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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* JOSEPH H. HIGGINBOTHAM, MORGAN P. BROWN,  
and COSMIN MECESANU

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Appeal 2017-011009  
Application 13/065,032  
Technology Center 2800

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Before ROMULO H. DELMENDO, JEFFREY B. ROBERTSON, and  
JANE E. INGLESE, *Administrative Patent Judges*.

INGLESE, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants<sup>1</sup> request our review under 35 U.S.C. § 134(a) of the Examiner's decision to finally reject claims 59–90. We have jurisdiction over this appeal under 35 U.S.C. § 6(b).

We AFFIRM.

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<sup>1</sup> Appellants identify HWH APPS, LLC as the real party in interest. Appeal Brief filed February 10, 2017 (“App. Br.”), 2.

STATEMENT OF THE CASE

Appellants' invention is generally directed to methods and computer-readable medium for determining seismic reflectivity attributes indicating the presence of hydrocarbons in the earth. Spec. 7, ¶ 3; independent claims 59, 62, 69, 78, 87, and 88.

Independent claim 59 illustrates the subject matter on appeal and is reproduced below:

59. A method executed in a host including a processor coupled to a memory of determining a reflectivity attribute indicating presence of hydrocarbons in a subsurface rock formation, comprising:  
inputting data representing the amplitude information of reflected seismic P-waves into the memory;  
inputting a volume of P-wave velocity into the memory;  
*computing, by the processor, a volume of S-wave velocity by using the P-wave velocity and the amplitude information from the data representing reflected seismic P-waves, to compute a volume of single-parameter  $b_k$  in a single-parameter mudrock line equation, wherein the single-parameter mudrock line equation for S-wave velocity is hyperbolic and independent of a value of rock porosity, and takes a form:*

$$V_s^2 = b_k^2 \left( \frac{V_p^2}{V_w^2} - 1 \right); \text{ and}$$

computing, by the processor, the reflectivity attribute using the volume of S-wave velocity and the volume of P-wave velocity, and the data representing the amplitude of reflected seismic P-waves, wherein  $V_s$  is the S-wave velocity,  $V_p$  is the P-wave velocity,  $V_w$  is a velocity of sound in water, and  $b_k$  is an estimated value of the hyperbolic mudrock parameter.

App. Br. 47 (Claims Appendix) (emphasis added).

The Examiner sets forth the following rejections in the Final Office Action entered August 2, 2016 (“Final Act.”), and maintains the rejections in the Examiner’s Answer entered June 27, 2017 (“Ans.”)<sup>2</sup>:

- I. Claims 59–90 under 35 U.S.C. § 101 as directed to non-statutory subject matter;
- II. Claims 59–90 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement;
- III. Claims 59–90<sup>3</sup> under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter that the Applicants regard as the invention; and
- IV. Claims 69 and 78 under 35 U.S.C. § 103(a) as unpatentable over Carrazzone et al. (US 5,583,825, issued December 10, 1996) in view of Castagna et al., *Relationships Between Compressional-Wave and Shear-Wave Velocities in Elastic Silicate Rocks*, 50 *Geophysics* 571–581 (1985).

#### DISCUSSION

Upon consideration of the evidence relied upon in this appeal and each of Appellants’ contentions,<sup>4</sup> we affirm the Examiner’s rejection of

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<sup>2</sup> Contrary to Appellants’ assertion that the claim objections set forth at pages 2–3 of the Final Action are rejections subject to Board review (Reply Br. 2–3), the objections are not within the jurisdiction of the Board because they are reviewable by petition under 37 C.F.R. § 1.181, and we therefore do not address them. *Ex parte Frye*, 94 USPQ2d 1072, 1078 (BPAI 2010) (precedential).

<sup>3</sup> Although the Examiner does not include claims 87–90 in the heading for this rejection in the Final Action (Final Act. 5), the Examiner explicitly addresses these claims in the body of the rejection (Final Act. 7–8), and we thus treat their omission from the heading as a harmless, inadvertent error.

<sup>4</sup> We do not consider any new argument raised in Appellants’ Reply Brief that could have been raised in their Appeal Brief. 37 C.F.R.

claims 59–90 under 35 U.S.C. § 101, rejection of claims 59–61, 65, 66, and 87–90 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement, and rejection of claims 59–90 under 35 U.S.C. § 112, second paragraph, for the reasons set forth in the Final Action, the Answer, and below. We reverse the Examiner’s rejection of claims 62–64, 67–86, and 90 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement, and rejection of claims 69 and 78 under 35 U.S.C. § 103(a), for the reasons set forth below.

We review appealed rejections for reversible error based on the arguments and evidence Appellants provide for each issue Appellants identify. 37 C.F.R. § 41.37(c)(1)(iv); *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) (cited with approval in *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) (explaining that even if the examiner had failed to make a prima facie case, “it has long been the Board’s practice to require an applicant to identify the alleged error in the examiner’s rejections”).

### Rejection I

Appellants argue claims 59–90 as a group. App. Br. 37–44. Therefore, we select claim 59 as representative, and decide the appeal as to Rejection I based on claim 59 alone. 37 C.F.R. § 41.37(c)(1)(iv).

The Examiner determines that claim 59 is directed to the abstract idea of computing a volume of a single parameter  $b_k$ , computing a volume of S-wave velocity, and computing a reflectivity attribute, which the Examiner

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§41.37(c)(1)(iv); 37 C.F.R. § 41.41(b)(2) (arguments raised for the first time in the Reply Brief that could have been raised in the Appeal Brief will not be considered by the Board unless good cause is shown).

determines corresponds to organizing information through mathematical correlations using mental processes that could be transformed in the human mind. Final Act. 8–11. The Examiner determines that the additional steps and elements recited in claim 59 do not add significantly more to the abstract idea. Final Act. 11; Ans. 18. Specifically, the Examiner determines that the steps of inputting data representing the amplitude information of reflected seismic P-waves into memory, and inputting a volume of P-wave velocity into memory, are directed to insignificant extra-solution activities of data gathering. Final Act. 11; Ans. 18 (citing *Digitech Image Techs., LLC v. Elecs. for Imaging, Inc.*, 758 F.3d 1344, 1351 (Fed. Cir. 2014)). The Examiner also determines that the recited memory and processor are routine and conventional features known in the industry. Final Act. 11; Ans. 18. The Examiner determines that the claimed subject matter is therefore ineligible for patenting. Final Act. 11.

Appellants argue that the claims recite a technological solution that overcomes a specific challenge with existing technology used for oil and gas prospecting. App. Br. 40–43. Appellants contend that the existing technology relies on an approximate method of converting the velocity of P-wave propagation in the earth to the velocity of S-wave propagation based on averaging well information from all over the world. *Id.* Appellants contend that their invention improves upon the exiting technology by allowing computation of an accurate and usable relation to find the seismic S-wave velocity from the seismic P-wave velocity in areas where no well information is available, and by allowing computation of a more accurate relation in areas where well information is available. *Id.*

Appellants further assert that the Examiner’s determination that all but claims 69 and 78 are novel and non-obvious “suggests we have claimed an inventive concept.” App. Br. 43–44.

The Court in *Alice Corp. Pty. Ltd. v. CLS Bank Int’l*, 134 S. Ct. 2347 (2014) identified a two-step framework for determining whether claimed subject matter is judicially excepted from patent eligibility under § 101. In the first step, “[w]e must . . . determine whether the claims at issue are directed to a patent-ineligible concept,” such as an abstract idea. *Alice*, 134 S. Ct. at 2355. Step two involves “a search for an ‘inventive concept’—*i.e.*, an element or combination of elements that is ‘sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself,’” and is more than “well-understood, routine, conventional activit[y].” *Alice*, 134 S. Ct. at 2355, 2359 (first alteration in original) (quoting *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 72–73 (2012)).

