



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO. Includes application details for Dennis J. Haggerty and examiner information for Jennifer Hawkins.

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patents@chamberlainlaw.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte DENNIS J. HAGGERTY

Appeal 2019-006184
Application 14/653,743
Technology Center 3600

Before MICHELLE R. OSINSKI, ERIC C. JESCHKE, and
AMANDA F. WIEKER, *Administrative Patent Judges*.

WIEKER, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE¹

Pursuant to 35 U.S.C. § 134(a), Appellant² appeals from the Examiner’s decision to reject claims 1–13 and 18–29, which constitute all pending claims. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

¹ In this Decision, we refer to the Specification dated June 18, 2015 (“Spec.”), the Final Action dated October 9, 2018 (“Final Act.”), the Appeal Brief dated April 16, 2019 (“Appeal Br.”), the Examiner’s Answer dated June 18, 2019 (“Ans.”), and the Reply Brief dated August 19, 2019 (“Reply Br.”).

² We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42(a). Appellant identifies the real party in interest as Halliburton Energy Services, Inc. Appeal Br. 3.

CLAIMED SUBJECT MATTER

The claims are directed to methods of determining effects of perforation on a subterranean formation sample under elevated pressure conditions. Appeal Br. 26–30 (Claims Appx.); Spec., Abstract.

Claim 1, reproduced below, is illustrative of the claimed subject matter:

1. A method for determining effects of perforation on a subterranean formation sample, comprising:

selecting a formation sample;

creating a perforation tunnel in the formation sample while the formation sample is subjected to an elevated pressure;

flowing a fluid into the formation sample and through the perforation tunnel while the formation sample remains subjected to the elevated pressure; and

thereafter conducting tomographic scans of flow in the formation sample and the perforation tunnel while the fluid is flowing in the formation sample and the perforation tunnel and while the formation sample remains subjected to the elevated pressure.

Appeal Br. 26 (Claims Appx.).

REFERENCES

The Examiner relies upon the following prior art:

Name	Reference	Dates
Haggerty et al.	US 2009/0241700 A1	Filed Mar. 31, 2008 Published Oct. 1, 2009
Gilliland et al.	US 5,297,420	Filed May 19, 1993 Issued Mar. 29, 1994
Blauch	US 5,331,155	Filed May 8, 1992 Issued July 19, 1994
Grader et al.	US 2014/0086381 A1	Filed Sept. 26, 2013 Published Mar. 27, 2014
Maucec	US 2012/0223235 A1	Filed Mar. 4, 2011 Published Sept. 6, 2012
Lecerf et al.	US 2014/0076544 A1	Filed Sept. 13, 2013 Published Mar. 20, 2014
Coenen	US 2010/0126266 A1	Filed Apr. 24, 2008 Published May 27, 2010

REJECTIONS

The Examiner maintains the following rejections:

1. Claims 1, 2, 6, 7, and 11–13 under 35 U.S.C. § 103 as unpatentable over Haggerty and Gilliland.
2. Claims 3–5 under 35 U.S.C. § 103 as unpatentable over Haggerty, Gilliland, and Blauch.
3. Claim 8 under 35 U.S.C. § 103 as unpatentable over Haggerty, Gilliland, and Grader.
4. Claims 9 and 21 under 35 U.S.C. § 103 as unpatentable over Haggerty, Gilliland, and Maucec.

5. Claims 10 and 25–27 under 35 U.S.C. § 103 as unpatentable over Haggerty, Gilliland, and Lecerf.
6. Claims 18–20 under 35 U.S.C. § 103 as unpatentable over Haggerty, Gilliland, and Coenen.
7. Claim 22 under 35 U.S.C. § 103 as unpatentable over Haggerty, Gilliland, Maucec, and Lecerf.
8. Claims 23 and 24 under 35 U.S.C. § 103 as unpatentable over Haggerty, Gilliland, Maucec, and Blauch.
9. Claim 28 under 35 U.S.C. § 103 as unpatentable over Haggerty, Gilliland, Lecerf, and Blauch.
10. Claim 29 under 35 U.S.C. § 103 as unpatentable over Haggerty, Gilliland, Lecerf, Blauch, and Maucec.

OPINION

Rejection 1

Appellant presents arguments directed to independent claim 1, and relies upon those arguments with respect to dependent claims 2, 6, 7, and 11–13. Accordingly, we treat claim 1 as representative for this Rejection.

The Examiner finds that Haggerty discloses the majority of limitations of claim 1, including the steps of creating a perforation tunnel in a formation sample while the sample is subjected to elevated pressure and flowing a fluid through the sample and perforation tunnel while remaining at the elevated pressure. Final Act. 5. The Examiner finds that Haggerty also teaches performing tests on the perforated sample, while under pressure, but does not disclose conducting the specific type of test that is claimed—tomographic scans. *Id.* at 3, 5; Ans. 4–5, 7.

