

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE PATENT TRIAL AND APPEAL BOARD

---

FERVO ENERGY CO.,  
Petitioner,

v.

ORMAT TECHNOLOGIES INC.,  
Patent Owner.

---

IPR2024-00665  
Patent 7,320,221 B2

---

Before JOSIAH C. COCKS, BENJAMIN D. M. WOOD, and  
PATRICK R. SCANLON, *Administrative Patent Judges*.

COCKS, *Administrative Patent Judge*.

DECISION  
Denying Institution of *Inter Partes* Review  
*35 U.S.C. § 314*

## I. INTRODUCTION

Petitioner, Fervo Energy Co. (“Petitioner”), filed a Petition (Paper 2, “Pet.”) requesting *inter partes* review of U.S. Patent No. 7,320,221 B2 (“the ’221 patent”). Patent Owner, Ormat Technologies, Inc. (“Patent Owner”), filed a Preliminary Response (Paper 6, “Prelim. Resp.”)

We have authority under 35 U.S.C. § 314, which provides that *inter partes* review may not be instituted unless the information presented in the Petition shows that “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a); *see also* 37 C.F.R § 42.4(a) (“The Board institutes the trial on behalf of the Director.”).

Having considered the arguments and evidence presented in the Petition, for the reasons discussed below, we do not institute an *inter partes* review.

### A. *Real Parties-In-Interest*

Each party identifies itself as the only real party-in-interest. Pet. 1; Paper 5 (Patent Owner’s Mandatory Notice), 1.

### B. *Related Matters*

The parties identify *Fervo Energy Co. v. Ormat Technologies, Inc.*, Case No. 4:24-cv-00006 (S.D. Tex. Jan. 02, 2024) as a related matter to the ’221 patent. Pet. 2; Paper 5, 1.

### C. *Overview of the ’221 patent*

The ’221 patent is titled “Method and Apparatus for Using Geothermal Energy for the Production of Power.” Ex. 1001, code (54). The Abstract of the ’221 patent is reproduced below:

An apparatus and method for enhancing the flow of geothermal fluid from at least one injection well to at least one production well, which comprises a first horizontal geothermal well, which is used as the injection well, and into which water is injected; a second horizontal, geothermal well, which is used as the production well and from which geothermal fluid issues, wherein the second, horizontal, production, geothermal well is substantially horizontally and vertically spaced from the first, horizontal, injection, geothermal well and located at a shallower depth than the first, horizontal, injection, geothermal well; and the apparatus form producing a pressure difference between the first horizontal, injection well and the second horizontal, production well and utilizing the water density difference induced by the temperature difference. Preferably, binary geothermal power plants or combined cycle geothermal power plants can be used to produce power from geothermal fluid recovered from the production well.

*Id.* at code (57).

Figures 3 and 4 of the '221 patent are reproduced below:

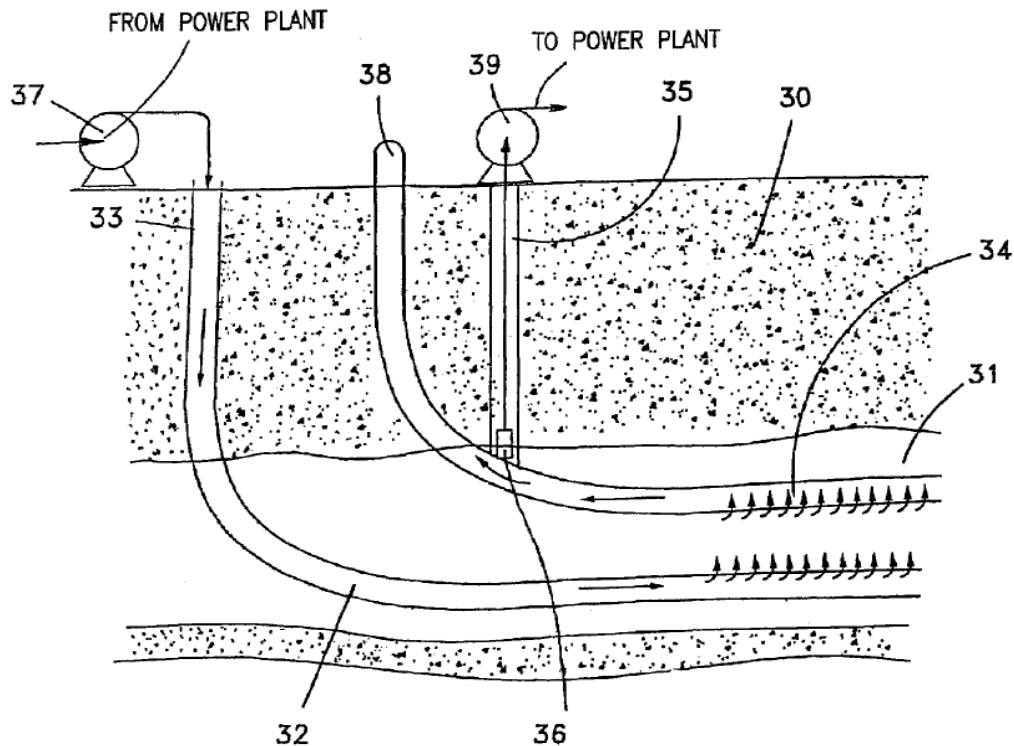


FIG. 3

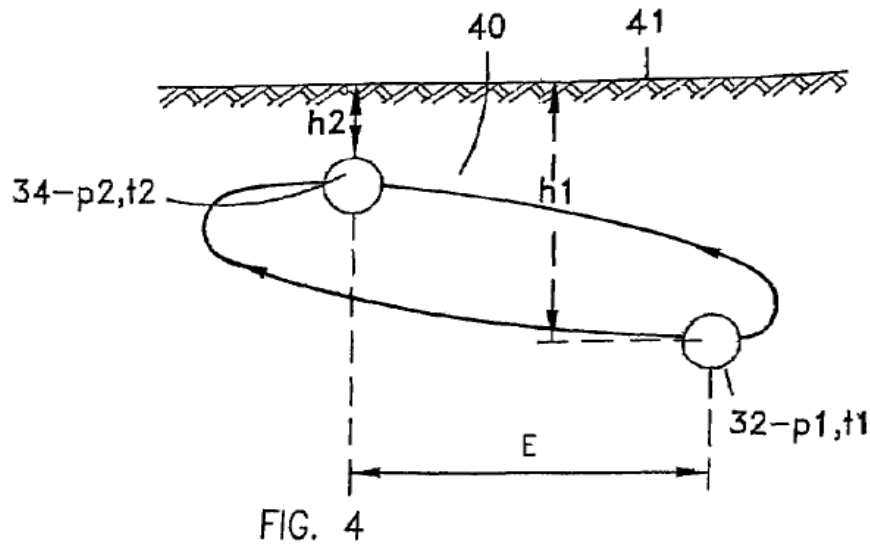


FIG. 4

Figures 3 and 4 above are, respectively, “a schematic vertical cross section of the ground, illustrating an embodiment of the apparatus of the invention,” and “a schematic illustration of the flow lines of water and geothermal fluid in an embodiment of the invention.” *Id.* at 5:26–27, 31–32. As shown in those figures, the apparatus “includes water injection pump 37 for supplying heat-depleted hot water to first (injection) horizontal geothermal well 32 via injection connection means 33.” *Id.* at 6:9–12. Vertically distanced from injection well 32 is a “second (production) horizontal geothermal well 34.” *Id.* at 6:18–22. The ’221 patent explains that the vertical distance between the two wells “depends on the structure of the geological layer 31 and on the vertical temperature profile within the geological layer.” *Id.* The ’221 patent further explains that “[t]he two wells are offset horizontally up to 300 ft so that the intersected layer is sufficiently large to enable ‘harvesting’ of a sufficient amount in heat.” *Id.* at 6:22–25.

