp.

Based on the entire record, we agree with Petitioner’s assessment, and find that a POSITA “would have [had] a degree in mechanical engineering or equivalent, and 3–5 years’ experience in the research, development, or application of hydraulic systems, and that significant experience with, or an understanding of hydraulic systems, would compensate for a formal degree.” Pet. 12. We also note that the cited references reflect the appropriate level of skill at the time of the claimed invention. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (“the prior art itself can reflect the appropriate level of skill in the art”).

C. Anticipation by Keiser – Claims 1, 2, 6, and 7

Petitioner challenges claims 1, 2, 6, and 7 as anticipated under 35 U.S.C. § 102(b) by Keiser. Pet. 15–31. In support thereof, Petitioner identifies the disclosure in Keiser alleged to describe the subject matter in each of the challenged claims. *Id.* Petitioner further cites the Declaration of Monika Ivantysynova (Ex. 1002) in support of the analysis advocated in the Petition. *Id.* Patent Owner counters that Keiser does not disclose “a ‘fluid controlled resistance brake’ that is a clutch that does not effect a gear ratio

² Specifically, Patent Owner argued that he “took his apprenticeship in clutch and transmissions in Sacramento, California at 18 years of age,” and that “[a] person of ordinary skill in the art at the time of the invention of the ’290 patent would need extensive knowledge in the automotive clutch and transmission fields.” Prelim Resp. 8.

change,” or “coupling” that would result in no gear ratio change. PO Resp. 3–4.

We have reviewed the parties’ contentions and supporting evidence. Given the evidence of record, we determine that Petitioner has demonstrated by a preponderance of the evidence that challenged claims 1, 2, 6, and 7 are anticipated by Keiser. We begin our analysis with a brief summary of Keiser, and then address the parties’ contentions in turn.

1. Overview of Keiser (Ex. 1004)

US Patent Publication No. 2003/0032517 A1 to Keiser was filed June 21, 2002, and published February 13, 2003. Ex. 1004, (10), (22), (43). Keiser is a continuation-in-part of US Patent No. 6,135,909, filed October 25, 1999, and is a continuation-in-part of US Patent No. 5,971,880, filed August 7, 1998. *Id.* at (63). Keiser is directed to “an infinitely variable ratio transmission.” *Id.* at ¶ 3. As shown in Figure 1 reproduced below, the infinitely variable ratio transmission includes an input shaft 12 attached to a carrier plate 20 of planetary gears 18 of a planetary gear set, an output shaft 24 attached to a ring gear 22 of the planetary gear set, and a pump 14 attached to a sun gear 16 of the planetary gear set. *Id.* Abst.

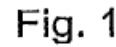


Figure 1 is a partial cross-sectional side view of Keiser's infinitively variable ratio transmission pump.

Keiser describes variator pump 14 as “any type of positive displacement pump known to those skilled in the art, such as, for example, a rotary vane pump, a piston pump, [etc.]” *Id.* ¶ 28. The pump can, for example, be a five piston variator pump, wherein the pistons act on an eccentric lobe mounted on the crankshaft to control rotational speed of the crankshaft. *Id.* ¶¶ 15, 37–32, Fig. 9.

2. Discussion

We previously instructed Patent Owner that “any arguments for patentability not raised in the [Patent Owner Response] will be deemed waived.” Paper 31, 7; *see also* 37 C.F.R. § 42.23(a) (“Any material fact not specifically denied may be considered admitted.”); *In re NuVasive, Inc.*, 842 F.3d 1376, 1379–82 (Fed. Cir. 2016) (holding that patent owner waived an argument addressed in the preliminary response by not raising the same argument in the patent owner response). Additionally, the Board’s Patent

Trial Practice Guide states that the Patent Owner Response “should identify all the involved claims that are believed to be patentable and state the basis for that belief.” Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012).

With the complete trial record before us, we note that we have reviewed arguments and evidence advanced by Petitioner to support its unpatentability contentions, and that Patent Owner chose not to address certain arguments and evidence in its Patent Owner Response. In this regard, the record now contains persuasive arguments and evidence presented by Petitioner, many of which are unrebutted, regarding the manner in which the asserted prior art teaches corresponding limitations of claims 1, 2, 6, and 7, against which the prior art is asserted. Based on a preponderance of the evidence before us, we conclude that the prior art identified by Petitioner discloses all uncontested limitations of claims 1, 2, 6, and 7. Below, we discuss a few of the uncontested limitations followed by a detailed analysis of the contested limitations.

a. Independent Claim 1

The preamble of claim 1 recites a “rotational power distribution and control system.” Ex. 1001, 32:34–51. Petitioner argues that this limitation is satisfied by the disclosure in Keiser of an infinitely variable ratio transmission (“IVRT”) 10 and a control valve 48. Pet. 15 (citing Ex. 1004, 5–2, 27:1–5, 29; Ex. 1002, 35). Petitioner’s expert, Monika Ivantysynova, testifies that “Keiser discloses an infinitely variable ratio transmission (IVRT 10) for transmitting power from a rotational power source (e.g., an

automobile engine) to a driven member (e.g., axle connected to the drive wheels of the automobile). Ex. 1002 ¶ 35 (citing Ex. 1004, Abst, 5:1–4).

As discussed in Section II(B)(3) above, we declined to limit the “rotational power distribution and control system” to a particular type of “gear system and components using a hydrostatic pump to control rotational output.” See Ex. 1001, 1:18–21 (“The present invention relates to rotational power distribution and control systems, and more particularly to gear systems and components using a hydrostatic pump to control rotational output.”). In his Response, Patent Owner argues that Keiser does not disclose a “fluid controlled resistance brake” that is a clutch and does not effect a gear ratio change — which is the species selected by the Patent Owner due to the Restriction required by the patent examiner during prosecution of the ’290 patent. PO Resp. 3. Petitioner counters that we correctly determined in our Decision on Institution that “[t]he election of an invention in response to an ambiguous restriction requirement . . . cannot be said to provide any guidance forming a basis for narrowing a broadly drafted claim.” Reply 4 (citing Dec. on Inst. 11–12).

Patent Owner’s previous election of a particular species for examination does not persuade us that the claim term “rotational power distribution and control system” is limited to a “fluid controlled resistance brake.” Indeed, the prosecution history indicates that Patent Owner elected the fluid valve controlled resistance brake species (Species I), and additionally traversed the restriction.³ Ex. 1003, 80. Although Patent

³ We note that Patent Owner argued during prosecution that “the species identified by the examiner are not separate and distinct inventions” because

Owner withdrew certain claims directed to other potential species during prosecution, this does not mean that claim 1 is limited to a resistance brake as Patent Owner now argues. Moreover, the claims were not amended to specifically limit the term “rotational power distribution and control system” to a resistance brake. *Id.* at 15.

Patent Owner, however, does not dispute Petitioner’s contention that Keiser’s infinitely variable ratio transmission (“IVRT”) 10 and control valve 48 is a “rotational power distribution and control system.” Based on the entire record, we find that Petitioner presented persuasive arguments and evidence to support a finding that Keiser’s infinitely variable ratio transmission (“IVRT”) 10 and control valve 48 satisfies the “rotational power distribution and control system” limitation of claim 1.

Claim 1 also recites “(a) a gear set.” Ex. 1001, 32:37. Petitioner provides a comparative annotated Figure 1 of the ’290 patent and Figure 1 of Keiser, reproduced below, to illustrate the correspondence between the gear set of the ’290 patent and Keiser. Patent Owner does not dispute Petitioner’s contention.

they perform the same function of “us[ing] hydrostatic means to power a drive wheel and to start a vehicle.” Ex. 1003, 80.