The Examiner finds that Gilliland teaches a method for measuring properties of a downhole rock formation that involves placing a formation sample into a pressurized vessel, flowing fluid through the sample, and conducting tomographic scans of the fluid flow through the sample. Final Act. 5. The Examiner finds that a person of ordinary skill in the art would have found it obvious “to have modified the method of [Haggerty] to include conducting tomographic scans of the flow through the sample, as suggested by [Gilliland], and perforation in order to have been able to establish the relative permeability and capillary pressure of the downhole formation.” *Id.*

Appellant presents three main arguments. Appeal Br. 11–16. First, Appellant argues that Gilliland does not disclose tomographic scanning of a perforated sample, as claimed, but only teaches scanning an *unperforated* core sample. *Id.* at 13 (also arguing Haggerty does not disclose tomographic scanning), 15 (“Gilliland fails to discuss . . . perforating the core sample 10 while maintaining an elevated pressure.”).

Second, Appellant argues that although Haggerty teaches maintaining an elevated pressure while perforating a sample and while conducting flow tests, Haggerty’s apparatus is disassembled after flow testing. Appeal Br. 14–15. Therefore, according to Appellant, Haggerty does not teach maintaining pressure while performing any other subsequent action, such as tomographic scanning. *Id.* at 15.

Third, Appellant argues that, as disclosed in the Specification, “[s]canning the fluid flow through the perforation tunnel enables better analysis of the performance of a shaped charge that created the perforation tunnel.” Appeal Br. 13. According to Appellant, “Gilliland’s sole purpose is to better understand the properties of the reservoir based on tests

performed on a core sample. Gilliland does not provide any reason to determine how the reservoir might react to any type of event, much less a perforation event.” *Id.*; *see also* Reply Br. 5–6. Therefore, Appellant alleges that “the proposed combination of Haggerty and Gilliland is impermissibly based on hindsight bias.” Appeal Br. 16.

Appellant has not demonstrated error in the Examiner’s findings regarding Haggerty. Haggerty discloses a testing apparatus substantially similar to that of the Specification. *See* Ans. 10 (comparing structures). Haggerty discloses steps of:

- creating a perforation tunnel in a formation sample while at elevated pressure (*see* Haggerty ¶ 32 (“confining pressure, wellbore pressure and pore pressure may be applied to target core 22”), ¶ 33 (“In this configuration . . . [g]un assembly 18 may now be used to detonate shaped charge 20 to form a perforation in target core 22.”));
- flowing a fluid into the sample and perforation tunnel while at the elevated pressure (*id.* ¶ 33 (“Once perforation 64 has been formed, the pore pressure is maintained or adjusted to initiate flow through target core 22.”), Figs. 3–4); and
- conducting flow tests in the sample and perforation tunnel while the fluid is flowing and while at the elevated pressure (*id.* ¶¶ 33–34 (“[F]luid is allowed to flow through target core 22 until no further change in flow rate occurs. Thereafter, any number and type of flow tests, such as those discussed above, may be performed. Following flow testing, apparatus 10 is disassembled and target

core 22 may be cut along its axial axis such that characteristics of the perforation can be determined.”), Fig. 4).

By this method, Haggerty obtains performance data, including target core permeabilities, perforation geometry, and differential pressure. *Id.* ¶35. Thus, we agree with the Examiner that Haggerty teaches all limitations of claim 1, except that Haggerty’s testing at elevated pressure does not involve conducting tomographic scans. Final Act. 5; Ans. 4.

Appellant also has not demonstrated error in the Examiner’s findings regarding Gilliland. Gilliland teaches a method of measuring properties of rock samples, including steps of placing a sample under pressure, flowing fluid through the sample, and conducting tomographic scans of the sample while the fluid is flowing. Gilliland, Abstract, 3:62–68, 5:38–54. Gilliland explains that tomographic scanning is useful for determining important properties like relative permeability and is advantageous because of, e.g., “its ability to display the electron density variations within the object scanned in a two-dimensional X-ray image.” *Id.* at 1:25–47, 2:40–55, 3:62–68, 5:54–67; *see also id.* at 1:10–11 (importance of permeability), 1:54–60 (additional advantages of tomography). Thus, we agree with the Examiner that Haggerty teaches conducting tomographic scans of a sample while fluid is flowing through it, in order to determine important flow parameters like permeability. Final Act. 5; Ans. 5.

In light of these teachings, we discern no error in the Examiner’s finding that a person of ordinary skill in the art would have found it obvious to modify Haggerty’s teachings to conduct tomographic scans of Haggerty’s perforated formation, such that relative permeability of the perforated formation can be determined. Final Act. 5. Gilliland supports the

Examiner’s finding that tomographic scanning is useful for determining important parameters of formation samples, such as relative permeability. Gilliland, 2:40–41, 5:40–63. We agree with the Examiner that this combination “would have allowed for the determination of [flow] parameters, as well as those disclosed by Haggerty et al., along the length of the perforation tunnel 64 of Haggerty.” Ans. 5.

We disagree with Appellant’s argument that there is no reason for the proposed modification, apart from hindsight. *See, e.g.*, Appeal Br. 13, 15–16. Haggerty teaches all limitations, including the step of conducting flow tests under pressure, except that Haggerty’s tests are not the specific type claimed—tomographic scans. Haggerty ¶¶ 32–35. Gilliland teaches conducting the specific type of flow test that is claimed—tomographic scans—because tomography provides advantages in determining relative permeability. Gilliland, 2:40–41, 5:40–63. Permeability is an important property, and is also detected by Haggerty’s tests. *Id.* at 2:40–41; Haggerty ¶ 35. Thus, we discern no error in the Examiner’s conclusion that it would have been obvious to modify Haggerty to include tomographic scanning in order to better determine relative permeability, as taught by Gilliland.

That Gilliland teaches tomographic scanning of an *unperforated* formation is not dispositive. Appeal Br. 13. The test for obviousness is what the *combined teachings* of the references as a whole would have suggested to those of ordinary skill in the art, not merely what Gilliland discloses. *In re Keller*, 642 F.2d 413, 425 (CCPA 1981); *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (“Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references.”). Here, Haggerty

plainly teaches performing flow tests on a perforated formation under pressure. Haggerty ¶ 33. We agree with the Examiner that “[t]he modification of Haggerty et al. to include the step of conducting tomographic scans would result in [Haggerty’s] perforated formation sample being scanned.” Ans. 6–7. We also agree with the Examiner that the use of tomographic scanning “is the same regardless of the characteristics of the formation sample being scanned,” i.e., whether perforated or not. *Id.* at 6. Appellant has not presented any persuasive reasoning to the contrary.

It is also not dispositive that Haggerty fails to disclose tomographic scanning at elevated pressure. Appeal Br. 14. Again, the Examiner rejected the claim over the *combination* of references. Haggerty plainly teaches performing flow tests at elevated pressure, and Gilliland plainly teaches a specific type of testing—tomographic scanning. We agree with the Examiner that the combination of teachings would have led a skilled artisan to employ Gilliland’s specific testing technique—tomographic scanning—in the process taught by Haggerty, i.e., while maintaining an elevated pressure of a perforated sample.

Accordingly, for the foregoing reasons, we are not apprised of error in the Examiner’s rejection of claim 1, which we affirm. For the same reasons, we affirm the rejection of claims 2, 6, 7, and 11–13.

Rejections 2, 3, 4 (Claim 9 only), 5 (Claim 10 only), and 6

The Examiner finds that claims 3–5, 8–10, and 18–20, each of which ultimately depends from claim 1, would have been obvious over the combined teachings of Haggerty and Gilliland, in further combination with Blauch, Grader, Maucec, or Lecerf. Final Act. 7–13. Appellant relies upon its unpersuasive arguments made with respect to claim 1, and further

contends that Blauch, Grader, Maucec, and Lecerf fail to cure the purported deficiencies argued regarding claim 1. Appeal Br. 16–18; Reply Br. 6–7.

The Examiner does not rely upon Blauch, Grader, Maucec or Lecerf to cure the purported deficiencies in the combination of Haggerty and Gilliland. Final Act. 7–13. Accordingly, Appellant has not apprised us of error, and we affirm the rejections of claims 3–5, 8–10, and 18–20.

Rejection 4 (Claim 21 only)

The Examiner’s findings regarding independent claim 21 are substantially similar to those made regarding claim 1, except that the Examiner relies upon Maucec for the additional step of “collecting image data . . . and, thereafter, processing the image data to create images of the flow in the sample.” Final Act. 12–13. Appellant relies upon substantially the same unpersuasive arguments made with respect to claim 1, and further contends that Maucec fails to cure the purported deficiencies argued regarding claim 1. Appeal Br. 18–20; Reply Br. 5–7. However, the Examiner does not rely upon Maucec to cure the purported deficiencies in the combination of Haggerty and Gilliland. Final Act. 12–13.

Appellant also contends that “Maucec is cited as allegedly teaching, ‘conducting tomographic scans of flow in the formation sample while fluid is flowing in the sample,’” and disputes Maucec’s teachings in that regard. Appeal Br. 19. However, the Examiner does not rely upon Maucec for this limitation. Final Act. 12–13 (“It would have been considered obvious . . . to have modified the method of [Haggerty] to include conducting tomographic scans of the flow through the sample, *as suggested by [Gilliland]*, and perforation in order to have been able to establish the relative permeability and capillary pressure of the downhole formation.”) (emphasis added), 13

(finding that “[Haggerty], as modified, discloses all of the limitations of the above claim(s) except for the method additionally comprising collecting data from the tomographic scans and processing the data to form images of the fluid flow,” and finding that Maucec teaches that limitation).

Accordingly, for the foregoing reasons, we are not apprised of error in the Examiner’s rejection of claim 21, which we affirm.

Rejections 7 and 8

The Examiner finds that claims 22–24, each of which ultimately depends from claim 21, would have been obvious over the combined teachings of Haggerty, Gilliland, and Maucec, in further combination with Blauch or Lecerf. Final Act. 14–15. Appellant relies upon its unpersuasive arguments made with respect to claim 21, and further contends that Blauch and Lecerf fail to cure the purported deficiencies argued regarding claim 21. Appeal Br. 20–21; Reply Br. 6–7.

The Examiner does not rely upon Blauch or Lecerf to cure the purported deficiencies in claim 21. Final Act. 14–15. Accordingly, we affirm the rejection of claims 22–24.

Rejection 5 (Claim 25–27 only)

The Examiner’s findings regarding independent claim 25 are substantially similar to those made regarding claim 1, except that the Examiner relies upon Lecerf for the additional step of “using tomographic scans of the sample made under the elevated pressure to make a three dimensional image of the walls of the perforation tunnel in the formation sample.” Final Act. 15–17. Appellant relies upon substantially the same unpersuasive arguments made with respect to claim 1, and further contends that Lecerf fails to cure the purported deficiencies argued regarding claim 1.

Appeal Br. 21–23; Reply Br. 5–7. However, the Examiner does not rely upon Lecerf to cure the purported deficiencies in the combination of Haggerty and Gilliland. Final Act. 15–17.

Appellant also contends that “Lecerf is cited as allegedly teaching a method of collecting tomographic scans of a formation sample and processing the data to form a three dimensional depiction of a ‘wormhole’ in the sample,” and disputes Lecerf’s teachings in that regard. Appeal Br. 22. However, the Examiner does not rely upon Lecerf for the limitation of conducting tomographic scans while fluid is flowing in the sample. Final Act. 16 (“It would have been considered obvious . . . to have modified the method of [Haggerty] to include conducting tomographic scans of the flow through the sample, as suggested by [Gilliland], and perforation in order to have been able to establish the relative permeability and capillary pressure of the downhole formation.”), 16–17 (finding that “[Haggerty], as modified, discloses all of the limitations of the above claim(s) except for using the tomographic scans to make a three dimensional image of the walls of the perforation tunnel in the formation sample,” and finding that Lecerf teaches that limitation).

Accordingly, for the foregoing reasons, we are not apprised of error in the Examiner’s rejection of claims 25–27, which we affirm.

Rejections 9 and 10

The Examiner finds that claims 28 and 29, each of which ultimately depends from claim 25, would have been obvious over the combined teachings of Haggerty, Gilliland, and Lecerf, in further combination with Blauch or with Blauch and Maucec. Final Act. 17–19. Appellant relies upon its unpersuasive arguments made with respect to claim 25, and further

contends that Blauch and Maucec fail to cure the purported deficiencies argued regarding claim 25. Appeal Br. 23–24; Reply Br. 6–7.

The Examiner does not rely upon Blauch or Maucec to cure the purported deficiencies in the combination of Haggerty, Gilliland, and Lecerf. Accordingly, we affirm the rejection of claims 28 and 29.

CONCLUSION

The Examiner’s rejections are AFFIRMED.

DECISION SUMMARY

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 2, 6, 7, 11–13	103	Haggerty, Gilliland	1, 2, 6, 7, 11–13	
3–5	103	Haggerty, Gilliland, Blauch	3–5	
8	103	Haggerty, Gilliland, Grader	8	
9, 21	103	Haggerty, Gilliland, Maucec	9, 21	
10, 25–27	103	Haggerty, Gilliland, Lecerf	10, 25–27	
18–20	103	Haggerty, Gilliland, Coenen	18–20	
22	103	Haggerty, Gilliland, Maucec, Lecerf	22	
23, 24	103	Haggerty, Gilliland, Maucec, Blauch	23, 24	
28	103	Haggerty, Gilliland, Lecerf, Blauch	28	
29	103	Haggerty, Gilliland, Lecerf, Blauch, Maucec	29	

Appeal 2019-006184
Application 14/653,743

Overall Outcome			1-13, 18-29	
----------------------------	--	--	----------------	--

TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED