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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte NIKITA V. CHUGUNOV and
TERIZHANDUR S. RAMAKRISHNAN

Appeal 2017-010167
Application 13/286,040
Technology Center 2100

Before THU A. DANG, CATHERINE SHIANG, and
JOHN P. PINKERTON, *Administrative Patent Judges*.

DANG, *Administrative Patent Judge*.

DECISION ON APPEAL

I. STATEMENT OF THE CASE

Appellant[1] appeals under 35 U.S.C. § 134(a) from the Final Rejection of claims 1–9, 11–14, and 17. Claims 10, 15, 16, 18, and 19 were previously canceled. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

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[1] Appellant identifies the real party in interest is Schlumberger Technology Corporation. App. Br. 2.

A. INVENTION

According to Appellant, the invention relates to "quantification of uncertainty in reservoir performance." (Spec. ¶ 1).

B. REPRESENTATIVE CLAIM

Claim 1 is representative of the subject matter on appeal:

> 1. A method for designing a monitoring program for a formation, comprising:
>
> (a) performing a measurement on the formation to obtain data associated with a physical property of the formation, wherein the measurement is made using at least one of well logging and a formation survey;
>
> (b) generating multiple representative realizations of a reservoir model using the data;
>
> (c) calculating a plurality of values for a property of at least one individual block within a grid by performing reservoir simulations using the realizations of the reservoir model;
>
> (d) calculating a tool measurement response corresponding to each realization of the reservoir model and the plurality of values for the property for at least two moments in time;
>
> (e) calculating a probability distribution for the tool measurement response of the at least one block;
>
> (f) distributing the tool measurement response of the at least one block and its probability distribution onto a map to generate a probability-map representing the formation for at least two moments in time; and
>
> (g) designing a monitoring program for the formation the probability-map;
>
> wherein processes (b) to (g) are performed by a processor.

C. REJECTIONS

Claims 1, 4–8, and 11 stand rejected under 35 U.S.C. § 103(a) over Busby (US 2009/0043555 A1; published Feb. 12, 2009), Zhu (WO 2009/126375 A1; published Oct. 15, 2009), and Gurpinar (US 6,980,940 B1; issued Dec. 27, 2005).

Claims 2, 3, 12–14, and 17 stand rejected under 35 U.S.C. § 103(a) over Busby, and Van Bemmel (US 6,912,491 B1; issued June 28, 2005).

Claim 9 stands rejected under 35 U.S.C. § 103(a) over Busby, and Edwards (US 2009/0132458 A1; published May 21, 2009).

II. ISSUES

The principal issues before us are whether the Examiner erred in finding the combination of Busby, Zhu, and Gurpinar teaches or *would have suggested* a method comprising the steps of "generating multiple representative realizations of a reservoir model" using "data associated with a physical property of the formation," and "calculating a tool measurement response corresponding to each realization of the reservoir model" (Claim 1).

III. FINDINGS OF FACT

The following Findings of Fact (FF) are shown by a preponderance of the evidence.

Busby

1. Busby discloses a method for evaluating an underground reservoir production scheme taking account of uncertainties, which comprises

constructing an approximate analytical model allowing the reservoir responses to be predicted, and evaluating the production scheme by analyzing the reservoir responses predicted by the approximate analytical model. Busby, Abstract. A reservoir model is constructed describing the spatial structure of the reservoir and property values characterizing the reservoir (porosity, permeability, lithology, pressure, nature of the fluids, etc.) associated therewith, wherein uncertainty has to be taken into account. *Id.* at ¶ 7.

Zhu

2. Zhu discloses a method for generating anisotropic resistivity models of a subsurface reservoir for seismic and well data, which provides for analyzing the uncertainty associated with the prediction of the resistivity volume. Zhu, Abstract. The method includes predicting electrical properties by incorporating information from seismic and well log data, and using rock physics models that link rock properties to geophysical responses. *Id.* at ¶ 2. The method first "provides a model as an initial guess and then updates the model until an acceptable match is obtained between the acquired and predicted data." *Id.* at ¶ 24.

Gurpinar

3. Gurpinar discloses a method of managing a fluid or gas reservoir which comprises iteratively producing a reservoir development plan that is used to optimize an overall performance of a reservoir. Gurpinar, Abstract. The method includes monitoring a performance of the reservoir by acquiring high rate monitoring data from a set of data measurement taken in the reservoir and using the high rate monitor data to perform well-regional and

field-reservoir evaluations. *Id.* When necessary, the initial reservoir development plan is updated. *Id.*

IV. ANALYSIS

We have reviewed the Examiner's rejection in light of Appellant's arguments presented in this appeal. Arguments which Appellant could have made, but did not make in the Brief are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(iv) (2016). On the record before us, we are unpersuaded the Examiner erred. We adopt as our own the findings and reasons set forth in the rejections from which the appeal is taken and in the Examiner's Answer, and provide the following for highlighting and emphasis.

Appellant contends that Busby "has nothing to do with calculating a tool measurement response, let alone calculating a tool measurement response corresponding to each realization of a reservoir model" as claimed. Br. 5. Instead, according to Appellant, Busby "constructs an analytical model for the output of the flow simulator by performing as few reservoir simulations as possible." *Id.* Similarly, Appellant also contends Gurpinar fails to disclose or suggest "calculating a tool measurement response corresponding to each realization of [a] reservoir model" as recited. *Id.* at 6.

Further, according to Appellant, Zhu "does not alleviate the deficiencies" of Busby. *Id.* In particular, Appellant contends that Zhu fails to disclose or suggest "a reservoir model that is used to perform reservoir simulations," and instead, "uses a rock physics model to convert seismic data to resistivity data," wherein the rock physics model "does not constitute the reservoir model" required by claim 1. *Id.* at 5.

Appellant concedes that, in Busby, "actual measurements are used to determine properties in a reservoir model." *Id.* at 7. Appellant also concedes that Zhu discloses a "calculation of tool measurement response," wherein one could "use a calculation of tool measurement response (such as the calculation in the Zhu reference) to help determine a reservoir model (such as the model in the Busby reference) by comparing actual tool response to predicted tool response." *Id.* However, according to Appellant, the resulting combination "would merely use the calculation of tool measurement response to determine a reservoir model and reservoir properties" instead of "calculating a tool measurement response corresponding to each realization of a reservoir model" as claimed. *Id.* That is, in claim 1, "the tool measurement response is calculated *after* the realization of the reservoir model are *already* determined," in contrast to the prior art. *Id.*

Further, Appellant contends that the rejection lacks a rational underpinning to support the combination of Busby and Zhu. *Id.* at 6–7. In particular, according to Appellant, there would be no reason for a person of ordinary skill in the art to combine Busby and Zhu "because the references address different problems." *Id.* at 8. Appellant contends that Busby "is directed to reservoir production" while, in contrast, Zhu "is directed to hydrocarbon exploration" and "converting seismic data to resistivity data so that hydrocarbons can be detected using the resistivity data." *Id.* Thus, according to Appellant, since the goal of Busby is "designing an optimized reservoir production scheme" wherein "[o]nce the reservoir model is determined . . . , there is no reason (or obvious benefit) to add a calculation of tool measurement response." *Id.*

We have considered all of Appellant's arguments and evidence presented. However, we agree with the Examiner's findings, and find no error with the Examiner's conclusion that claim 1 would have been obvious over the *combination* of the teachings *and suggestions* of Busby, Zhu, and Gurpinar.

Although Appellant contends that Busby "has nothing to do with calculating a tool measurement response," that Gurpinar fails to disclose or suggest "calculating a tool measurement response corresponding to each realization of a reservoir model," and that Zhu fails to disclose or suggest "a reservoir model that is used to perform reservoir simulation" (App. Br. 5–6), the Examiner rejects the claim as obvious over the combination of Busby, Zhu, and Gurpinar. The test for obviousness is what the combination of Busby, Zhu, and Gurpinar teaches or would have suggested to one of ordinary skill in the art. *See In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). As the Examiner points out, "one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references." Ans. 2 (citing *In re Keller*, 642 F.2d 413, 426 (CCPA 1981); *Merck*, 800 F.2d at 1097).

Thus, although Appellant contends that Zhu fails to disclose or suggest "a reservoir model that is used to perform reservoir simulation" (App. Br. 5–6), the Examiner relies on Busby, instead, for teaching and suggesting the claimed reservoir model. *See* Final Rej. 3–5. Busby discloses a method for evaluating an underground reservoir production scheme taking account of uncertainties, which comprises constructing an approximate analytical model (describing the spatial structure of the reservoir and property values characterizing the reservoir), allowing the reservoir responses to be predicted. FF 1. In Busby, the production scheme is evaluated by analyzing the reservoir responses predicted by the approximate analytical model. *Id.*

As Appellant concedes, in Busby, "actual measurements are used to determine properties in a reservoir model." App. Br. 7. Further, as the Examiner finds, "[Busby] is concerned with evaluating schemes in the presence of uncertainty" and thus is directed "to both measurements and responses." Ans. 4–5. Thus, although Appellant contends that Busby fails to disclose a tool measurement response that is "calculated *after* the realizations of the reservoir model are *already* determined" (App. Br. 7), the Examiner finds that "Busby discloses relationships between initial measurements (initial measures) and uncertainty in input parameters" wherein "Busby discloses relationships between uncertainties in input parameters and 'global uncertainty of a response' (final measures) for the selection of new measurements." Ans. 5.

Further, the Examiner relies on Zhu for teaching and suggesting the claimed "tool measurement response." Final Rej. 6–7; Ans. 7. Zhu discloses a method for generating models, such as anisotropic resistivity models, of a reservoir, which provides for analyzing the uncertainty associated with predictions, such as predictions of the resistivity volume, wherein the method includes predicting electrical properties and using a model, such as a rock physics model, that links rock properties to geophysical responses. FF 2. In Zhu, the method first "provides a model as an initial guess and then updates the model until an acceptable match is obtained between the acquired and predicted data." *Id.* In Zhu, the tool measurement is calculated after the model is determined. *Id.* Even Appellant acknowledges that Zhu discloses a "calculation of tool measurement response." App. Br. 7. Here, the Examiner finds that Zhu discloses "modeling for predicting responses along with the associated uncertainties." Ans. 7. As the Examiner finds, "Zhu['s] methods allow for an accounting of the uncertainties between the measurements and properties as well as the properties and predicted measurements." Ans. 9.

The Examiner then relies on Gurpinar for teaching and suggesting a "monitoring program" and in particular, "Gurpinar is concerned with uncertainties in data associated with a monitoring program used in the context of production," which includes "reservoir monitoring, data assimilation and model updating." Ans. 8. In particular, Gurpinar discloses a method which comprises iteratively producing a reservoir development plan that is used to optimize an overall performance of a reservoir, wherein the method includes monitoring a performance of the reservoir by acquiring monitoring data from data measurement taken in the reservoir. FF 3. Gurpinar then updates the reservoir development plan. *Id.*

Accordingly, we agree with the Examiner's finding that the combination of Busby, Zhu, and Gurpinar teaches or at least suggests the contested limitations.

We are also not persuaded by Appellant's contention that there would be no reason for a person of ordinary skill in the art to combine Busby and Zhu "because the references address different problems." Br. 8. Here, we find no error with the Examiner's combination of: 1) Busby's use of actual measurements to determine properties in a reservoir model and generating realizations of the reservoir model using the measurements (FF 1), with 2) Zhu's calculation of tool measurement responses and updating a model until an acceptable match is obtained between the acquired and predicted data, to account for uncertainties (FF 2), for teaching and suggesting the contested limitations of claim 1. That is, according to the Examiner, the references are directed to the same field of endeavor of addressing "the propagation of uncertainties as it relates to geological modeling" (Ans. 11), wherein Zhu also "allow[s] for an accounting of the uncertainties between the measurements and properties as well as the properties and predicted measurements," while "Busby is relating the uncertainty of the inputs with uncertainties of the outputs by running multiple flow simulation where each simulation includes a different realization of the input parameters." *Id.* at 9. Thus, "Zhu's methods may be used to determine the uncertainties which are used for each realization as found in Busby's methods." *Id.* at 10.

The Supreme Court guides that the conclusion of obviousness can be based on the background knowledge possessed by a person having ordinary skill in the art. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). The skilled artisan is "a person of ordinary creativity, not an automaton." *Id.* at 421. Here, we agree with the Examiner that one of ordinary skill in the art, upon reading Busby's need to account of uncertainties while allowing the reservoir responses to be predicted (FF 1), would have found it obvious to apply Zhu's calculating tool measurement responses and updating a prediction model to account for uncertainties (FF 2), as well as Gurpinar's model updating in reservoir modeling (FF 3).

Accordingly, Appellant has not shown the Examiner erred in rejecting claim 1, and claims 4–8, and 11, which are not separately argued and thus falling therewith, over Busby, Zhu, and Gurpinar. Appellant does not provide substantive arguments for claims 2, 3, 9, 12–14, and 17 separate from those for claim 1. Br. 8. Accordingly, we also affirm the Examiner's rejections of: claims 2, 3, 12–14, and 17 over Busby, in further view of Van Bemmel; and of claim 9 over Busby, in further view of Edwards.

V. DECISION

We affirm the Examiner's rejections of claims 1–9, 11–14, and 17 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)(1)(iv).

AFFIRMED