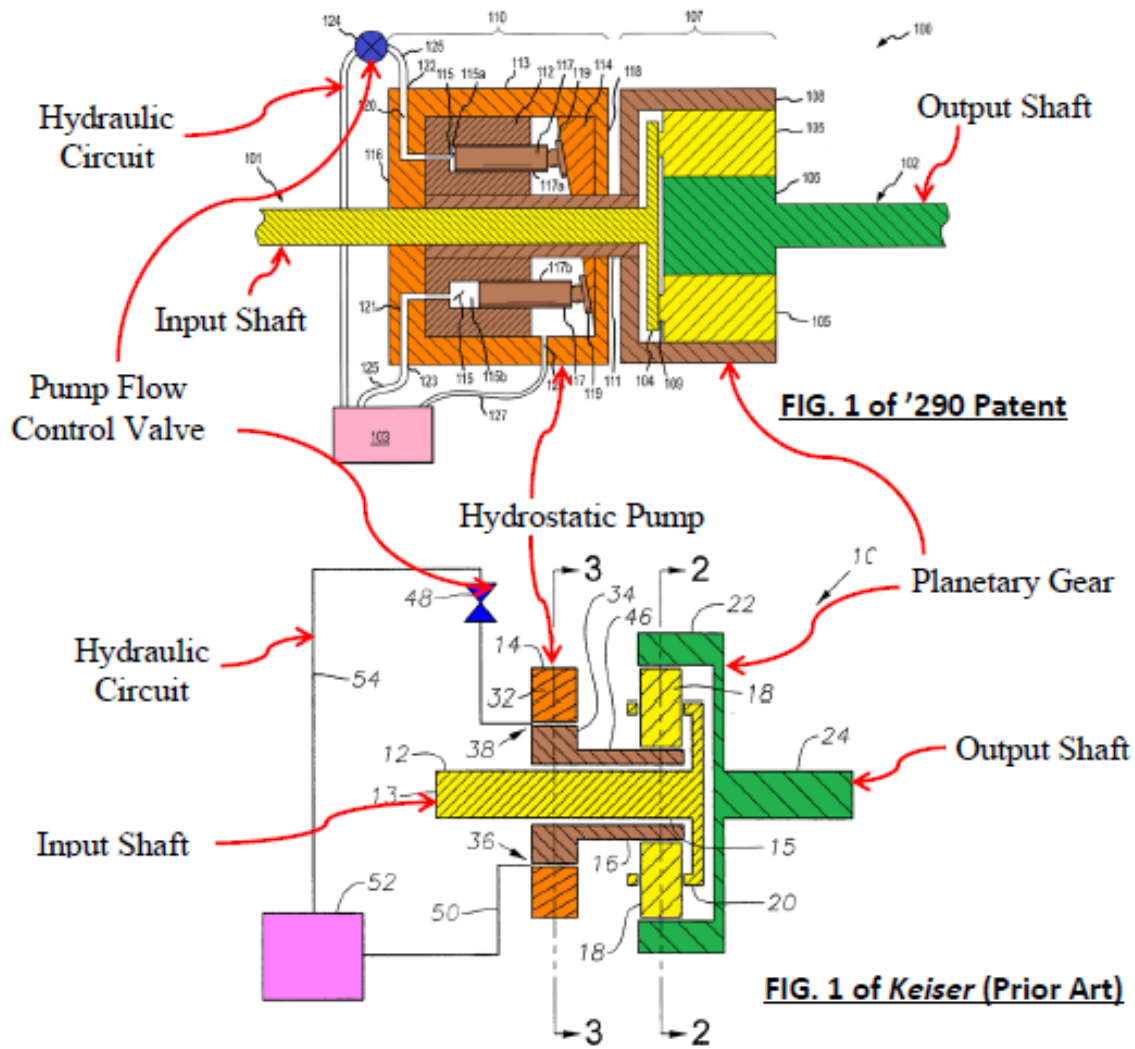


Figure 1 of the '290 patent and Figure 1 of Keiser, as annotated by Petitioner.

We find that Keiser, as contended by Petitioner, discloses a gear set as required by claim 1.

Claim 1 also recites, in relevant part, that the gear set includes “a first rotational interface,” “a second rotational interface,” and “a third rotational interface.” Ex. 1001, 32:38–40. Petitioner argues that the first rotational interface is met by Keiser’s disclosure regarding input shaft 12, planetary gears 18, and planetary carrier plate 20, which are color coded yellow in

Keiser's Figure 1, above. Pet. 16 (citing Ex. 1004, 27:9–14, Fig. 1; Ex. 1002, 36–37, Section VIII.1.iii). Referring to ring gear 22, fixedly attached to output shaft 24, and color coded green in Keiser's Figure 1 above, Petitioner argues that Keiser discloses the second rotational interface. *Id.* at 17 (citing Ex. 1004, 5:4–5, 27:22–23, Fig. 1; Ex. 1002, Section VIII.1.iv). Referring to sun gear 16 (color coded brown) coupled to pump 14 (color coded orange) by connecting shaft 46 in Keiser's Figure 1 above, Petitioner argues that Keiser discloses the claimed third rotational interface. Pet. 17–18 (citing Ex. 1004 at 27:24–27, 28:1–5, 23–26, Fig. 1 and 2; Ex. 1002, ¶¶ 36–37, Section VIII.1.v). Patent Owner does not dispute Petitioner's contention in his Response. We find that Keiser, as contended by Petitioner, discloses the first rotational interface, second rotational interface and third rotational interface as required by claim 1.

Claim 1 then recites “(b) a hydrostatic pump coupled to a selected rotational interface in the form of one of said first rotational interface, said second rotational interface and said third rotational interface.” Ex. 1001, 32:41–44.

Petitioner further annotates Figure 1 of Keiser, reproduced below, to show the correspondence between this claim element and Keiser.

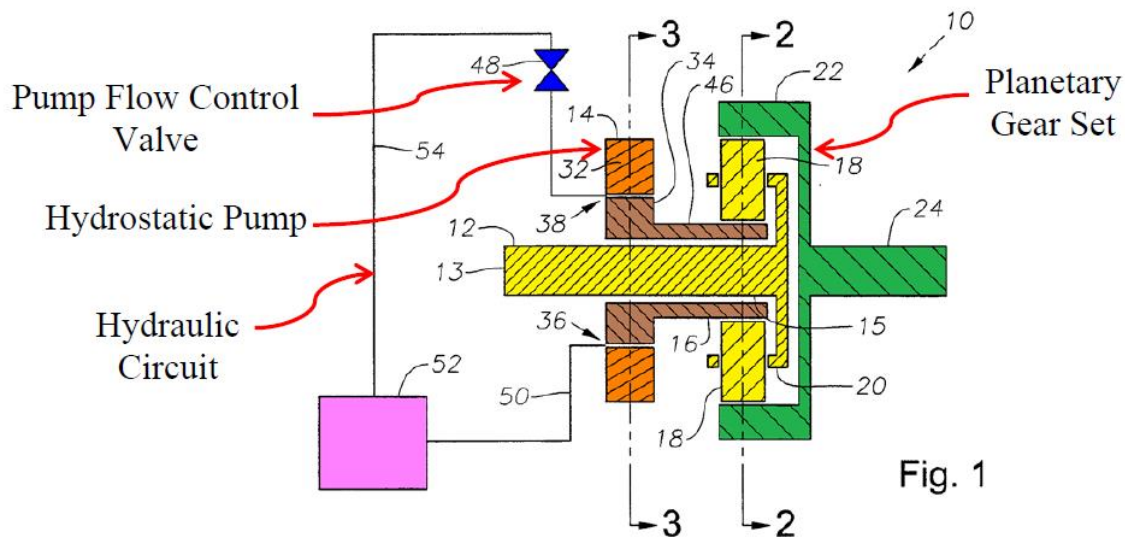


Figure 1 of Keiser as annotated by Petitioner.