Claim 59 recites steps directed to (1) inputting data into memory, and (2) computing by a processor (A) a volume of a single parameter ( $b_k$ ) in a single-parameter mudrock line equation, (B) a volume of S-wave velocity, and (C) a reflectivity attribute. The computing steps, taken individually, are directed to abstract ideas of manipulating or analyzing data (amplitude information of reflected seismic P-waves and P-wave velocity) to generate additional data (a volume of S-wave velocity, a volume of single-parameter  $b_k$ , and the reflectivity attribute). Merely combining these steps as recited in claim 59 fails to render the combined steps any less abstract. *See Digitech Image Techs., LLC v. Elecs. for Imaging, Inc.*, 758 F.3d 1344, 1351 (Fed. Cir. 2014) (“Without additional limitations, a process that employs

mathematical algorithms to manipulate existing information to generate additional information is not patent eligible.”); *FairWarning IP, LLC v. Iatric Sys., Inc.*, 839 F.3d 1089, 1093 (Fed. Cir. 2016) (abstract ideas include collecting information and analyzing that information “by steps people go through in their minds, or by mathematical algorithms”); *Synopsis, Inc. v. Mentor Graphics Corp.*, 839 F.3d 1138, 1146–47 (Fed. Cir. 2016) (“[W]e continue to ‘treat[] analyzing information by steps people go through in their minds, or by mathematical algorithms, without more, as essentially mental processes within the abstract-idea category.’” (second alteration in original) (citation omitted)); *Intellectual Ventures I LLC v. Capital One Fin. Corp.*, 850 F.3d 1332, 1340 (Fed. Cir. 2017) (organizing, displaying, and manipulating data is an abstract idea).

As the Examiner correctly determines, the step of inputting data into the memory of a processor is conventional and routine in the art, and this step in claim 59 therefore does not constitute an inventive concept that transforms the abstract ideas discussed above into a patent-eligible application. *See, e.g., Ultramercial, Inc. v. Hulu, LLC*, 772 F.3d 709, 715–716 (Fed. Cir. 2014) (holding the claims insufficient to supply an inventive concept because they did not “do significantly more than simply describe [the] abstract method,” but rather are simply “conventional steps, specified at a high level of generality” (quoting *Alice*, 134 S. Ct. at 2357)).

Although Appellants argue that their invention improves upon existing technology by allowing computation of an accurate and usable relation to find the seismic S-wave velocity from the seismic P-wave velocity, Appellants do not direct us to any factual evidence supporting this conclusory assertion, such as data of record comparing Appellants’ method

to the “existing technology.” App. Br. 37–44; *In re Schulze*, 346 F.2d 600, 602 (CCPA 1965) (“Argument in the brief does not take the place of evidence in the record.”).

In addition, although Appellants assert that the subject matter of claim 59 is directed to an inventive concept because the Examiner deems the claimed subject matter to be novel and non-obvious, the Federal Circuit has made clear that a “claim for a *new* abstract idea is still an abstract idea.” *Synopsis, Inc. v. Mentor Graphics Corp.*, 839 F.3d 1138, 1151 (Fed. Cir. 2016).

Therefore, Appellants’ arguments are unpersuasive of reversible error in the Examiner’s rejection of claims 59–90 under 35 U.S.C. § 101, which we accordingly sustain.

### Rejection II

Although the Examiner includes claims 59–90 in the heading for this rejection, the Examiner only addresses independent claims 59, 69, 78, 87, and 88 in the body of the rejection, and does not address independent claim 62 or any of the claims depending from claim 62. Final Act. 4–5. We accordingly do not sustain the Examiner’s rejection of claim 62 and its dependent claims (63, 64, 67, 68, and 90) under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement.

#### *Claims 59–61, 65, 66, and 89*

The Examiner finds that Appellants’ original disclosure does not describe “the single-parameter mud rock line equation for S-wave velocity is . . . independent of the rock value porosity” as recited in independent claim

59.<sup>5</sup> Final Act. 4. The Examiner finds that the single parameter mudrock line equation for S-wave velocity is defined in the Specification as equation (41), and finds that equation (41) indicates that S-wave velocity ( $V_s$ ) depends on  $b_k$ . Ans. 2–3 (citing Spec. 64). The Examiner finds that equation (42) in the Specification indicates that  $b_k$  depends on  $\gamma$ , and equation (32) in the Specification indicates that  $\gamma$  depends on the bulk density ( $\rho_1$ ), which the Examiner finds corresponds to the rock porosity. Ans. 3 (citing Spec. 50, 54, and 64). The Examiner determines that the Specification thus indicates that the single parameter mudrock line equation for S-wave velocity depends on a value of rock porosity. Ans. 3.

Appellants argue that page 63, paragraph 3 to page 66, paragraph 4 of their Specification, Figures 35 and 36 of their application, and Castagna et al., *Rock Physics - The Link Between Rock Properties and AVO Response*, in *Offset-Dependent Reflectivity - Theory and Practice of AVO Analysis*, Society of Exploration Geophysics (1993) (“Castagna”),<sup>6</sup> provide support for the claim language at issue. App. Br. 23–24. Appellants contend that Figure 36, which depicts a cross-plot of  $V_P$  and  $V_s$ , shows that  $b_k$  is constant for limestone when the porosity of the mineral is changing, as disclosed in Castagna, demonstrating that  $b_k$  is independent of porosity. *Id.*

However, as the Examiner points out, Appellants argue that the cited portions of the Specification, Figures 35 and 36, and Castagna demonstrate that  $b_k$  (the hyperbolic parameter) is independent of porosity, but claim 59 requires the single parameter mudrock *line equation* for S-wave velocity to be independent of a value of rock porosity. Ans. 4; *In re Self*, 671 F.2d

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<sup>5</sup> We note that independent claim 87 also includes this language.

<sup>6</sup> Incorporated by reference into Appellants’ Specification at page 66.

1344, 1348 (CCPA 1982) (“[A]ppellant’s arguments fail from the outset because . . . they are not based on limitations appearing in the claims.”).

In addition, as discussed above, the Examiner finds that equations 41, 42, and 32 of Appellants’ Specification indicate that the single parameter mudrock line equation for S-wave velocity is dependent on rock porosity, and Appellants do not dispute this finding. Reply Br. 3–7. Appellants’ arguments are therefore unpersuasive of reversible error in the Examiner’s rejection of claims 59–61, 65, 66, and 89 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement, which we accordingly sustain.

*Claim 87*

The Examiner finds that Appellants’ original disclosure does not describe “determining a reflectivity attribute indicating the presence of hydrocarbons in a subsurface rock formation to determine placement of an oil/gas well drilling rig” and “displaying the reflectivity attribute on a two-dimensional, or three-dimensional grid map that represents the subsurface to determine the placement of an oil/gas well drilling rig and the well target position including depth and lateral offset from the surface location of the oil/gas well drilling rig,” as recited in independent claim 87. Final Act. 5.

Appellants argue that page 32, paragraph 4 to page 33 paragraph 2 of their Specification and Figures 17A–17C of their application “show a reflectivity attribute plotted on a two-dimensional map, which is a slice through a three-dimensional map.” App. Br. 29. Appellants argue that page 2, paragraph 2 of their Specification provides “[s]upport for the placement of the drilling rig.” *Id.*

However, although Figures 17A–17C may show a reflectivity attribute plotted on a two-dimensional map as Appellants assert, we find no disclosure of displaying the reflectivity attribute on a *three-dimensional* grid map in the portions of the Specification identified by Appellants. Accordingly, Appellants’ arguments do not explain with a reasonable degree of specificity how the disclosures found at pages 32–33 of the Specification and Figures 17A–17C demonstrate that Appellants were in possession of “displaying the reflectivity attribute on a two-dimensional, or three-dimensional grid map that represents the subsurface to determine the placement of an oil/gas well drilling rig and the well target position including depth and lateral offset from the surface location of the oil/gas well drilling rig” at the time of filing. *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563–64 (Fed. Cir. 1991) (To fulfill with written description requirement “the applicant must . . . convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention. The invention is, for purposes of the ‘written description’ inquiry, *whatever is now claimed.*”). Appellants’ arguments are therefore unpersuasive of reversible error in the Examiner’s rejection of claim 87 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement, which we accordingly sustain.

#### *Claim 88*

The Examiner finds that Appellants’ original disclosure does not describe “using amplitude information of reflected seismic P-waves to image a seismic survey of reflected seismic waves” as recited in claim 88. Final Act. 5.