The ’221 patent explains that temperature differences and hydrostatic pressure differences arising due to the positioning of injection well 32 and

production well 34, along with operation of “deep well pump” 36,<sup>1</sup> provides for water to flow from injection well 32 into the “hot earth” surrounding the well where it is heated and then flows into production well 34. *Id.* at 6:48–7:24; *see* 4:40–59. From production well 34, the heated water is conveyed to a “heat consumer,” e.g., a power plant, where the heat is extracted. *Id.* at 6:1–7. The ’221 patent generally characterizes its disclosure as providing “an increase of the efficiency of the exploitation of the geothermal energy,” and “will enhance the productivity at the shallower well upwards.” *Id.* at 4:60–5:4.

#### *D. The Challenged Claims*

Petitioner challenges claims 1–38 (“the challenged claims”) of the ’221 patent. Claims 1, 9, and 34 are independent claims. Claim 1 is representative and is reproduced below:

1. Method for recovering geothermal heat, which comprises enhancing the flow of geothermal fluid from at least one injection well to at least one production well, by the following steps:
  - a. Providing a first, horizontal, geothermal well in the ground at a geological layer having an elevated temperature, which is used as said injection well;
  - b. Injecting water into said injection well, whereby the injected water is heated;
  - c.<sup>[2]</sup> [1c-1] Providing a second, horizontal, geothermal well in the ground, which is used as said production well, [1c-2] such that said second, horizontal, production, geothermal well is substantially horizontally and vertically spaced from said first,

---

<sup>1</sup> At times, the ’221 patent appears to mislabel pump “36” using reference character “86.” *See, e.g.*, 6:1–2, 64.

<sup>2</sup> Petitioner identifies element c of claim 1 as having three subparts designated 1c-1, 1c-2, and 1c-3. *See* Pet. 3. For clarity, we identify those subparts in reproducing element c.

horizontal, injection, geothermal well by a distance dependent on the elevated temperature and [1c-3] located at a shallower depth than said first, horizontal, injection, geothermal well;

- d. Recovering geothermal fluid from said production well;
- e. Generating a water density difference and a pressure difference between said first horizontal, injection well and said second horizontal, production well; and
- f. Inducing geothermal fluid into said second horizontal geothermal well from the geological layer because of buoyancy of the water and the pressure difference between the horizontal injection and horizontal production wells.

Ex. 1001, 9:61–10:19.

Independent claim 9 is an apparatus claim corresponding to the method claim 1, and includes some similar corresponding limitations. Independent claim 34 is drawn to a “[m]ethod for assuring the flow of geothermal fluid from at least an injection well to as least a production well” and includes some similar steps as presented in claim 1. *Id.* at 12:19–38. Claims 2–8, 10–33, and 35–38 ultimately depend from one of claims 1, 9, and 34.

### *E. Alleged Grounds of Unpatentability*

Petitioner asserts the following grounds of unpatentability:

<b>Ground<sup>3</sup></b>	<b>Claim(s) Challenged</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/Basis</b>
1	1–3, 6–11, 24–31, 34–37	103	Rinaldi <sup>4</sup> “in view of the general knowledge of a POSITA <sup>[5]</sup> ” (Pet. 11)

<sup>3</sup> For convenience we reference the Ground numbering that is offered in the Petition. *See* Pet. 11.

<sup>4</sup> U.S. Patent No. 4,676,313 issued Jun. 30, 1987 to Rinaldi (Ex. 1006, “Rinaldi”).

<sup>5</sup> “POSITA” is an acronym for “person of ordinary skill in the art.”

<b>Ground<sup>3</sup></b>	<b>Claim(s) Challenged</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/Basis</b>
2	1–11, 23–37	103	Rinaldi, Swenson <sup>6</sup>
3	1–38	103	Rinaldi, Grassiani, <sup>7</sup> Brannan <sup>8</sup>
4	1, 2, 6, 7, 9–11, 25–31, 34–37	103	Mims <sup>9</sup> “in view of the general knowledge of a POSITA” ( <i>id.</i> )
5	1, 2, 4–7, 9–11, 25–37	103	Mims, Kruger, <sup>10</sup> Swenson
6	1–7, 9–23, 25– 31, 34–38	103	Mims, Grassiani, Brannan
7	1–11, 16, 17, 23– 37	103	Rinaldi, Swenson, Alkhasov <sup>11</sup>

Pet. 1. In addition to the references listed above, Petitioner relies on the Declaration of Robert Schaaf (Ex. 1004).

---

<sup>6</sup> Swenson, D.V. et al., “Modeling Flow in a Jointed Geothermal Reservoir.” (Ex. 1008, “Swenson”).

<sup>7</sup> Grassiani, M., “Advanced Power Plants for Use with Hot Dry Rock (HDR) and Enhanced Geothermal Technology,” Proceedings World Geothermal Congress 2000 (Ex. 1011, “Grassiani”).

<sup>8</sup> U.S. Patent No. 5,273,111 issued Dec. 28, 1993 to Brannan et al. (Ex. 1009, “Brannan”).

<sup>9</sup> U.S. Patent No. 4,850,429 issued Jul. 25, 1989 to Mims et al. (Ex. 1007, “Mims”).

<sup>10</sup> Kruger, P. “Stimulation of Geothermal Energy Resources,” Energy Research and Development Administration, Div. of Geothermal Energy (Ex. 1010, “Kruger”).

<sup>11</sup> Alkhasov, A.B. “Prospects of Horizontal Drilling when Construction Geothermal Power Plants,” Proceedings, Twenty-Fourth Workshop on Geothermal Reservoir Engineering. (Ex. 1012, “Alkhasov”).

## II. ANALYSIS

### A. *Principles of Law*

A petition must show how the construed claims are unpatentable under the statutory grounds it identifies. 37 C.F.R. § 42.104(b)(4). Petitioner bears the burden of demonstrating a reasonable likelihood that it would prevail with respect to at least one challenged claim for a petition to be granted. 35 U.S.C. § 314(a).

A patent claim is unpatentable under 35 U.S.C. § 103 “if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” 35 U.S.C. § 103. 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), if present, any objective evidence of obviousness or non-obviousness.<sup>12</sup> *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics*,

---

<sup>12</sup> Neither party has introduced any objective evidence in this proceeding.



*Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

At this preliminary stage, we determine whether the information presented shows a reasonable likelihood that Petitioner would prevail in establishing that at least one of the challenged claims would have been obvious over the proposed prior art. We analyze the asserted grounds with the above-noted principles in mind.