Specifically, Petitioner argues that sun gear 16 (color coded brown), coupled to variator pump 14 (color coded orange) by connecting shaft 46, satisfies this limitation because Keiser’s variator pump 14 is a hydrostatic pump and is coupled to Keiser’s third rotational interface. Pet. 18–19 (citing Ex. 1004, 28:1–5, 23–26; Ex. 1002 ¶ 38, Section VIII.1.vi.). Petitioner further explains that variator pump 14 is a mechanically driven, positive displacement pump, with hydraulic working fluid, and based on this, a POSITA would recognize Keiser’s variator pump 14 to be a hydrostatic pump. *Id.* (citing Ex. 1004, 28:2–6, 37–50; Ex. 1002 at Section VIII.1.vi). We find that Keiser, as contended by Petitioner, discloses this limitation, and Patent Owner does not refute this contention.

Claim 1 further recites “a cylinder block of said hydrostatic pump being coupled to one of said gear set.” Ex. 1001, 32:44–45. Petitioner

argues that “Keiser discloses that the variator pump 14 may be a piston pump.” Pet. 19 (citing Ex. 1004, 28:2–6; Ex. 1002 ¶¶ 46–47, Section VIII.1.vii). Relying on the testimony of its declarant, Petitioner argues that

Figs 9 and 10 of *Keiser* provide an example of a variator pump in the form of a piston pump. Ex. 1002 at Section VIII.1.vii. In particular, Figs. 9 and 10 are disclosed as “another embodiment of a variator pump 100 for use in IVRT’s” to control the speed of a crankshaft attached to a sun gear of a planetary gear set. Ex. 1004 at 24-25; 37:1-5 (note that the Figs. 9 and 10 are incorrectly referred to as Figs. 7 and 8 in the description of these figures in ¶¶ [0028], [0037]-[0040] of *Keiser*); Ex. 1002 at Section VIII.1.vii.

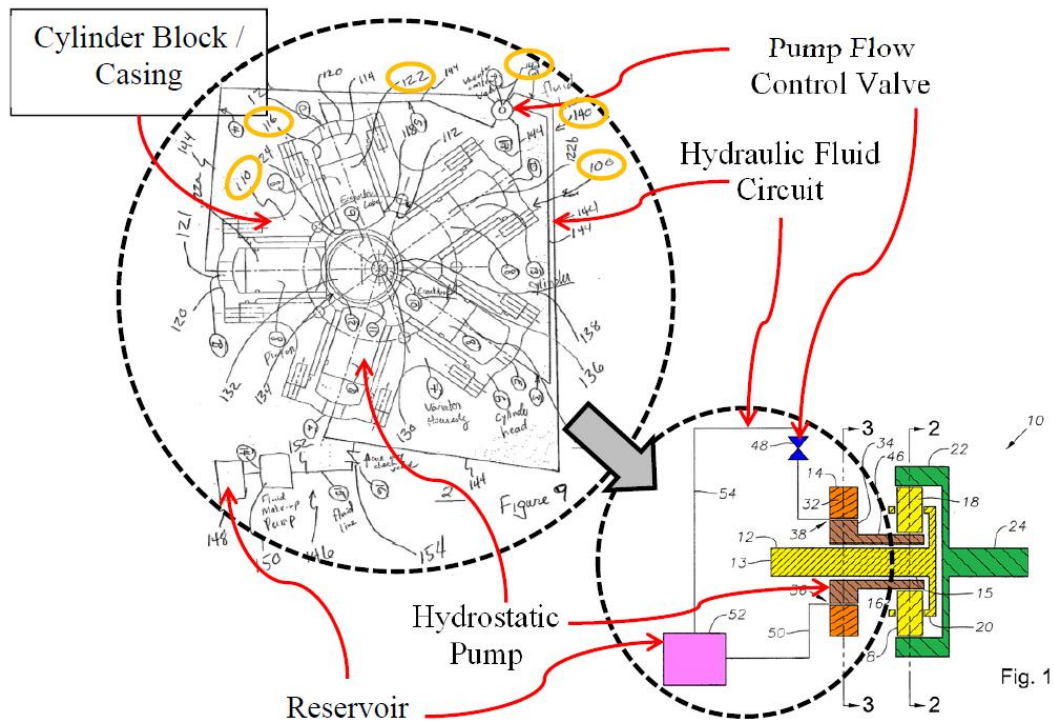
Id.

Again relying on the testimony of its declarant, Petitioner further explains that

Keiser discloses a system having the variator pump 100, and its associated hydraulic circuit 140 (and pump flow control valve 142), with the planetary gear system of Fig. 1 of Keiser. Ex. 1002 at Section VIII.1.vii. . . . Based on this, in this analysis, reference will be made to the features of Keiser’s Fig. 1 with the details of the variator pump system of Keiser’s Figs. 9 and 10.

Id.

Petitioner annotates Figures 1 and 9 of Keiser, reproduced below, to illustrate how “variator pump 100 includes a plurality of pistons 122 that reciprocate in cylinder bores 116 of a casing 110” (Pet. 20 (citing Ex. 1004, 40:1–6)) and “[c]asing 110, with the cylinder bores 116 provided therein, is the claimed ‘cylinder block’ recited in claim 1 of the ’290 patent.” *Id.* (citing Ex. 1004, 40:1–6).



Figures 1 and 9 of Keiser as annotated by Petitioner.

According to Petitioner, because variator pump 100 is coupled to the sun gear, “the cylinder block (that forms a part of the variator pump 100) is coupled to the sun gear.” Pet. 20 (citing Ex. 1002, Section VIII.1.vii). Relying on the testimony of its declarant, Petitioner argues that “[s]imilar to variator pump 14, variator pump 100 is a mechanically driven, positive displacement pump, with hydraulic working fluid, and based on this, a POSITA would recognize it to be a hydrostatic pump.” *Id.* at 22 (citing Ex. 1004, 37:5–16; 38:8–11; 39:1–4; Ex. 1002, Section VIII.1.vii).

Patent Owner does not dispute that one of skill in the art would consider Keiser’s gear pump 14 and piston pump 100 to be variator pumps. Rather, Patent Owner challenges whether Keiser discloses “a cylinder block of said hydrostatic pump being coupled to one of said gear set.” PO Resp.

3–5. Patent Owner argues that Keiser “makes no mention whatsoever of different methods of coupling (as taught in the specification of the ‘290 patent), let alone teach that several ways of coupling (as listed in the specification of the ‘290 patent) would result in no gear ratio change, merely a rotational power transferal from one gear or shaft to another.” PO Resp. 3. According to Patent Owner, the recited coupling would not result in a gear ratio change, while Keiser “requires the gear ratio change of a planetary gear set.” *Id.* at 4.

First, we consider Petitioner’s argument that pump 100 in Figure 9 is a variator pump. We understand Keiser as disclosing that pump 14, shown in its Figure 1, “may be any type of positive displacement pump known to those of ordinary skill in the art, such as, for example, a rotory vane pump, a piston pump, an external-external gear pump (see Fig. 8 . . .), or an external-internal gear pump (see Fig. 3 . . .).” Ex. 1004 ¶ 28. We note that variator pump 14 is depicted generally in Figure 1. Keiser describes one type of variator pump 14 is shown in Figure 3, and another type of variator pump 14 in Figure 8. *Id.* Keiser further states that “the present invention is not limited to any particular type of positive displacement pump,” such as the gear pump of Figure 3. *Id.* Keiser provides a detailed description of yet another type of variator pump, variator pump 100 of Figure 9, which is a piston pump. *Id.* at ¶ 37.

While an anticipatory reference “must clearly and unequivocally disclose the claimed [invention] or direct those skilled in the art to the [invention] without any need for picking, choosing, and combining various disclosures,” (see *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (quoting *In re Arkley*, 455 F.2d 586, 587 (CCPA 1972)), the portions of

Keiser on which Petitioner relies are directly related to each other by Keiser's teachings that the pump of Keiser's Figure 9 is an exemplary embodiment of a variator pump 14 as disclosed in Keiser's Figure 1. See *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1343 (Fed. Cir. 2016) (distinguishing *NetMoneyIN* when the reference in question explicitly contemplated the combination of the disclosed functionalities).

Thus, Petitioner argues persuasively that one of skill in the art would understand gear pump 14 shown in Figure 3 and piston pump 100 shown in Figure 9 to both be variator pumps.

Next, we consider Patent Owner's argument that Keiser discloses neither coupling of the pump to the gear set, nor coupling that would result in no gear ratio change. PO Resp. 3–4. Keiser, although not using the term “coupling,” teaches or suggests connecting parts of its machinery as pointed out by Petitioner. Pet. 20–21.

Additionally, we credit the testimony of Petitioner's expert, Monika Ivantysynova, that the casing 110 of Keiser's variator pump 100 shown in its Figure 9 “is the claimed ‘cylinder block’ recited in claim 1 of the '290 patent,” such that Keiser's variator pump 100 – and thus its cylinder block 110 – is disclosed as coupled to the sun gear. Ex. 1002, p. 28. According to Ms. Ivantysynova, Keiser's cylinder block 110 “is interconnecting to the sun gear via the variator pump 100 (a power transfer mechanism) that is disposed outside of the continuously variable connection, i.e., not through a planetary [or differential] gear set.” *Id.* at 28–29 (citing Ex. 1004, 37:1–4).

Patent Owner's argument regarding a gear ratio change is not convincing because it is not commensurate with the scope of the claim. That is, the language of claim 1 does not recite *coupling without a gear ratio*

change, and Patent Owner has not provided evidence or explanation regarding why the recitation of claim 1 necessitates a lack of gear ratio change.

Based on the entire record, Petitioner presents sufficient arguments and credible evidence to support a finding that Keiser discloses “a cylinder block of said hydrostatic pump being coupled to one of said gear set” as required by claim 1.

Claim 1 next recites “a hydraulic fluid circuit . . . interconnected to a first port on said hydrostatic pump, [and] interconnected to a second port on said hydrostatic pump.” Petitioner argues that Keiser’s Figure 9 shows a variator pump 100 representing a detailed embodiment of the schematic variator pump 14 shown in Keiser’s Figure 1, and includes a fluid distribution system 140 that controls synchronized actuation of pistons 122, and that a valve 142 of the fluid distribution system 140 is in fluid communication with cylinder ports 121 of cylinder heads 120 via fluid distribution lines 144. Pet. 22–23 (citing Ex. 1004, 39:1–7; Ex. 1002, 48; Section VIII.1.viii). Patent Owner does not refute this contention. *See, e.g.*, PO Resp. 1–17. We agree with Petitioner that Keiser’s fluid distribution system 140 shown in its pump embodiment of Figure 9 satisfies this limitation for the reason explained above by Petitioner.

Claim 1 lastly recites “a valve to selectively control flow through said first port on said hydrostatic pump.” Petitioner contends that Keiser’s fluid distribution system 140 includes a variator control valve 142 in fluid communication with cylinder ports 121 of cylinder heads 120 via fluid distribution lines 144. Pet. 23 (citing Ex. 1004 at 39:4–7; Ex. 1002 at 48–49, Section VIII.1.ix). Regarding selective control, Petitioner contends that

Keiser's control valve 142 can be gradually closed to cause the working pressure within the fluid distribution system 140 to rise, causing pistons 122 to apply a greater force to eccentric lobe 132, which retards rotation of the crankshaft 130 and causes the rotational speed of the crankshaft 130 to be infinitely variable. *Id.* at 23–24 (citing Ex. 1004, 41:8–11, 20–22; Ex. 1002, Section VIII.1.ix). Patent Owner does not refute these contentions. *See, e.g.*, PO Resp. 1–17. We agree with Petitioner that Keiser's variator control valve 142 of its pump embodiment of Figure 9 satisfies this limitation, for the reasons set forth by Petitioner above.

In view of the foregoing, we conclude Petitioner has established by a preponderance of the evidence that independent claim 1 is unpatentable under 35 U.S.C. § 102 as anticipated by Keiser.

b. Claim 2

Claim 2 depends from claim 1, discussed above, and further recites the cylinder block of the hydrostatic pump being “interconnected to said third rotational interface.” Ex. 1001, 32:52–54. Petitioner asserts that, considering the pump embodiment of Keiser's Figure 9, the cylinder block 110 is a component of the pump 100, and the pump 100 is coupled to the crankshaft 130. Pet. 24 (citing Ex. 1004 at 37:5–7, 38; Ex. 1002 at 46–47, 51). Petitioner further asserts that Keiser's crankshaft 130 is attached to a sun gear of its planetary gear set or “third rotational interface,” such that Keiser's cylinder block 110 is interconnected to its third rotational interface via the crankshaft 130. *Id.* (citing Ex. 1004, 37:3–5; Ex. 1002, 51). Patent Owner does not refute Petitioner's assertions regarding claim 2. Based on the entire record, we agree with Petitioner that Keiser, as contended by

Petitioner, discloses the limitation of claim 2, and conclude Petitioner has established by a preponderance of the evidence that dependent claim 2 is unpatentable under 35 U.S.C. § 102 as anticipated by Keiser.

c. Claim 6

Independent claim 6 recites “[a] method of transmitting rotational power from a rotational power source to a load comprising,” *inter alia*, “restricting flow from a hydrostatic pump” coupled to an element of the gear set, “wherein said hydrostatic pump comprises a plurality of reciprocating pistons.” Ex. 1001 at 34:5–13. As explained above in our analysis of claim 1, Keiser discloses a schematic pump 14 that “may be any type of positive displacement pump known to those of ordinary skill in the art, such as, for example, a rotory vane pump, a piston pump, an external-external gear pump (see Fig. 8 . . .), or an external-internal gear pump (see Fig. 3 . . .).” Ex. 1004, ¶ 28. Petitioner asserts that “Keiser discloses that the variator pump 14 may be a piston pump,” and Keiser’s Figures 9 and 10 “provide an example of the variator pump in the form of a piston pump.” Pet. 27 (citing Ex. 1004 at 28:2–6; Ex. 1002 at Section VIII.3.iii) (emphasis removed). Petitioner proposes to replace Keiser’s pump 14 in Figure 1 with Keiser’s pump 100 in Figure 9. *Id.* at 28. As explained above in connection with anticipation of claim 1 by Keiser, Keiser discloses the limitations of claim 6, and the portions of Keiser on which Petitioner relies are directly related to each other by Keiser’s teachings that the pump of Keiser’s Figure 9 is an exemplary embodiment of a variator pump 14 as disclosed in Keiser’s Figure 1.

Having considered the entire record, and for the same reasons as discussed above in connection with claim 1, we conclude Petitioner has

established by a preponderance of the evidence that independent claim 6 is unpatentable under 35 U.S.C. § 102 as anticipated by Keiser.

d. Claim 7

Claim 7 depends from claim 6, and further recites that the gear set “is a planetary gear set.” Ex. 1001, 43:19–21. Petitioner asserts that Keiser discloses rotational power being “transmitted from the input shaft 12 through [a] planetary gear set to the output shaft 24.” Pet. 31 (citing Ex. 1004, 29:31–33, 37:2–5; Ex. 1002, 53). Patent Owner does not refute Petitioner’s assertions regarding claim 7. Based on the entire record, we agree with Petitioner that Keiser, as contended by petitioner, discloses the limitation of claim 7 and conclude Petitioner has established by a preponderance of the evidence that dependent claim 7 is unpatentable under 35 U.S.C. § 102 as anticipated by Keiser.

C. Obviousness over Keiser – Claims 1, 2, 6, and 7

We next consider Petitioner’s alternative contention that claims 1, 2, 6, and 7 are unpatentable under 35 U.S.C. § 103(a) over Keiser. Pet. 32–34. Petitioner relies on the arguments it presented regarding anticipation of claims 1, 2, 6, and 7 by Keiser, providing a rationale to support the proposed modification of Keiser. *Id.* Specifically, Petitioner argues that “Keiser also discloses ‘another embodiment’ of the variator pump and fluid circuit in the form of the variator pump 100 and fluid circuit 140 of Figs. 9 and 10.” *Id.* at 32 (citing Ex. 1004, 37:1–5; Ex. 1002, 54).

According to Petitioner,

[t]o the extent that a POSITA would view the variator pump 100 and fluid circuit 140 of Figs. 9 and 10 as indirectly related to the IVRT 10 of Fig. 1, and thus not arranged or combined in

the same way as recited in the claims, it would have been obvious to a POSITA to replace the variator pump 14 and associated fluid circuit of *Keiser's* Fig. 1 with the variator pump 100 and associated fluid circuit 140 of *Keiser's* Figs. 9 and 10. Ex. 1002 at 54-55. In such a modification, the crankshaft 130 of the variator pump 100 would form the connecting shaft 46 to the sun gear 16 of the IVRT system of Fig. 1. Ex. 1002 at 55.

Id.

Petitioner further contends that modifying *Keiser's* Figure 1 to include the pump of *Keiser's* Figure 9 would have been a simple substitution of one known element (i.e., the pump embodiment of *Keiser's* Figure 9) for another (i.e., the pump schematic of *Keiser's* Figure 1) to obtain predictable results, “and the substitution would operate as expected given the similar structural arrangement and purposes.” *Id.* at 33.

As discussed above in Section II(C), Patent Owner does not provide a separate argument for most of the claim elements of claim 1, 2, 6, and 7, and we determined that Petitioner presented sufficient arguments and credible evidence that those claim elements are disclosed by *Keiser*. Moreover, as discussed above with regards to the ground based on anticipation by *Keiser*, we are not persuaded by Patent Owner's argument that (1) *Keiser* does not disclose a “‘fluid controlled resistance brake’ that is a clutch that does not effect a gear ratio change” (PO Resp. 3); and (2) that *Keiser* does not disclose coupling of the cylinder block to the gear set (*id.*).

Additionally, Patent Owner challenges Petitioner's reason to combine *Keiser* with the knowledge of one of skill in the art, arguing that *Keiser* didn't work and was abandoned. *Id.* at 4, 6. This argument is not convincing because, even if Patent Owner had provided evidence that *Keiser* “never worked,” which he did not, *Keiser* need not have worked for its

teachings to be available as prior art. *See In re Mouttet*, 686 F.3d 1322, 1331 (Fed. Cir. 2012) (“A reference may be read for all that it teaches, including uses beyond its primary purpose.”). First, we observe that though abandoned, Keiser was published on February 13, 2003, and thus became a printed publication before the July 30, 2007, filing date of the ’290 patent. Ex. 1001, (22). Documents upon which a prior art rejection may be based include an issued patent, a published application, and a non-patent printed publication. *See* 35 U.S.C. § 311(b) (“A petitioner in an *inter partes* review may request to cancel as unpatentable 1 or more claims of a patent . . . only on the basis of prior art consisting of patents or printed publications.”).

In addition to arguing that Keiser did not work, Patent Owner also argues that “Petitioner did not show that a ‘skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.’” PO Resp. 5. This argument is not persuasive because Petitioner’s analysis considers Keiser as a whole and concludes that modifying Keiser’s Figure 1 to include the pump of Keiser’s Figure 9 would have been a simple substitution of one known element for another to obtain predictable results. Pet. 33. Moreover, a prior art reference must be considered for everything it teaches by way of technology and is not limited to the particular example it is describing. *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985). Furthermore, in an obviousness analysis, we must consider the combination of references, as a whole, in light of the general knowledge of an ordinarily skilled artisan. *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). Based on the entire record, we are persuaded by Petitioner’s argument that modifying

Keiser's Figure 1 to include the pump of Keiser's Figure 9 would have been a simple substitution of one known element (i.e., the pump embodiment of Keiser's Figure 9) for another (i.e., the pump schematic of Keiser's Figure 1) to obtain predictable results, "and the substitution would operate as expected given the similar structural arrangement and purposes." Pet. 33.

We next turn to Patent Owner's evidence and arguments relating to secondary considerations of non-obviousness. PO Resp.7.⁴ As to secondary considerations, we note that factual inquiries for an obviousness determination include secondary considerations based on evaluation and crediting of objective evidence of non-obviousness. *Graham*, 383 U.S. at 17. Notwithstanding what the teachings of the prior art would have suggested to one with ordinary skill in the art at the time of the invention, the totality of the evidence submitted, including objective evidence of non-obviousness, may lead to a conclusion that the claimed invention would not have been obvious to one with ordinary skill in the art. *In re Piasecki*, 745 F.2d 1468, 1471–1472 (Fed. Cir. 1984).

Specifically, Patent Owner argues that

For years prior to the time of the invention of the '290 patent, in fact, dating back to the development of the first automobile by Henry Ford, persons of ordinary skill in the art in the field of transmissions and clutches have tried to solve problems inherent to the clutch of the standard transmission and the torque converter of the automatic transmission; such as the slippage

⁴ In the Preliminary Response, Patent Owner also argues that (1) Keiser teaches away from the claimed invention, (2) Keiser is not prior art, and (3) Keiser is non-analogous art. These arguments were not maintained in the Patent Owner Response, and are deemed waived for the reason set forth above. These arguments were addressed in our Decision on Institution. Paper 30, 20–22.

which is necessary but contributes to the problems by creating excess heat. The invention claimed in the '290 patent solves the long-felt problems by significantly reducing the excess heat and explosions of prior clutch and torque converter devices.

Id.

Patent Owner's arguments regarding secondary considerations are not convincing. We agree that objective evidence of non-obviousness plays an important role as a guard against the statutorily proscribed hindsight reasoning in the obviousness analysis. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1328 (Fed. Cir. 2016). "[E]vidence of secondary considerations may often be the most probative and cogent evidence in the record." *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983). "[E]vidence rising out of the so-called 'secondary considerations' must always when present be considered en route to a determination of obviousness." *Id.* In addition, "[f]or objective evidence . . . to be accorded substantial weight, its proponent must establish a nexus between the evidence and the merits of the claimed invention." *In re Kao*, 639 F.3d 1057, 1068 (Fed. Cir. 2011) (quoting *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010)) (emphasis omitted) (internal quotation marks omitted).

Here, Patent Owner has not provided evidence to support this allegation, and it is therefore not persuasive of objective indicia of non-obviousness. For example, Patent Owner has not provided any argument or evidence regarding the required nexus to the claim language of the '290 patent. Nor has Patent Owner offered evidence regarding commercial success, long-felt unsolved needs, failure of others, or unexpected results. *See Graham v. John Deere*, 383 U.S. at 17.

We agree with Petitioner that Patent Owner did not support an allegation of any secondary considerations alleged to support non-obviousness of his invention. Reply 7–8. A showing of unexpected results must be based on evidence, not argument or speculation. *In re Mayne*, 104 F.3d 1339, 1343–44 (Fed. Cir. 1997).

Based on the final record, Petitioner provides a sufficient rationale for combining Keiser with the knowledge of one of skill in the art, namely, that modifying Keiser’s Figure 1 to include the pump of Keiser’s Figure 9 would have been a simple substitution of one known element for another to obtain predictable results.

For the reasons explained above, Petitioner has established obviousness of claims 1, 2, 6, and 7 based on Keiser by a preponderance of the evidence.

D. Obviousness based Partially on Keiser

Petitioner also challenges the patentability of: claims 1–3 and 6–9 of the ’290 patent as obvious under 35 U.S.C. § 103(a) based on Keiser and Rush; claim 10 based on Keiser, Rush, and Britt; claim 4 based on Keiser, Rush, and Whitaker; and claim 5 based on Keiser, Rush, and Britt. Pet. 32–72. In support thereof, Petitioner identifies the disclosures in the cited references alleged to describe the subject matter in the challenged claims as well as reasons why one skilled in the art would have modified Keiser based on the teachings of Rush, Whitaker, and Britt. *Id.*

Patent Owner disagrees, arguing generally that Petitioner did not establish that a skilled artisan would have been motivated to combine the prior art teachings because the proposed combination of references is

unavailable because none of the prior art references “worked,” and “their patents and applications have all been abandoned.” PO Resp. 4–5.

We begin our analysis with an overview of Rush and then address the parties’ contentions.

1. Overview of Rush (Ex. 1005)

International Publication No. WO 2004/033906 A1 to Rush was filed October 10, 2003, and published April 22, 2004. Ex. 1005, (10), (22), (43). Rush claims priority to Australian Application No. AU 2002951972, filed October 10, 2002. *Id.* at (30). Rush is directed to a “hydraulic pump/motor with epicyclic gear control.” *Id.* at (54). As shown in Rush’s Figure 1, reproduced below, the hydraulic pump/motor 1 includes a rotary cylinder block 3, and a circular array of cylinders 6 around a central axis 5 with a piston 10 disposed in each cylinder 6. *Id.* at (57). A drive shaft 12 extends through a bore 13 and rotates the cylinder block 3. *Id.* A valve plate 20 provides inlet and outlet ports for fluid communication with a source of hydraulic fluid and a hydraulic load. *Id.* A coupling mechanism having an epicyclic gear train 30 connects the drive shaft 12 to the cylinder block 3. *Id.*

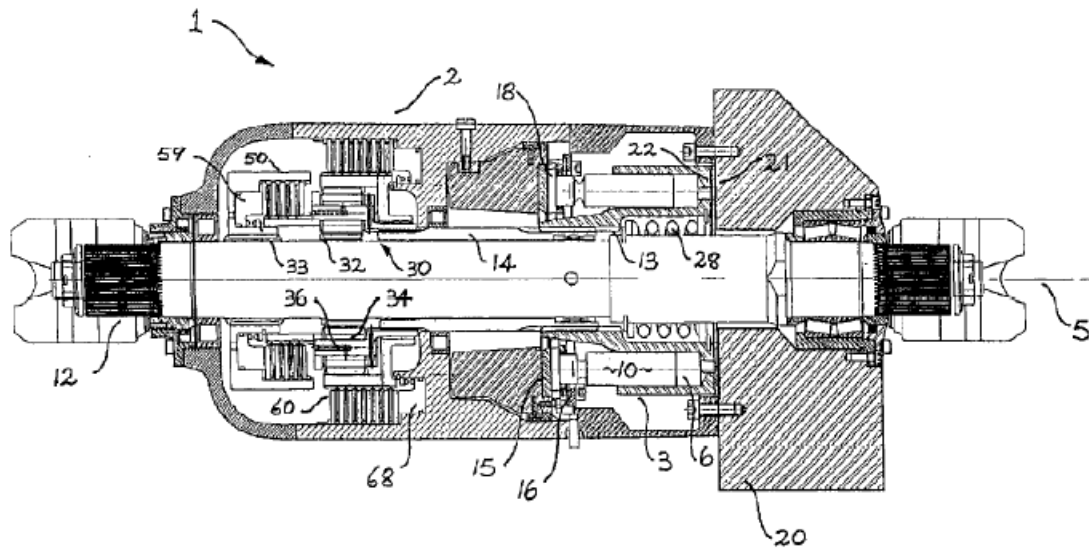


Figure 1 is a cross sectional view showing an embodiment of Rush's pump/motor assembly incorporating a coupling mechanism.

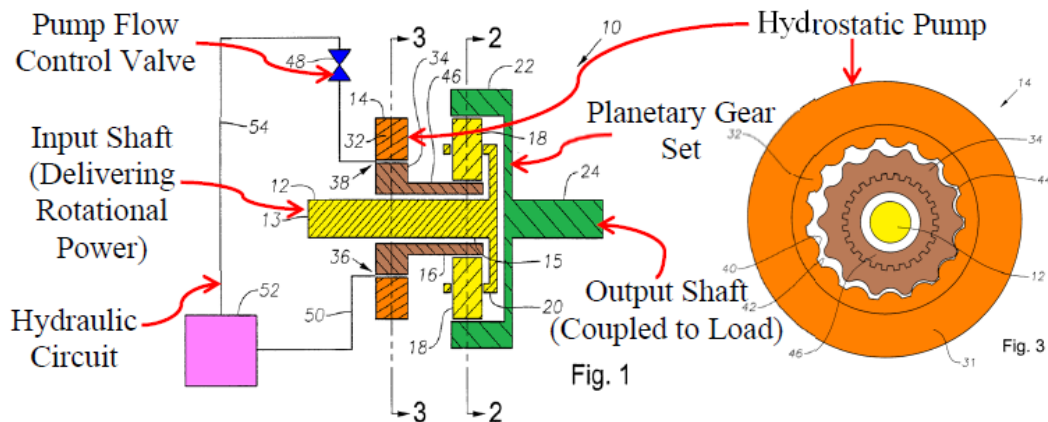
2. Discussion

a. *Claims 1, 2, and 6–9*

As to the grounds based on Keiser and Rush, Petitioner provides a detailed mapping of each of the limitations of claims 1, 2, and 6–9 onto the combined teachings of Keiser and Rush. Pet. 34–66. That is, Petitioner relies on Keiser for most of the limitations of claim 1, and Rush for certain aspects of the pump limitation. Patent Owner, in its Patent Owner Response, only contests Petitioner's assertions regarding the pump limitation. Based on the preponderance of the evidence before us, and for the reasons discussed above with regards to the obviousness ground based on Keiser alone, we conclude that Keiser teaches or suggests all the uncontested limitations of claim 1. We address the contested pump limitation below.

To establish obviousness over Keiser as modified by Rush, Petitioner argues that the pump 14 in Keiser's Figure 1 can be the gear pump of Keiser's Figure 3, which includes a pump gear 34 attached to a connecting

shaft 46 that is coupled to/part of the sun gear 16. Pet. 37 (citing Ex. 1004 at 28:30–37; Ex. 1002 at 44–45, 67). Petitioner provides the following corresponding annotated illustration of Keiser's Figures 1 and 3.



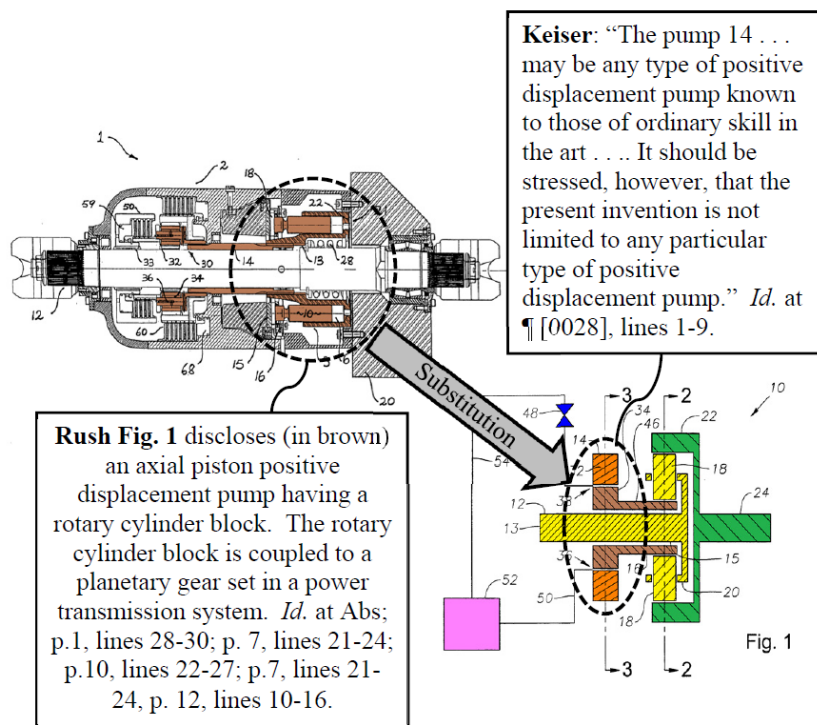
Pictured above is an annotated illustrations of
Keiser's Figures 1 and 3.

Id.

According to Petitioner, although Keiser's gear pump 34 does not include a cylinder block coupled to a gear of the planetary gear set, Rush's Figure 1 "discloses (shaded in brown) an axial piston positive displacement pump coupled to a planetary gear set," the pump including "a plurality of reciprocating pistons 10 disposed in cylinders 6 of a cylinder block 3." *Id.* at 37–38 (citing Ex. 1005, Abstract; 1:28–30, 7:21–24, 10:22–31, 7:21–24, 12:10–16; Ex. 1002, 57, 58, 68).

Petitioner contends that Rush includes a drive shaft 12 and a drive sleeve 14 that extends circumferentially around — but is free to rotate relative to — its drive shaft 12, and one end of Rush's drive sleeve 14 is splined to its cylinder block 3, while its other end is splined to a sleeve 42 of a carrier 36 of the planetary gear set. *Id.* at 38 (citing Ex. 1005 at 10:22–31, 12:13–22, 13:18–19; Ex. 1002 at 68). Petitioner proposes replacing Keiser's

pump 14/34 with Rush's pump and rotating cylinder block 3, such that Rush's rotating cylinder block 3 is coupled to Keiser's connecting shaft 46 and sun gear 16. *Id.* Petitioner provides the following annotated versions of Keiser's Figure 1 (on the lower right) and Rush's Figure 1 (on the upper left), which illustrate the proposed modification.



Pictured above is an annotated illustrations of Keiser's Figure 1 and Rush's Figure 1. *Id.* at 39.

According to Petitioner, the modification "would have been a simple substitution of one known element for another to obtain predictable results." *Id.* (citing *KSR*, 550 U.S. at 417).

Patent Owner makes no challenge to Petitioner's assertions beyond the "abandoned" and "didn't work" arguments. PO Resp. 4–5. Patent Owner's contentions concerning the operability of the inventions disclosed

in the cited references are not persuasive. Reply 6–7 (citing MPEP 2121 I (citation omitted)).

As explained above regarding Keiser, printed patent applications are available for what they teach to one skilled in the art, regardless of subsequent abandonment, because documents upon which a prior art rejection may be based include an issued patent, a published application, and a non-patent printed publication. *See* 35 U.S.C. § 311(b) (“A petitioner in an inter partes review may request to cancel as unpatentable 1 or more claims of a patent . . . only on the basis of prior art consisting of patents or printed publications.”). We find that Rush is prior art because it became a published application, and thus a printed publication, on April 22, 2004, which is before the July 30, 2007 filing date of the ’290 patent. Ex. 1005 (43). Britt is prior art because it issued as a patent on October 21, 2003, which is before the July 30, 2007, filing date of the ’290 patent. Ex. 1006 (45). Whitaker is prior art because it became a published application, and thus a printed publication, on September 30, 2004, which is before the July 30, 2007, filing date of the ’290 patent. Ex. 1007 (43).

Regarding Patent Owner’s contention that the prior art references “never worked,” as explained above regarding Keiser, even if Patent Owner had provided evidence that Rush, Britt, and Whitaker “never worked,” which he did not, these prior art references need not have worked for their teachings to be available as prior art.

For the reasons explained above, Petitioner has established obviousness of claim 1 based on Keiser and Rush by a preponderance of the evidence.

b. Claim 2

Regarding claim 2, which recites that “said cylinder block . . . is interconnected to said third rotational interface,” Petitioner argues that Keiser’s sun gear 16 (brown) is coupled to the second pump gear 34 (also brown) of its pump 14 via connecting shaft 46 (also brown). Pet. 42 (citing Ex. 1004, 28:23–26, Figs. 1, 3; Ex. 1002 at 75). Further, Rush’s rotating cylinder block 3 (brown) is connected to a gear of its planetary gear through the output shaft (drive sleeve 14 (brown)). *Id.* (citing Ex. 1005, 10:22–31; 12:20–22; 13:18–19; Ex. 1002 at 59, 75). In the proposed substitution of Keiser’s gear pump 14 with Rush’s axial piston pump, Keiser’s coupling to sun gear 16 would be unaffected because, in the modification of Keiser by Rush, the rotary cylinder block 3 of Rush’s pump will be connected to Keiser’s sun gear 16, which is its third rotational interface. *Id.* at 42–43.

Patent Owner does not contest Petitioner’s assertions regarding claim 2. For the reasons explained above, Petitioner has established obviousness of claim 2 based on Keiser by a preponderance of the evidence.

c. Claim 3

Claim 3 depends from claim 2, and claim 2 depends from independent claim 1.

Claim 3 recites, *inter alia*, the hydrostatic pump comprising:

a housing with a first end and a second end opposed to said first end, wherein said hydrostatic pump is an axial piston pump comprising a plurality of axially movable pistons and an angled swash plate, wherein said plurality of pistons are disposed to slideably interface with said angled swash plate, wherein said angled swash plate is rigidly interconnected to said housing,

wherein said first rotational interface is a first shaft extending through said first end and said second end of said

housing, wherein said first shaft is rotatable relative to said housing,

wherein said second rotational interface is a second shaft rotatable relative to said housing, wherein said second shaft is collinear with said first shaft,

wherein said third rotational interface is a hollow shaft extending through said second end of said housing, wherein said hollow shaft is rotatable relative to said housing, wherein said hollow shaft is coaxial with said first shaft, wherein said hollow shaft is operable to rotate independently from said first shaft.

Ex. 1001, 32:55–33:9.

Referring to the combination of Keiser and Rush disclosed above, Petitioner argues that modifying “Keiser to include the axial piston pump of Rush would satisfy the limitations of . . . claim 3.” Pet. 43–48. According to Petitioner, Rush’s axial piston pump includes a stationary pump housing 2 and a rotary cylinder block 3 therein, the cylinder block 3 including an array of cylinders 6 and pistons 10 disposed therein as claimed. *Id.* at 44 (citing Ex. 1005, Fig. 1, 9:5–6, 10:23–27; Ex. 1002, 77). Rush’s pump also includes an angled swash plate 15 interacting with the pistons 10, the swash plate being “rigidly interconnected” to the housing 2 because it is non-rotating and non-removable. *Id.* (citing Ex. 1005, 6:25–27, 11:1–5, 11, 26–30, Fig. 1; Ex. 1002, 77–78). In disputing Petitioner’s contentions, Patent Owner argues that “the prior art does not contain the limitation of the ‘hollow shaft.’” PO Resp. 4.

Petitioner argues persuasively that Keiser discloses a planetary carrier plate 20 and input shaft 12 fixed thereto as the first rotational interface (shown in yellow), a ring gear 22 and output shaft 24 fixed thereto as the second rotational interface (shown in green), and a sun gear 16 and connecting shaft 46 fixed thereto as the third rotational interface (shown in

brown). Pet. 45. Petitioner also argues persuasively that “Keiser’s input shaft 12 extends through the first end and second end of a pump housing 31 (not illustrated in Fig. 1, see Fig. 3). *Id.* at 45–46 (citing Ex. 1002 at 79–80) (emphasis omitted).

Petitioner also demonstrates persuasively that Keiser’s “connecting shaft 46 (‘third rotational interface’ shaded in brown) is a hollow shaft that extends through the ‘second end’ of the pump housing [(element 31 shown in Fig. 3)] and is attached to, or formed integrally with, the sun gear 16.” *Id.* at 47–48 (citing Ex. 1004, 28:30–37, Fig. 1; Ex. 1002, 83 (wherein Monika Ivantysynova declares her unchallenged opinion that Keiser’s hollow shaft 46 extends through a second end of its pump housing)). According to Petitioner, in the proposed modification of Keiser with Rush, “the stationary pump housing 2 of Rush’s axial piston pump would allow for relative rotation with respect to connecting shaft 46 in the same manner as housing 31 of Keiser’s pump,” because “Rush is similarly configured to have a tubular connecting shaft 14 that is rotatable relative to the pump housing 2, and coaxial and rotatable relative to a drive shaft 12 extending through the tubular connecting shaft 14.” *Id.* at 48 (citing Ex. 1004 at 29:30–31, Ex. 1005 at Fig. 1; Ex. 1002 at 83–84).

Patent Owner argues, regarding claim 3, that the prior art does not disclose the “hollow shaft.” PO Resp. 4. Additionally, Patent Owner argues that Keiser and Rush teach different structures and approaches, specifically, that

Keiser teaches an “Infinitely Variable Ratio Transmission Five Piston Variator” for an automotive vehicle using the combination of a hydraulic radial piston pump and a planetary gear set for gear ratio change. Rush teaches nearly the same device titled

“Hydraulic Pump/Motor with Epicyclic Gear Control” with gear ratio changes, but using an axial piston pump. An “epicyclic gear train” is a “planetary gear set”.

Id. Patent Owner contends that Keiser and Rush “require either a planetary or differential gear set” and achieve a gear ratio change. *Id.* Patent Owner also argues that “Petitioner did not provide evidence as to why one of ordinary skill in the art would have modified Keiser’s IVT by changing the radial piston pump to that of Rush’s axial piston pump.” *Id.* The proposed modification, according to Patent Owner, would have resulted in a variable speed gear changing device and “not a fluid controlled resistance brake/hydraulic clutch that does not change gear ratio.” *Id.* at 5.

Lacking an explanation of why Keiser’s connecting shaft 46, which is illustrated as hollow and surrounding Keiser’s input shaft 12, cannot meet the “hollow shaft” limitation of claim 3, we are not persuaded by Patent Owner’s argument that Petitioner’s proposed combination of Keiser and Rush fails to disclose a hollow shaft.

Based on the entire record and for the reasons explained above, Petitioner has established obviousness of claim 3 based on Keiser by a preponderance of the evidence.

2. Keiser, Rush, and Britt – Claim 10

Claim 10 depends from claim 6 and recites the gear set being “a differential gear set.” Ex. 1001, 34:30–32. As set forth above, we conclude that Petitioner has established that Keiser anticipates, and renders unpatentable obvious, claim 6. Petitioner provides an additional detailed mapping of the limitations of claim 10 onto the combined teachings of Keiser, Rush, and Britt. Pet. 61–63. Patent Owner makes no challenge to

Petitioner's assertions beyond the "abandoned" and "didn't work" arguments that are not persuasive for the reasons set forth above. PO Resp. 4–5. We conclude that Petitioner has established that Keiser as modified by Rush and Britt renders claim 10 unpatentable as obvious.

3. Keiser, Rush, and Whitaker – Claim 4

Claim 4 depends from claim 3 and recites "said hydraulic fluid circuit is a closed circuit," and "said housing comprises a leaked fluid return path interconnected to said hydraulic fluid circuit and an interior volume of said housing." Ex. 1001 at 33:10–14. As set forth above, we conclude that Petitioner has established that Keiser and Rush teach or suggest the limitations of claim 3. Petitioner asserts that Keiser and Rush disclose a closed hydraulic fluid circuit, but not a leaked fluid return path. Pet. 64 (citing Ex. 1004, Fig. 1, 28:46–53; Ex. 1002, 118). Petitioner relies on Whitaker for its disclosure of a leaked fluid return path as "a case drain line 48 for conveying, inter alia, internal leakage of pump 20, to a reservoir 36 of the circuit 10." Pet. 64 (citing Ex. 1007, 29:6–18, Fig. 1, see also 7:2–4 (explaining that pump drain lines are old and well known); Ex. 1002, 119). Petitioner further asserts that Whitaker's closed loop hydraulic system works in the same manner as the systems of Keiser and Rush, such that "a POSITA would recognize that the pump case drain line could be incorporated into the system of Keiser and Rush in the same manner as Whitaker, and the results of such an incorporation would" predictably "capture leaked oil from the pump (axial piston pump of Rush), and return the leaked oil to reservoir 52." *Id.* at 66 (citing Ex. 1002 at 120).

Patent Owner makes no challenge to Petitioner's assertions beyond arguing that Whitaker was "abandoned" and "didn't work" (PO Resp. 4–5), which argument is not persuasive for the reasons set forth above. Based on the entire record, we conclude that Petitioner has established that Keiser, as modified by Rush and Whitaker, renders claim 4 unpatentable as obvious.

4. Keiser, Rush, and Britt – Claim 5

Independent claim 5 recites a rotational power distribution and control system comprising, as in claim 1, a gear set with first, second, and third rotational interfaces, a hydrostatic pump coupled to one of the first, second, and third rotational interfaces, a hydraulic fluid circuit interconnected to the pump at first and second ports, and a valve selectively controlling flow through the first port. As set forth in our analysis above, we conclude that Petitioner has established that Keiser and Rush teach or suggest the limitations of claim 1. Ex. 1001, 33:16–34:4. Claim 5 additionally recites that the gear set includes a carrier as the first rotational interface, a first gear coupled to the second rotational interface, a second side gear coupled to the third rotational interface, and that the pump includes a cylinder block coupled to one of the first gear and the second side gear. *Id.* at 33:22–31; Pet. 66–67.

Regarding the limitations that distinguish claim 5 from claim 1, Petitioner provides an additional detailed mapping of the limitations of claim 5 onto the combined teachings of Keiser, Rush, and Britt. Pet. 61–63. Patent Owner makes no challenge to Petitioner's assertions beyond the "abandoned" and "didn't work" arguments that are not persuasive for the reasons set forth above. PO Resp. 4–5. Based on the entire record, we

conclude that Petitioner has established that Keiser, as modified by Rush and Britt, renders independent claim 5 unpatentable as obvious.

III. CONCLUSIONS

For the foregoing reasons, and based on the record before us, we determine that Petitioner has demonstrated by a preponderance of the evidence that: claims 1, 2, 6, and 7 are anticipated by Keiser; claims 1, 2, 6, and 7 are unpatentable as obvious over Keiser; claims 1–3 and 6–9 are unpatentable as obvious over Keiser and Rush; claim 10 is unpatentable as obvious over Keiser, Rush, and Britt; claim 4 is unpatentable as obvious over Keiser, Rush, and Whitaker; and claim 5 is unpatentable as obvious over Keiser, Rush, and Britt.

IV. ORDER

For the reasons given, it is:

ORDERED, based on a preponderance of evidence, that claims 1–10 of U.S. Patent 7,824,290 B1 have been shown to be unpatentable;

FURTHER ORDERED that, because this is a final written decision, the parties to this proceeding seeking judicial review of our Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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