Appellants argue that “[t]he specification supports this language in claim 88, for example, in using amplitude information of reflected seismic P-waves as shown in Figure 15 to image a seismic survey of reflected seismic waves as shown in Figures 17A–17C.” App. Br. 30.

However, as the Examiner correctly determines (Ans. 8), Appellants do not identify any disclosure in the Specification describing how information from Figure 15 is used to image a seismic survey as shown in Figures 17A–17C. Accordingly, Appellants’ arguments do not explain with a reasonable degree of specificity how Figures 15 and 17A–17C demonstrate that Appellants were in possession of “using amplitude information of reflected seismic P-waves to image a seismic survey of reflected seismic waves” at the time of filing. *Vas-Cath*, 935 F.2d at 1563–64. Appellants’ arguments are therefore unpersuasive of reversible error in the Examiner’s rejection of claim 88 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement, which we accordingly sustain.

*Claims 69–86 and 88*

The Examiner finds that Appellants’ original disclosure does not describe “ $b_k$  is constant for a mineral with fluid filled pores and independent of porosity, varying only from mineral to mineral” as recited in independent claims 69, 78, and 88. Final Act. 4.

To fulfill the written description requirement, the original disclosure does not have to describe claimed subject matter in *haec verba*. *Vas-Cath*, 935 F.2d at 1563–64; *In re Wertheim*, 541 F.2d 257, 262 (CCPA 1976) (“The function of the description requirement is to ensure that the inventor had possession, as of the filing date of the application relied on, of the

specific subject matter later claimed by him; how the specification accomplishes this is not material.”).

As Appellants point out (App. Br. 25–26), the Specification explains that a hyperbolic mudrock line is accurate for fitting limestone and dolomite (Spec. 66), and Figure 36 illustrates a hyperbolic mudrock line fit for limestone in which  $b_k$  is a constant value of 831.7 m/s. The Examiner does not adequately explain why these disclosures would not reasonably convey to those skilled in the art that Appellants had possession at the time of filing of a method and non-transitory computer-readable medium in which “ $b_k$  is constant for a mineral with fluid filled pores and independent of porosity, varying only from mineral to mineral.” We accordingly do not sustain this rejection of claims 69–86 and 88 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement. However, as discussed above, we sustain the Examiner’s separate rejection of claim 88 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement on other grounds.

### Rejection III

#### *Claims 59–61, 65, 66, and 89*

The Examiner finds that “the amplitude information from the data representing reflected seismic waves” used in the method of claim 59 to transform S-wave velocity is not included in the recited mudrock line equation for computing S-wave velocity, rendering claim 59 (and claims 60, 61, 65, 66, and 89, which depend from claim 59) indefinite. Final Act. 6.

Appellants argue that the method of claim 59 utilizes the amplitude information of the reflected seismic P-waves in equation (42), which is set forth in the Specification and not recited in claim 59, to compute  $b_k$ , and

then uses the computed value of  $b_k$  in the mudrock line equation recited in claim 59 to compute the S-wave velocity. App. Br. 31.

However, as the Examiner correctly points out (Ans. 9), while claims must be interpreted in view of the Specification, limitations from the Specification may not be read into the claims. *Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d 861, 867 (Fed. Cir. 1985) (“Generally, particular limitations or embodiments appearing in the specification will not be read into the claims.”); *In re Priest*, 582 F.2d 33, 37 (CCPA 1978) (“We have consistently held that no ‘applicant should have limitations of the specifications read into a claim where no express statement of the limitation is included in the claim.’” (quoting *In re Prater*, 415 F.2d 1393, 1405 (CCPA 1969))).

Appellants do not direct us to any disclosure in the Specification unequivocally indicating that the method of claim 59 is limited to the use of equation (42) to compute  $b_k$ . App. Br. 31. Accordingly, although Appellants’ Specification describes utilizing equation (42) to compute  $b_k$  from, *inter alia*, the P-wave velocity (Spec. 64), this disclosure does not limit the scope of claim 59. Therefore, one of ordinary skill in the art would be uncertain as to the equations (or other means) that could be used in the method of claim 59 to compute  $b_k$  in order to compute a volume of S-wave velocity using the amplitude information from the data representing reflected seismic P-waves, rendering the scope of the claim unclear. *See, e.g., Amgen, Inc. v. Chugai Pharm. Co., Ltd.*, 927 F.2d 1200, 1217 (Fed. Cir. 1991) (a claim is considered indefinite under 35 U.S.C. § 112, second paragraph, if it does not reasonably apprise those skilled in the art of its scope).

The Examiner further finds, in connection with inclusion of the velocity of sound in water ( $V_w$ ) in the mudrock line equation recited in claim 59, that it is unclear if the water “is pure water or is in/from the subsurface rock formation having a certain degree of salinity.” Final Act. 6; Ans. 10 (citing Spec. 64 (stating that the velocity of sound in water varies “depending on salinity, temperature, etc.”)).

Appellants assert that “[w]ater in the subsurface rock formation’ is not recited in claim 59 so it’s irrelevant to claim 59.” App. Br. 31. However, Appellants do not address the basis for the Examiner’s rejection. Because claim 59 does not recite the type and/or condition (temperature, salinity) of the water in which the velocity of sound is measured (unlike claims 87 and 88 which recite “ $V_w$  is the velocity of sound in formation salt water local to the well”), one of ordinary skill in the art would be unable to determine the appropriate value for the velocity of sound in water ( $V_w$ ) to use in the mudrock line equation recited in claim 59, rendering the scope of the claim unclear.

We accordingly sustain the Examiner’s rejection of claims 59–61, 65, 66, and 89 under 35 U.S.C. § 112, second paragraph.<sup>7</sup>

*Claims 63, 73, and 82*

The Examiner finds that “the relationship between A and ‘amplitude information from the data representing reflected seismic P-waves’ is not clearly recited” in claims 63, 73, and 82, and further finds that the

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<sup>7</sup> Because we affirm the Examiner’s rejection of claim 59 under 35 U.S.C. § 112, second paragraph based on the first two grounds provided by the Examiner for finding the claim indefinite (Final Act. 6), it is unnecessary for us to reach the third ground articulated by the Examiner (*id.*).

“relationship between B and ‘amplitude information from the data representing reflected seismic P-waves’ is [also] not clearly recited” in claims 63, 73, and 82. Final Act. 6.

Appellants argue that Figure 33 and page 55, paragraph 3 of the specification state “the relationship between ‘A’ and ‘B’ and the ‘amplitude information from the data,’” rendering claims 60, 63, 73, and 82 definite. App. Br. 33–34.

However, the portion of the Specification cited by Appellants indicates that “Figure 33 illustrates a method of least-squares inversion to determine volumes of A and B parameters.” Appellants’ arguments do not adequately explain how this disclosure relating to *volumes* of A and B parameters in combination with Figure 33 clarifies the relationship between the A and B parameters and the amplitude information from the data representing reflected seismic P-waves called into question by the Examiner. Therefore, Appellants’ arguments are insufficient to identify reversible error in the Examiner’s rejection of claims 63, 73, and 82 under 35 U.S.C. § 112, second paragraph as being indefinite, which we accordingly sustain. *Jung*, 637 F.3d at 1365.

*Claims 62–64, 67–88, and 90*

The Examiner finds that it is unclear if the mudrock line equation recited in independent claims 62, 87, and 88, or the “formula” recited in independent claims 69 and 78, is used to determine/compute both  $b_k$  and  $V_s$ . Final Act. 6–7. The Examiner finds that if this is the case, independent claims 62, 69, 78, 87, and 88 (and the claims depending therefrom (claims 63, 63, 67, 68, 70–77, 79–86, and 90)) are “indefinite because there are two

implied unknowns (i.e., S-wave velocity,  $b_k$ ). Two unknowns cannot be transformed/computed using one equation.” *Id.*

Appellants agree with the Examiner that two unknowns cannot be computed using one equation, and argue that their method does not do so. App. Br. 34–35. Appellants contend that instead, the method of claims 62, 69, 78, 87, and 88 uses amplitude information of the reflected seismic P-waves in equation (42) described in the Specification, which is not recited in the claims, to compute  $b_k$ , and then uses the mudrock line equation or formula recited in claims 62, 69, 78, 87, and 88 to compute the S-wave velocity using the computed  $b_k$  value. *Id.* Appellants assert that their Specification explains that the single-parameter mudrock line equation needs only one parameter— $b_k$ —to relate  $V_s$  to  $V_p$ . App. Br. 36.

However, as discussed above, the description in Appellants’ Specification of utilizing equation (42) to compute  $b_k$  may not be read into claims 62, 69, 78, 87, and 88. Accordingly, one of ordinary skill in the art would be uncertain as to the equations (or other means) that could be used in the method of claims 62, 69, 78, 87, and 88 to compute  $b_k$  in order to compute the S-wave velocity using the mudrock line equation recited in claims 62, 87, and 88, or using the “formula” recited in claims 69 and 78. Consequently, one of ordinary skill in the art would be unable to determine the metes and bounds of claims 62, 69, 78, 87, and 88. We accordingly sustain the Examiner’s rejection of these claims under 35 U.S.C. § 112, second paragraph. Having done so, it is unnecessary for us to reach the additional grounds provided by the Examiner for rejecting claims 62, 87, and 88 under 35 U.S.C. § 112, second paragraph (Final Act. 6–7). *Cf. In re Gleave*, 560 F.3d 1331, 1338 (Fed. Cir. 2009) (not reaching obviousness

after finding anticipation); *In re Basell Poliolefine*, 547 F.3d 1371, 1379 (Fed. Cir. 2008) (“Having concluded that the Board properly affirmed the rejection of claims 1–52 of the ’687 patent based on obviousness-type double patenting in view of the ’987 patent, we need not address the remaining issues raised by Basell regarding the §§ 102(b) and 103(a) rejections, as well as the additional double patenting rejections.”); *Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (ITC having decided a dispositive issue, there was no need for the Commission to decide other issues decided by the presiding officer).

*Claims 89 and 90*

Claims 89 and 90 recite that “B is a seismic reflection amplitude gradient, wherein B is a calibrated value for the amplitude gradient.”

The Examiner determines that the recitation in claims 89 and 90 that “B is a seismic reflection amplitude gradient” is inconsistent with the recitation that “B is a calibrated value for the amplitude gradient.” Final Act. 8. The Examiner further determines that “the amplitude gradient” lacks antecedent basis because it is unclear if “the amplitude gradient” refers to the “seismic reflection amplitude gradient.” *Id.* The Examiner determines that if this is the case, “the claims are indefinite because ‘B is a calibrated value for B’ is indefinite.” *Id.*

However, as Appellants correctly argue, the Specification explicitly defines “B” as the seismic reflection amplitude gradient, and describes calibration of the B value. App. Br. 37 (citing Spec. 51, 61). The plain language of claims 89 and 90—in view of the description provided in the Specification—is sufficiently clear to allow one of ordinary skill in the art to understand that the recitation of “B is a calibrated value for the amplitude

gradient” refers to a calibrated value for the seismic reflection amplitude gradient. “[T]he amplitude gradient” recited in claims 89 and 90 therefore does not lack antecedent basis, and one of ordinary skill in the art would reasonably be able to understand the scope and meaning of claims 89 and 90.

We accordingly do not sustain this rejection of claims 89 and 90 under 35 U.S.C. § 112, second paragraph. However, as discussed above, we sustain the Examiner’s rejection of claims 89 and 90 under 35 U.S.C. § 112, second paragraph on other grounds.

#### Rejection IV

Independent claims 69 and 78 both recite “using amplitude information of reflected seismic P-waves to determine a volume of parameter  $b_k$  required by a formula for computing a volume of S-wave velocity  $V_s$  from a volume of a P-wave velocity  $V_P$ ,” and recite that “ $b_k$  is constant for a mineral with fluid filled pores and independent of porosity, varying only from mineral to mineral.”