### *B. Level of Ordinary Skill in the Art*

In determining the level of skill in the art, we consider the type of problems encountered in the art, the prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the educational level of active workers in the field. *Custom Accessories, Inc. v. Jeffrey-Allan Indus. Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986); *Orthopedic Equip. Co. v. U.S.*, 702 F.2d 1005, 1011 (Fed. Cir. 1983).

Petitioner contends the following assessment in connection with a person of ordinary skill in the art:

The Challenged Claims pertain to a method of recovering geothermal heat. However, “[m]any of the techniques are derived from oil and gas industry.” EX1001 at 4:23-24. Accordingly, here, a person of ordinary skill in the art (“POSITA”) is a person with a Bachelor’s degree, Master’s degree, and/or Ph.D. in Chemical Engineering, Petroleum Engineering, Energy Resource Engineering, or the like, or at least five years of experience engineering, drilling, and constructing wells. Furthermore, a person with less formal education but more experience, or more formal education but less experience, could also have met the relevant standard for a POSITA.

Pet. 16–17 (citing Ex. 1004 ¶¶ 34–36).

Patent Owner does not offer its own assessment of a POSITA. For purpose of this Decision, we adopt Petitioner’s assessment.

### *C. Claim Construction*

We construe claims in the same manner used in a civil action under 35 U.S.C. § 282(b) “including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b). When applying that standard, we interpret the claim language as it would have been understood by one of ordinary skill in the art in light of the specification. *Wasica Fin. GmbH v. Cont’l Auto. Sys., Inc.*, 853 F.3d 1272, 1279–80 (Fed. Cir. 2017). Thus, we give claim terms their ordinary and customary meaning as understood by an ordinarily skilled artisan. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. v. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

Here, Petitioner contends that “[t]he plain meaning should be applied to all claim terms,” and that “[n]o terms need to be construed to resolve” this proceeding. Pet. 16.

Patent Owner does not offer any particular claim construction of its own for any claim term. Patent Owner does, however, note that “claim element 9c<sup>[13]</sup> includes the terms ‘means for,’ which are presumed to invoke

---

<sup>13</sup> The referenced “claim element 9c” reads in-part “Means for producing a water density difference and a pressure difference between said first

means-plus-function treatment under Section 112.” Prelim. Resp. 17 (citing *Samsung Electronics Co., Ltd. v. Power2B Inc.*, IPR2022-01378, Paper 12 at 11 (PTAB Mar. 15, 2023) (citing *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1348 (Fed. Cir. 2015) (en banc in relevant part))). Patent Owner further submits that “[u]nder Rule 104(b)(3),<sup>14</sup> Petitioner had an obligation to provide a construction of claim element 9c that includes both the claimed function and the specific portions of the specification that describe the structure, material, or acts corresponding to each claimed function.” *Id.*

We agree with Patent Owner that the term “means for” when appearing in a claim triggers a rebuttable presumption that treatment under § 112 applies. On the record before us, however, Petitioner has not explained why the noted presumption has been rebutted or does not apply, and has not provided a construction of the pertinent “means for” term in the Petition in contradiction to the requirements of 37 C.F.R. § 104(b)(3).

We determine that for the purposes of this Decision, it is unnecessary to expressly construe any claim term. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (Only terms in controversy must be construed and only to the extent necessary to resolve the controversy); *see also Nidec*, 868 F.3d at 1017 (citing *Vivid Techs* in the context of an *inter partes* review).

---

horizontal, injection well and said second horizontal, production well.” Ex. 1001, 10:59–61.

<sup>14</sup> Section 104(b)(3) of 37 C.F.R. reads in part “[w]here the claim to be construed contains a means-plus-function limitation as permitted under 35 U.S.C. § 112(f), the construction of the claim must identify the specific portions of the specification that describe the structure, material, or acts corresponding to each claimed function.”

*D. Grounds Based on Rinaldi (Grounds 1–3 and 7)*

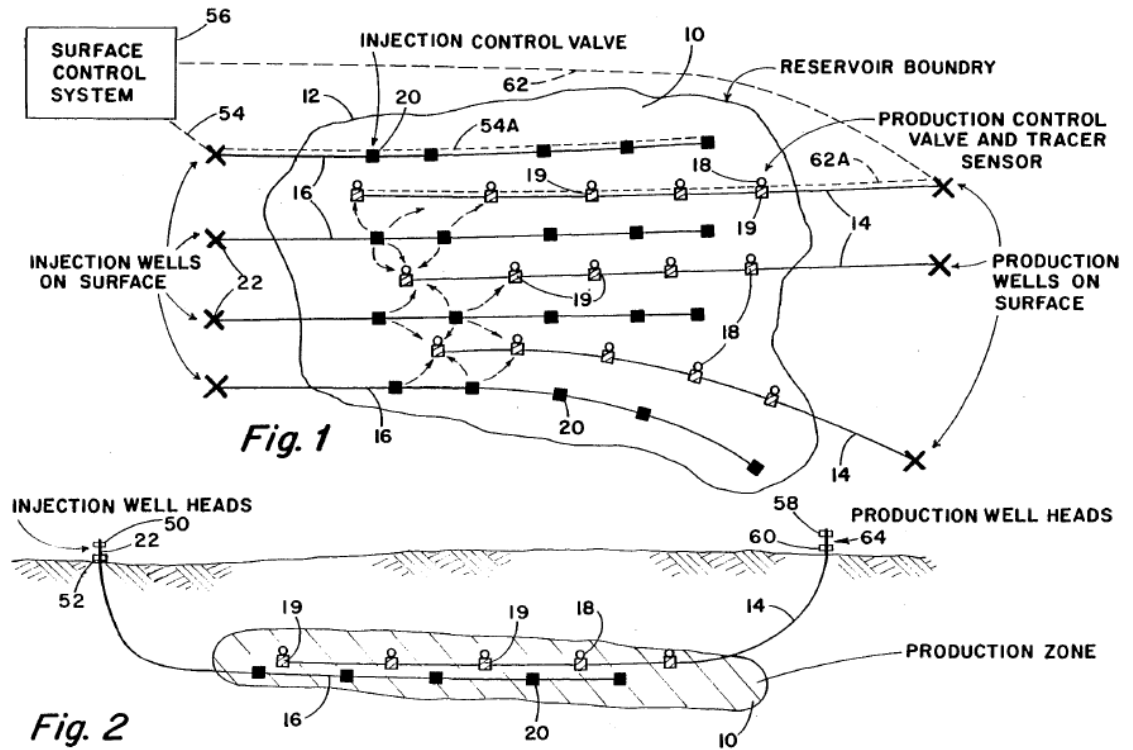
Petitioner alleges four grounds of unpatentability based primarily on Rinaldi (Grounds 1–3 and 7).

*1. Ground 1 Involving Rinaldi and “general knowledge of a POSITA” (see, e.g., Pet. 17)*

Petitioner contends that claims 1–3, 6–11, 24–31, and 34–37 are unpatentable over Rinaldi and “general knowledge of a POSITA.” *See* Pet. 19–40.

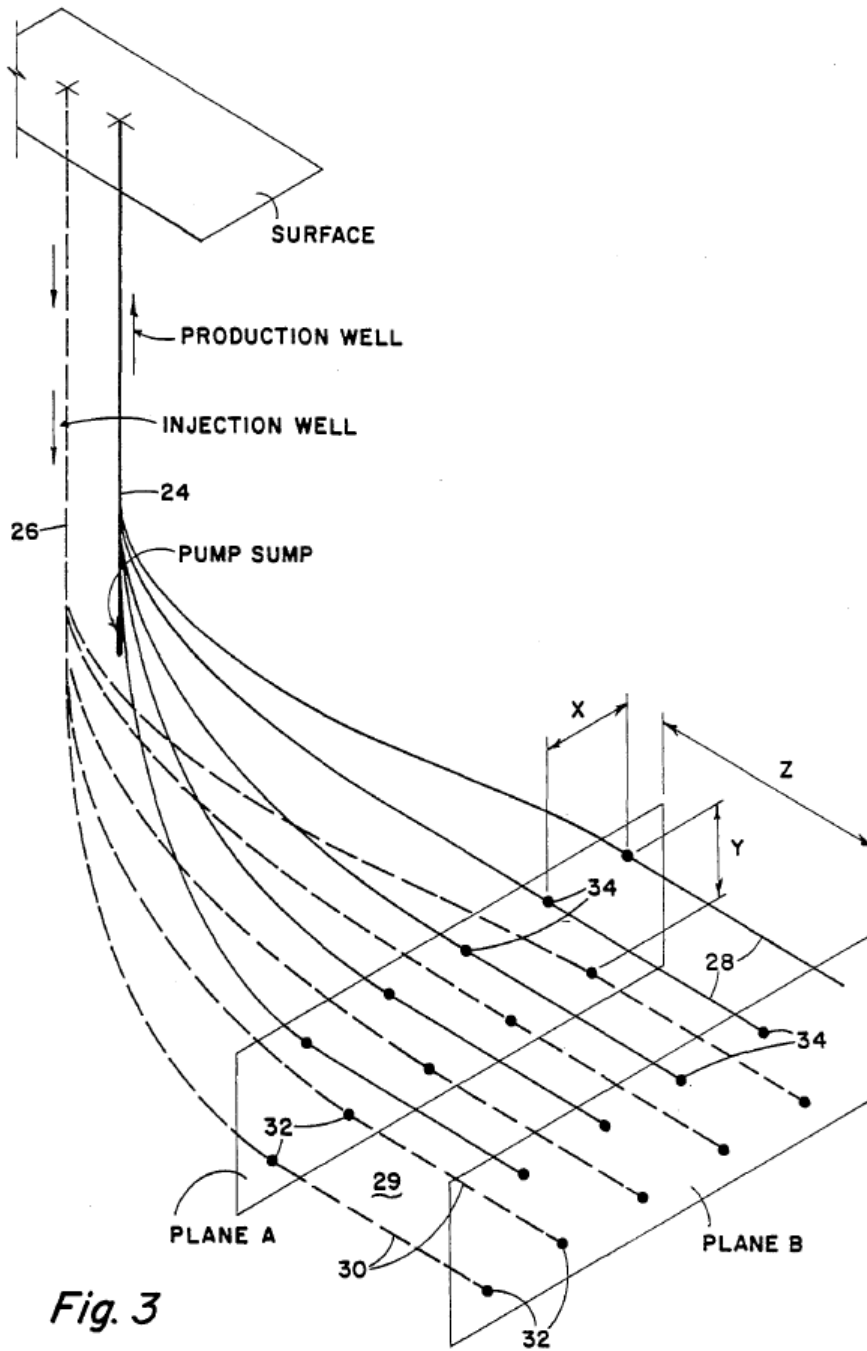
*a) Overview of Rinaldi*

Rinaldi is titled “Controlled Reservoir Production.” Ex. 1006, code [54]. As conveyed in the Abstract, Rinaldi characterizes its disclosure as “contemplat[ing] a method of enhancing oil and/or gas recovery by properly drilling injection and production wells into a reservoir, incorporating flow control valves and sensors in both sets of wells, and connecting these valves and sensors to a surface computer.” *Id.* at code [57]. Rinaldi’s Figures 1 and 2 are reproduced below:



Figures 1 and 2 above show “a schematic top or plan view” (Fig. 1) and “a sectional elevation view” (Fig. 2) of a reservoir and oil or gas recovery method embodied by Rinaldi’s invention. *Id.* at 2: 64–68. Rinaldi describes that injection well bores 16 and production well bores 14 are positioned within reservoir 10 and are controlled via surface control system 56 to convey injection fluid from injection well heads 22 to production well heads 64. *See id.* at 1:65–2:47.

Rinaldi's Figure 3 is reproduced below:



**Fig. 3**

Figure 3 above shows a “schematic perspective view of a modified enhanced oil and/or gas recovery methods embodying the invention.” *Id.* at 3:1–3.

Rinaldi describes Figure 3 as showing “a single production well bore 24 in spaced relation to a single injection well bore 26[.]” *Id.* at 4:47–49.

*b) Discussion*

*(1) Independent Claim 1*

Claim 1, generally, is drawn to a method of recovering heat from a geological layer having “an elevated temperature” involving the placement and operation of a first injection well and a second production well. *See* Ex. 1001, 9:61–10:20. Patent Owner disputes that many of the limitations required by claim 1 are accounted for as a part of Ground 1. *See, e.g.*, Prelim. Resp. 2–16. We focus first on the limitation designated 1c-2.

The limitation 1c-2 recites “said second, horizontal, production, geothermal well is substantially horizontally and vertically spaced from said first, horizontal, injection, geothermal well by a distance dependent on the elevated temperature.” Ex. 1001, 10:5–8. The emphasis on this limitation is the requirement that the placement of the injection and production wells in relation to one another is “dependent on the elevated temperature.”

In first proposing to account for that limitation, Petitioner refers to a “log and drill stem test,” associated with spacing injection well bores in a reservoir. Pet. 23. Petitioner then states that “[a] POSITA would recognize that the reservoir data obtained by the disclosed drill stem test would include temperature at the formation.” *Id.* (citing Ex. 1004 ¶ 68). Petitioner also points to a general statement in Rinaldi that “temperature” is a characteristic that “must obviously be considered” in some context. Pet. 23 (citing Ex. 1006, 5:34–40). Coupled with Rinaldi’s prior disclosure of the use of a “computer model that can simulate the actual subsurface fluid reservoir conditions and characteristics” in connection with well drilling, Petitioner extrapolates that Rinaldi contemplates that temperature would be used “to

determine the placement of wells and drill spaced apart production and injection wells.” *Id.* at 23–24 (citing Ex. 1006, 3:30–49).

Patent Owner counters, among other arguments, that none of Rinaldi’s disclosure cited by Petitioner “states therein that the vertical position of a production well relative to an injection well is based to any extent on the temperature of the geological layer where that injection well is located.” *See* Prelim. Resp. 5–6. Patent Owner also contends that the portion referenced by Petitioner of Rinaldi that mentions temperature (*i.e.*, Ex. 1006, 5:34–40) “concerns determining what is going to be injected to increase production, not where the production well should be placed.” Prelim. Resp. 6. In a similar vein, Patent Owner asserts that Rinaldi contemplates use of its “computer model to ‘determine the type, volume and location of the fluids to be injected into the reservoir so as to maximize reservoir productivity’ rather than dictating well placement. *See* Prelim. Resp. 6–7 (quoting Ex. 1006, 3:37–40).

We agree with Patent Owner, and in doing so, determine that Petitioner’s first theory in accounting for limitation 1c-2 based on Rinaldi falls short. Notably, Petitioner’s statement on page 23 and Mr. Schaaf’s testimony (Ex. 1004) at paragraph 68 that “[a] POSITA would recognize that the reservoir data obtained by the disclosed drill stem test would include temperature at the formation” has no supporting evidentiary citation. Petitioner also does not adequately tether Rinaldi’s single reference to “temperature” as something that must generally be “considered” to a practice of positioning wells with respect to one another, *i.e.*, vertical and horizontal relationship. We further agree with Patent Owner (*see* Prelim. Resp. 4–5) that Rinaldi’s “computer model” disclosure on which Petitioner relies (Ex. 1006, 3:30–40) pertains to modeling “type, volume and location”



of fluids to be injected into a reservoir, rather than any consideration of positioning wells in relation to one another based on temperature.

Petitioner alternatively, or additionally, refers to disclosure of the '221 patent, itself, that is characterized as “prior art.” In particular, Petitioner argues the following:

Further, the '221 patent itself notes prior art as disclosing well locations being dependent on the temperature for vertically drilled injection and production wells. *See* EX1001 at 1:39-52 (“In the prior art, geothermal energy recovery systems typical comprise production as well as injection wells ... drilled vertically or at an angle slightly deviated from the vertical .... The production location in said vertical geothermal wells are made at the depth where the temperature is sufficiently high.”). It would have been obvious for a POSITA to employ the prior art technique of placing vertical wells based on the formation’s temperature to the horizontal wells and achieve predictable fluid flow.

Pet. 24 (citing Ex. 1004 ¶ 69).

As Patent Owner urges, however, the description of “prior art” in the '221 patent says nothing concerning spacing injection wells and production wells in relation to one another based on temperature. Petitioner’s concluding sentence in the above-reproduced paragraph regarding what it contends would have been obvious to a skilled artisan simply does not follow from the noted statements in the '221 patent as to prior art. Likewise, Mr. Schaaf’s testimony at paragraph 69 that it is his “opinion” that the required well spacing based on temperature “would have been obvious” rings hollow and is unsupported by any record citation. *See* Ex. 1004 ¶ 69.

Further still, Petitioner attempts to infer that Rinaldi’s discussion of locating control valves at column 4 line 63 through column 5 line 3 based on a computer model somehow gives rise to the following statement “[a]

POSITA would recognize that controlling which injection and production valves are open and closed necessarily has the effect of controlling the spacing between the active injection and production wells based on the measured reservoir characteristics.” Pet. 24–25 (citing Ex. 1004 ¶ 70). Petitioner, however, provides no meaningful explanation as to why well spacing concerns “necessarily” are impacted by valve control, much less that any such well spacing is based on temperature. Mr. Schaaf simply echoes that statement without record citation or explanation. *See* Ex. 1004 ¶ 70.

We are not satisfied that Petitioner adequately accounts for the requirements of limitation 1c-2 based on Rinaldi’s disclosure.

With respect to other limitations of claim 1, such as limitation 1c-3, as Patent Owner notes, Petitioner shifts between reliance on aspects of Rinaldi’s Figures 2 and 3 in accounting for requirements of limitation 1c-3. *See* Prelim. Resp. 11–12. We agree with Patent Owner those two figures are recognizable as being directed to two different embodiments of Rinaldi’s invention. *See id.* Indeed, Figures 1 and 2 are expressed as views of one embodiment of the invention having certain characteristics, and Figure 3 is characterized as a “modified” embodiment having different characteristics. *See, e.g.,* Ex. 1001, 2:64–3:3, 4:45–49.

While it is certainly the case that “a prior art reference is relevant for all that it teaches to those of ordinary skill in the art,” *see In re Fritch*, 972 F.2d 1260, 1264–65 (Fed. Cir. 1992), it is incumbent on a petitioner, in advancing a permissible theory of obviousness, to explain why a skilled artisan would recognize to pick and choose certain aspects of a reference and combine them with other aspects of the reference, particularly so where the reference itself does not suggest such combination. *See In re Hedges*, 783 F.2d 1038, 1041 (Fed. Cir. 1986) (“It is impermissible within the framework

of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests”) (citation and inner quotes omitted). Here, Petitioner’s oscillation between different embodiments of Rinaldi in an attempt to reach the requirements of claim 1 is not adequately explained, and more closely resembles impermissible hindsight. *See Metalcraft of Mayville, Inc. v. The Toro Co.*, 848 F.3d 1358, 1367 (Fed. Cir. 2017). (“[W]e cannot allow hindsight bias to be the thread that stitches together prior art patches into something that is the claimed invention.”).

In sum, we determine that Petitioner has not shown a reasonable likelihood of prevailing in its assertion that claim 1 is unpatentable as a part of Petitioner’s proposed Ground 1.

(2) *Independent Claim 9*

Independent claim 9 is directed to an “[a]pparatus for enhancing the flow of geothermal fluid from at least one injection well to at least one production well.” Ex. 1001, 10:46–48.

At the outset, as noted above in conjunction with claim construction, claim 9 includes a limitation that reads “[m]eans for producing a water density difference and a pressure difference between said first horizontal, injection well and said second horizontal, production well.” *Id.* at 10:59–61 (limitation 9c). That “means for” recitation triggers the presumption of treatment under 35 U.S.C. § 112, and necessitates identification of corresponding structure in the Specification for that functional recitation. Petitioner has not identified any corresponding structure. Indeed, in addressing limitation 9c, Petitioner simply refers to discussion concerning

“Element 1e” which is “incorporated herein by reference.” *See* Pet. 34. Element or limitation 1e is a method step directed to generating a water density difference and pressure difference between the injection and production wells. Petitioner’s discussion of limitation 1e vis-à-vis Rinaldi references a “computer” and “valves” but does not explain why those are structures that correspond to structure that is presented in the Specification of the ’221 patent. *See* Pet. 26–27.

Additionally, claim 9 requires the particular structures of an “open slotted outlet” associated with an injection geothermal well and an “open slotted inlet” associated with a production geothermal well. Ex. 1001, 10:62–66 (limitation 9d). Petitioner allegedly accounts for those structures by stating “Rinaldi discloses the wells ‘may be provided with valves, nozzle or other suitable injection means’ (EX1006 at 4:63–5:3) that were ‘well known.’” Pet. 35. In referencing the above-quoted sentence Patent Owner notes the following:

But that mis-states Rinaldi, which says what is “well known” is that “[t]he production wells 28 may be provided with suitable intake means or valve means 34 disposed in the proximity of the planes A and B or in the medium therebetween for retrieval of the fluid therefrom.” Rinaldi at 4:67-5:3. Rinaldi does not say that “valves, nozzle or other suitable injection means 32” (Rinaldi at 4:62-67) are well known.

Prelim. Resp. 18–19.

Patent Owner has the better reading of what Rinaldi discloses in that respect. In particular, Patent Owner is correct that Rinaldi does not associate specifically its statement as to what is “well known” with the category of “valves, nozzle or other suitable injection means.” Petitioner, however, then bases the following statements as its misreading of Rinaldi’s disclosure:

By 2004, a POSITA would understand that open slotted outlets are suitable injection means well known in the art at the time to suit different reservoir conditions and production requirement. EX1004 at ¶110. In the context of hydrocarbon extraction, slotted liners have been used for many decades to support the well structure and to filter out sand and other fine particles from the produced fluids. *Id.*

Pet. 35.

Yet, Mr. Schaaf’s testimony at paragraph 110 has no supporting citation for the premise that “slotted liners have been used for many decades. . . .” Thus, the basis for Petitioner’s accounting for the claimed open slotted inlets and outlets rests solely on bare statements in the Petition and Mr. Schaaf’s testimony as to what was purportedly known without any evidentiary basis.

For at least the above-noted reasons, we determine that Petitioner has not shown a reasonable likelihood of prevailing in its assertion of the unpatentability of claim 9 in conjunction with Ground 1.

### *(3) Independent Claim 34*

Independent claim 34 is a method claim that shares similar themes with method claim 1. Claim 34 includes a recitation of “[g]enerating a water density difference and a pressure difference between said first horizontal well and said second horizontal well by providing a fluid pump connection to said second horizontal well.” Ex. 1001, 12:34–38 (limitation 34V). In accounting for that limitation and, in particular, the configuration of a fluid pump with respect to the second horizontal well, Petitioner relies in part on its contentions as to claim 1 (specifically limitation 1e) and claim 3, which rely on Rinaldi’s production well bore 14 from the embodiment of Figures 1 and 2 as constituting the claimed second horizontal well. *See* Pet. 40. In

accounting for the required pump as a part of its claim 3 contention, Petitioner points to the “Pump Sump” label of Figure 3, which Petitioner claims to show “a fluid pump connection to the horizontal production well.” See Pet. 31–32. Petitioner does not point to any discussion or description of the “Pump Sump” in Rinaldi and simply states “A POSITA would recognize that fluids flow from high pressure areas to low pressure areas and for the geothermal fluid to be extracted through the production well, its pressure has to be reduced by the pump to be lower than the surrounding pressures.” Pet. 32 (citing Ex. 1004 ¶ 92).

Patent Owner contends that Petitioner’s approach to claim 34 as a part of Ground 1 is deficient in both explaining why a person of ordinary skill in the art would have modified Rinaldi’s well bore 14 of the embodiment of Figures 1 and 2 to incorporate the required fluid pump, or why any such fluid pump would operate as required by claim 34. Prelim. Resp. 21–22.

We agree with Patent Owner that Petitioner’s accounting for the requirements of limitation 34V is deficient. Petitioner does not adequately explain why a skilled artisan would have implemented the “Pump Sump” of Rinaldi’s Figure 3 into the well bore 14 of Rinaldi’s Figures 1 and 2, or why that “Pump Sump” would constitute the required “fluid pump” that functions in the manner required of that fluid pump as set forth in claim 34. Accordingly, we determine that Petitioner has not shown a reasonable likelihood of success in its challenge to claim 34 as a part of Ground 1.

*(4) Dependent claims 2, 3, 6–8, 11, 24–31, and 35–37*

Claims 2, 3, 6–8, 11, 24–31, and 35–37 ultimately depend from one of claims 1, 9, and 34. We conclude that the deficiencies discussed above with respect to claims 1, 9, and 34 as a part of Ground 1 also apply to dependent

claims 2, 3, 6–8, 11, 24–31, and 35–37. Accordingly, we determine that Petitioner has not shown a reasonable likelihood of prevailing in its assertion that claims 2, 3, 6–8, 11, 24–31, and 35–37 are unpatentable based on Ground 1.

2. *Ground 2 Involving Rinaldi and Swenson*

Petitioner contends that claims 1–11 and 23–37 are unpatentable over Rinaldi and Swenson. *See* Pet. 41–50. The same deficiencies discussed above in connection with Ground 1’s reliance on Rinaldi also apply to Ground 2. With respect to limitation 1c-2, Petitioner offers additional statements as follows:

Swenson states that “[m]odels, including GEOCRACK, show that longevity is dependent upon rock temperatures, flow path spacing, numbers of active flow paths, well spacing, and flow rates. Because well spacing and flow rates may be controlled to a much greater extent than the internal geometry of reservoir flow paths, GEOCRACK indicates that reservoir operators could engineer systems with extensive lifetimes and profitable thermal productivity by appropriate well spacing and limiting energy production rates.” EX1008 at 2558. *See also id.* at 2553 (describing use of the GEOCRACK model to address number and spacing of wells).

Pet. 43.

Petitioner, however, does not adequately explain why the above-quoted statements provide insight as to how Swenson’s disclosure accounts for the requirement of limitation 1c-2 pertaining to the vertical and horizontal spacing of an injection well and a production well in relation to one another based on temperature. To that end, we agree with Patent Owner. *See* Prelim. Resp. 24–26.

With respect to Swenson, Patent Owner additionally contends that Petitioner has failed to show that Swenson “was publicly accessible before the critical date of the challenged patent and therefore that there is a reasonable likelihood that it qualifies as a printed publication.” Prelim. Resp. 23 (quoting *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 13 (PTAB Dec. 20, 2019) (precedential)). That is so because, as Patent Owner notes, although the Petitioner states that Swenson was “published in 1995,” Swenson does not itself set forth 1995 as a publication date, or that it was “disseminated for otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art[,] exercising reasonable diligence [could] locate it.” See Prelim. Resp. 23 (quoting Pet. 41; *SRI Int’l, Inc. v. Internet Sec. Sys., Inc.*, 511 F.3d 1186, 1194 (Fed. Cir. 2008) (citation omitted)).

Although Petitioner points to page “2553” of Swenson as indicating a publication date of 1995 (Pet. 41), we search that page in vain for any indication of a 1995 publication date, or any other publication date. We also agree with Patent Owner that there is simply no adequate evidence on this record that Swenson was made available in the manner required so as to be regarded as publicly accessible and constitute prior art to the ’221 patent.

For the above-noted reasons, we determine that Petitioner has not shown a reasonable likelihood of success in showing that claims 1–11 and 23–37 would have been unpatentable based on Ground 2.

### 3. *Ground 3 Involving Rinaldi, Grassiani, and Brannan*

Petitioner contends that claims 1–38 are unpatentable over Rinaldi, Grassiani, and Brannan. See Pet. 50–62. Petitioner does not rely on Grassiani or Brannan to remedy any of the deficiencies in Petitioner’s



reliance on Rinaldi noted above in connection with Ground 1. For the same reasons set forth above, we determine that Petitioner has not shown a reasonable likelihood of prevailing in its contention that the challenged claims are unpatentable based on Ground 3.

*4. Ground 7 Involving Rinaldi, Swenson, and Alkhasov*

Petitioner contends that claims 1–11, 16, 17, and 23–37 are unpatentable over Rinaldi, Swenson, and Alkhasov. *See* Pet. 84–88. The same deficiencies discussed above with respect to Grounds 1 and 2 are also present in Ground 7. We discern that Petitioner additionally generally makes the bare statement that “Alkhasov further teaches that the production well is spaced from the injection well by a distance dependent on the elevated temperature.” Pet. 85 (citing Ex. 1004 ¶ 360). Mr. Schaaf’s testimony at paragraph 360 simply makes the same statement devoid of any supporting citation. The record does not reveal that the statement is adequately supported, or why it is correct. We agree with Patent Owner that Petitioner’s reliance on Alkhasov does not remedy the deficiencies discussed above with respect to the challenged claims. *See* Prelim. Resp. 56–59.

Patent Owner also argues that there is an additional defect associated with Petitioner’s reliance on Alkhasov. Patent Owner contends that Petitioner has not asserted where or how Alkhasov was published and that it was publicly accessible in a manner to be considered prior art to the ’221 patent. *See* Prelim. Resp. 56.

On its face, Alkhasov does not appear to include any publication information. The header of the first page Alkhasov refers to “Twenty-Fourth Workshop on Geothermal Reservoir Engineering Stanford University, Stanford, California, January 25–27, 1999.” Ex. 1012, 1. There

is no indication from that heading that Alkhasov was published or that the “January 25–27, 1999” notation constitutes a publication date. We agree with Patent Owner that, on this record, Petitioner has not met its burden to show that Alkhasov constitutes prior art to the ’221 patent.

Accordingly, for the foregoing reasons, we determine that Petitioner has not shown a reasonable likelihood of success in its challenged to claims 1–11, 16, 17, and 23–37 as a part of Ground 7.

*E. Grounds Based on Mims (Grounds 4–6)*

Petitioner alleges three grounds of unpatentability to the challenged claims based on Mims (grounds 4–6).

*1. Ground 4 Involving Mims and “General Knowledge of POSITA” (see, e.g., Pet. 62)*

Petitioner contends that claims 1, 2, 6, 7, 9–11, 25–31, and 34–37 are unpatentable based on Mims and “General Knowledge of a POSITA.” See Pet. 62–74.

*a) Overview of Mims*

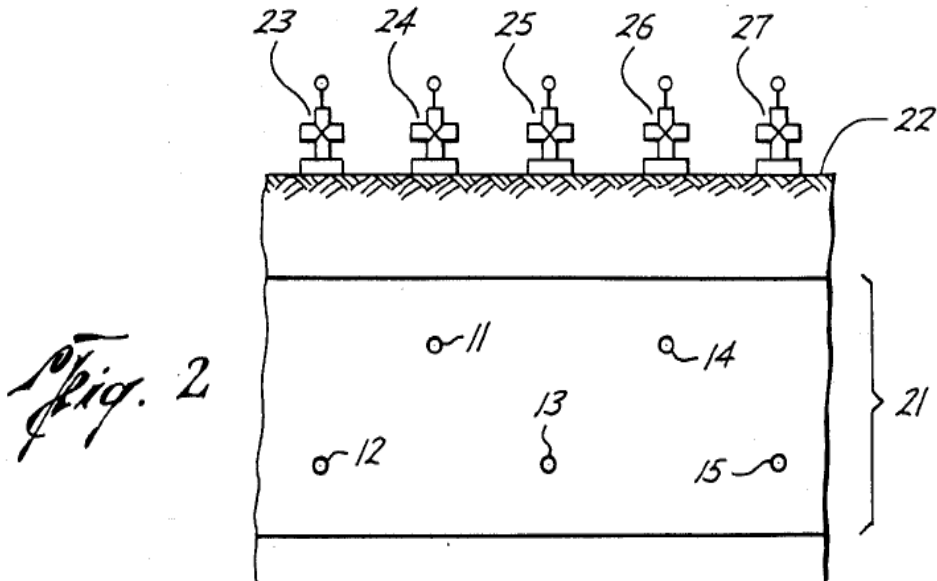
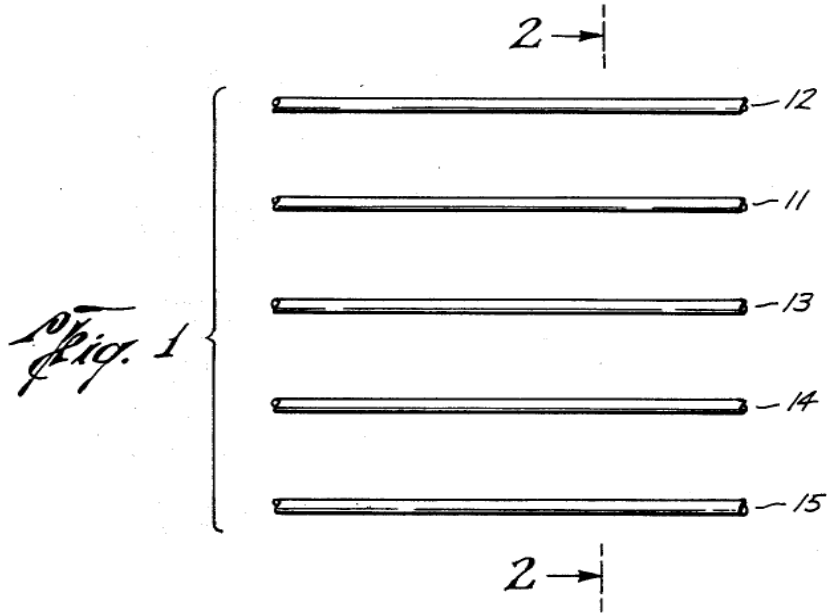
Mims is titled “Recovering Hydrocarbons with a Triangular Horizontal Well Pattern.” Ex. 1007, code [54]. Mims Abstract is reproduced below:

The invention is a method of recovering hydrocarbons from an underground hydrocarbon formation which comprises drilling and completing at least three substantially parallel horizontal wells to form a substantially triangular well pattern within a hydrocarbon formation. The first well is placed relatively near the top of a hydrocarbon interval and the second and third wells are placed near the bottom of the interval on each side of the first well. A recovery fluid is injected into the

formation through the second and third wells and hydrocarbons and other fluids are recovered through the first well.

*Id.* at code [57].

Mims Figures 1 and 2 are reproduced below:



“[Figures 1 and 2 above] illustrate the basic triangular well pattern of the invention with parallel horizontal wells. [Figure 1] is a top sectional view showing five parallel horizontal wells, and [Figure 2] is a side view along line 2—2 of [Figure 1].” *Id.* at 2:20–24. Horizontal wells 11, 12, and 13 are said to form a “substantially triangular horizontal well pattern.” *Id.* at 4:9–11. Wells 14 and 15 are said to form a “second adjacent well pattern with shared bottom well 13.” *Id.* at 4:11–14. Well heads 23–27 reside above ground 22. *Id.* at 4:16–18.

*b) Discussion*

*(1) Independent Claim 1*

For this Ground 4, we also first focus on limitation 1c-2. For convenience we again reproduce that limitation: “said second, horizontal, production, geothermal well is substantially horizontally and vertically spaced from said first, horizontal, injection, geothermal well by a distance dependent on the elevated temperature.” Ex. 1001, 10:5–8. In view of the well configuration shown in Mims’s Figures 1 and 2, Petitioner first asserts that “[a] POSITA would recognize that in such a configuration, the injection and production wells are substantially horizontally and vertically spaced from each other.” Pet. 65 (citing Ex. 1004, ¶ 213). Petitioner then asserts the following:

A POSITA would further understand that Mims teaches well spacing dependent upon many factors known to those skilled in the art, including the characteristics of the formation, which at the time of the earliest priority date of the ’221 patent would have included temperature (EX1007 at 4:27–47).

*Id.* (citing Ex. 1004, ¶ 214).

Patent Owner contends that nothing in the portions of Mims cited by Petitioner discloses “that the vertical spacing between any two wells is dependent on the claimed temperature” and that Petitioner’s assertion (and Mr. Schaaf’s testimony) that a skilled artisan would have understood temperature to be characteristic of a formation “is too generic” to satisfy element 1c-2. Prelim. Resp. 36–37.

We agree with Patent Owner. The portions of Mims at column 4 on which Petitioner relies do not indicate the temperature is a characteristic that determines any spacing of any wells in relation to one another. The one mention of “temperatures” at column 4, lines 46–47 is made in connection with “[p]erforation size” not any well spacing or placement. Citing to the same parts of column 4, Mr. Schaaf simply testifies the following:

It is also my opinion that a POSITA would further understand that Mims teaches well spacing dependent upon many factors known to those skilled in the art, including the characteristics of the formation, which as the time of the earliest priority date of the ’221 patent would have included temperature.

Ex. 1004 ¶ 214.

We agree with Patent Owner that the testimony does not find support in the portions of Mims to which Mr. Schaaf cites. *See* Prelim. Resp. 36–37. We further agree with Patent Owner that Petitioner and Mr. Schaaf’s assertions are “too generic” to reach the particular requirement of limitation 1c-2 of vertically and horizontally spacing horizontal injection and production wells “by a distance dependent on the elevated temperature of the geological layer at the first injection well.” *See* Prelim. Resp. 37 (emphasis omitted).

As a result, we determine that Petitioner has not shown a reasonable likelihood of success in showing that claim 1 is unpatentable based on Ground 4.

*(2) Independent Claim 9*

As with the grounds based on Rinaldi, Petitioner does not offer any construction of the “means for” recitation that appears in limitation 9c. In failing to do so Petitioner does not identify the necessary structure to account for limitation 9c. Moreover, in purporting to address limitation 9c, Petitioner simply refers to its assessment of limitation 1e. *See* Pet. 70. Petitioner’s evaluation of limitation 1e does not make reference to structure of any kind. *See id.* at 66–67. Those circumstances are sufficient in and of themselves do undermine Petitioner’s contention that claim 9 is satisfied by Ground 4.

Patent Owner additionally argues that Petitioner has not accounted adequately for the open slotted inlets and open slotted outlets required by limitation 9d. *See* Prelim. Resp. 40–41. We agree. Petitioner simply “incorporate[s]” the position it took on the requirements of limitation 9d as a part of Ground 1 involving Rinaldi “for the POSITA knowledge on the open slots used for injection means.” *See* Pet. 70. As discussed above in connection with Ground 1, Petitioner’s approach to the requirements of claim 9d is not adequately supported by record evidence or well founded. *See supra* § II.D.1.b)(2).

We determine that Petitioner has not shown a reasonable likelihood of success in its challenge to claim 9 as a part of Ground 4.

*(3) Independent Claim 34*

As noted above, claim 34 includes a requirement as a part of limitation 34V pertaining to a fluid pump connected to a second horizontal well that generates a water density difference and a pressure difference between that well and a first horizontal well. In purporting to account for that requirement, Petitioner simply states that “Mims, along with the general knowledge of a POISTA, teaches this element,” cites to four paragraphs of Mr. Schaaf’s testimony, and refers to prior discussion of limitation 1e. *See* Pet. 74 (citing Ex. 1004 ¶¶287–290). Neither Petitioner’s discussion of limitation 1e (Pet. 66–67) nor Mr. Schaaf’s cited testimony provides any mention of a fluid pump or explanation of such a pump configured to operate in the manner required by claim 34.

We determine that Petitioner has not shown a reasonable likelihood of success in its challenge to claim 34 as a part of Ground 4.

*(4) Dependent claims 2, 6, 7, 10, 11, 25–31, 35–37*

Claims 2, 6, 7, 10, 11, 25–31, and 35–37 ultimately depend from one of claims 1, 9, and 34. We conclude that the deficiencies discussed above with respect to claims 1, 9, and 34 as a part of Ground 4 also apply to dependent claims 2, 6, 7, 10, 11, 25–31, and 35–37. Accordingly, we determine that Petitioner has not shown a reasonable likelihood of prevailing in its assertion that claims 2, 6, 7, 10, 11, 25–31, and 35–37 are unpatentable based on Ground 4.

*2. Ground 5 Involving Mims, Kruger, and Swenson*

Petitioner contends that claims 1, 2, 4–7, 9–11, 25–31, and 34–37 are unpatentable based on Mims, Kruger, and Swenson. *See* Pet. 75–83. The

deficiencies noted above pertaining to Mims with respect to Ground 4 are also present in Ground 5. Petitioner does not rely on Kruger to remedy any of those deficiencies.

With regard to Swenson, Petitioner makes the same inadequate assertions as to Swenson's disclosure that it did in conjunction with Ground 2. *See* Pet. 78. As we determined above (*see supra* § II.D.2), the assertions are also inadequate here. Petitioner's reliance on Swenson as a part of Ground 5 is also deficient because, as we previously noted, Petitioner has not established suitably that Swenson is prior art to the '221 patent. *See supra* § II.D.2

We determine that Petitioner has not shown a reasonable likelihood of success in its challenge to claims 1, 2, 4–7, 9–11, 25–31, and 34–37 as a part of Ground 5.

### 3. *Ground 6 Involving Mims, Grassiani, and Brannan*

Petitioner contends that claims 1–7, 9–23, 25–31, and 34–38 are unpatentable over Rinaldi, Grassiani, and Brannan. *See* Pet. 83–84. Petitioner does not rely on Grassiani or Brannan to remedy any of the deficiencies in Petitioner's reliance on Mims noted above in connection with Ground 4. For the same reasons set forth above, we determine that Petitioner has not shown a reasonable likelihood of prevailing in its contention that claims 1–7, 9–23, 25–31, and 34–38 are unpatentable based on Ground 6.



### III. CONCLUSION

For the reasons set forth above, we conclude that Petitioner has not shown a reasonable likelihood that it would prevail with respect to any of the challenged claims of the '221 patent.

### IV. ORDER

It is

ORDERED that Petitioner's request for an *inter partes* review of the challenged claims of the '221 patent is denied and trial is not instituted.

IPR2024-00665  
Patent 7,320,221 B2

FOR PETITIONER:

Enes Ovcina  
[eovcina@azalaw.com](mailto:eovcina@azalaw.com)

Sujeeth Rajavolu  
[Sujeeth.rajavolu@gmail.com](mailto:Sujeeth.rajavolu@gmail.com)

FOR PATENT OWNER:

Mark Garrett  
[Mark.garrett@nortonrosefulbright.com](mailto:Mark.garrett@nortonrosefulbright.com)

Charles Walker  
[Charles.walker@nortonrosefulbright.com](mailto:Charles.walker@nortonrosefulbright.com)