The Examiner finds that Carrazzone discloses all of the features of claims 69 and 78 except computing, by a processor, the volume of parameter  $b_k$  required by a formula for computing a volume of S-wave velocity  $V_s$ , wherein  $b_k$  is constant for a mineral with fluid-filled pores and independent of porosity, varying only from mineral to mineral. Final Act. 12–13; Ans. 23.

The Examiner finds that Castagna discloses computing the density of sandstone grains ( $\rho_s$ ) using equation 5d, and discloses that the density of sandstone grains ( $\rho_s$ ) is required by equation 10 to determine  $V_s$ . Final Act. 13; Ans. 24–25. The Examiner interprets the “parameter  $b_k$ ” recited in

claims 69 and 78 as “any” parameter, including the grain density ( $\rho_s$ ) disclosed in Castagna. Ans. 23. The Examiner finds that Castagna’s disclosure of computing the density of sandstone grains ( $\rho_s$ ) using equation 5d, which is required by equation 10 to determine  $V_s$ , therefore corresponds to determining a volume of a parameter  $b_k$  required by a formula for computing a volume of S-wave velocity  $V_s$ . Ans. 23–25. The Examiner finds that “in Castagna, while the density of wet rock  $\rho_w$  depends on porosity (see equation 5d) the density of grains,  $\rho_s$ , is constant and does not depend on porosity.” Ans. 24–25 (emphasis omitted). The Examiner concludes that “it would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide Carrazzone . . . with the equations as disclosed by Castagna . . . for the purposes of computing, by a processor, a volume of parameter  $b_k$  and a volume of S-wave velocity  $V_s$ .” Final Act. 13; Ans. 24.

However, as Appellants correctly argue (App. Br. 44–45), Castagna discloses that the grain density described in the reference is dependent upon—rather than independent of—porosity. Castagna 576–577. Specifically, equation (5d) of Castagna indicates that the density of sandstone grains ( $\rho_s$ ) is dependent on the porosity ( $\phi$ ) of the sandstone:

$$\rho_w = \phi\rho_F + (1 - \phi)\rho_s, \quad (5d)$$

where  $\rho_w$  is the density of wet sandstone,  $\phi$  is the porosity, and  $\rho_F$  is the density of the fluid, and  $\rho_s$  is the density of sandstone grains. *Id.* at 576. Castagna further discloses that Equations (5a)–(5d), (9), and (10) set forth in the reference “allow computation of  $V_s$  given  $V_p$ ,  $\phi$  [porosity], and the grain and fluid densities and bulk moduli.” *Id.* at 577. In view of these

disclosures, even if the grain density disclosed in Castagna corresponds to a volume of a parameter  $b_k$  required by a formula for computing a volume of S-wave velocity  $V_s$  from a volume of a P-wave velocity  $V_p$  as the Examiner asserts, the Examiner does not provide a sufficient factual basis to establish that the grain density is independent of porosity, as required by claims 69 and 78.

Therefore, the Examiner fails to establish that the combined disclosures of Carrazzone and Castagna would have suggested using amplitude information of reflected seismic P-waves to determine a volume of parameter  $b_k$  required by a formula for computing a volume of S-wave velocity  $V_s$  from a volume of a P-wave velocity  $V_p$ , in which  $b_k$  is constant for a mineral with fluid filled pores *and independent of porosity*, varying only from mineral to mineral, as required by claims 69 and 78. It follows that the Examiner fails to establish a prima facie case of obviousness of the subject matter recited in claims 69 and 78 within the meaning of 35 U.S.C. § 103(a). *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992) (“[T]he examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a prima facie case of unpatentability.”).

We accordingly do not sustain the Examiner’s rejection of claims 69 and 78 under 35 U.S.C. § 103(a).

#### DECISION

We affirm the Examiner’s rejection of claims 59–90 under 35 U.S.C. § 101, rejection of claims 59–61, 65, 66, and 87–90 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement, and rejection of claims 59–90 under 35 U.S.C. § 112, second paragraph. We reverse the Examiner’s rejection of claims 62–64, 67–86,

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and 90 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement, and rejection of claims 69 and 78 under 35 U.S.C. § 103(a).

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED