

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GENERAL ELECTRIC CO.,
Petitioner,

v.

UNIVERSITY OF VIRGINIA PATENT FOUNDATION,
Patent Owner.

Case IPR2016-00357
Patent RE44,644 E

Before KARL D. EASTHOM, TREVOR M. JEFFERSON, and
J. JOHN LEE, *Administrative Patent Judges*.

LEE, *Administrative Patent Judge*.

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

INTRODUCTION

On December 16, 2015, General Electric Co. (“GE”) filed a Petition (Paper 1, “Pet.”) requesting *inter partes* review of claims 75, 76, 78–82, 84–92, 94–102, 107–109, 111, 113–115, 118, 128–130, 132–136, 138–140, 157, 158, 169–178, 180–184, 186–194, 196–204, 209–211, 213, 215–17, 220, 230–232, 234–238, 240, 241, and 254–260 (“the challenged claims”) of U.S. Patent No. RE44,644 E (Ex. 1001, “the ’644 Patent”). Patent Owner University of Virginia Patent Foundation (“UVAPF”) timely filed a Preliminary Response. Paper 7.

An *inter partes* review of all challenged claims was instituted on June 22, 2016. Paper 13 (“Inst. Dec.”). After institution, UVAPF filed a Patent Owner Response (Paper 21, “PO Resp.”), and GE filed a Petitioner Reply (Paper 27, “Pet. Reply” (redacted public version); Paper 25 (filed under seal)).¹ UVAPF further filed a Motion for Observations on Cross-Examination (Paper 34), and GE filed a Response to UVAPF’s Observations (Paper 41). The parties also filed additional motions that remain pending, which are addressed below. An oral hearing was held on March 2, 2016. Paper 56 (“Tr.”).²

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. As

¹ This Decision cites to the public versions of all cited documents unless otherwise specified.

² A combined hearing was held for this case as well as related *inter partes* reviews IPR2016-00358 and IPR2016-00359. Although the parties at times referred to specific claims at issue in only one of these cases, many of the substantive issues also are present in all three cases and, as such, the parties’ statements at the hearing are applied to each of the cases as appropriate. Additionally, the parties raised objections to demonstrative exhibits presented at the oral hearing. Upon review, all such objections are denied.

explained below, GE has shown by a preponderance of the evidence that the challenged claims of the '644 Patent are unpatentable.

A. *Related Proceedings*

GE identifies the following matters as related to its Petition: (1) *University of Virginia Patent Foundation v. General Electric Co.*, No. 3:14-cv-00051-nkm (W.D. Va.); (2) two other petitions requesting *inter partes* review of other claims of the '644 Patent (IPR2016-00358 and IPR2016-00359); and (3) a petition requesting *inter partes* review of certain claims of U.S. Patent No. RE45,725 E, a related patent (IPR2017-00109). Pet. 1–2; Paper 46, 1. In addition to the above, UVAPF further identifies U.S. Patent Application No. 14/708,875 as related to the '644 Patent. Paper 8, 1.

B. *The '644 Patent*

The '644 Patent is a reissue of U.S. Patent No. 7,164,268 (“the '268 Patent”). Ex. 1001, at [64]. The '268 Patent was issued on January 16, 2007, from a PCT application filed on December 21, 2001. *Id.* The '268 Patent—and, thus, the '644 Patent—claims priority to U.S. Provisional Application No. 60/257,182 (“the '182 Application”), which was filed on December 21, 2000. *Id.* at [60]. Dr. John P. Mugler III and Dr. James R. Brookeman are the named inventors of the '644 Patent. *Id.* at [75].

According to the specification, the '644 Patent relates to nuclear magnetic resonance imaging (“MRI”) technology. Ex. 1001, 1:34–38. In particular, the '644 Patent relates to spin-echo MRI, which provides “a wide range of useful image contrast properties that highlight pathological changes and are resistant to image artifacts from a variety of sources such as radio-frequency or static-field inhomogeneities.” *Id.* at 1:44–49.

In spin-echo MRI, one or more spin-echo magnetic resonance (“MR”) signals are generated after an initial “excitation radio-frequency (RF) pulse.” *See id.* at 1:50–2:36. Data about the imaged subject in k-space may be collected periodically in conjunction with a series of spin echoes (i.e., a spin-echo train), and gradient magnetic fields are used for spatial encoding, to produce an image of the subject. *See id.* The spin echoes are generated using RF “refocusing” pulses, which are characterized by, among other things, a “flip angle.” *See id.* at 2:46–48. Conventional spin-echo techniques at the time of the invention—including, for example, “fast spin-echo” or “turbo spin-echo” techniques—used high flip angle refocusing RF pulses, which limited the usable duration of the echo trains and, thus, the amount and/or quality of data obtained. *See id.* at 2:46–3:6.

Unlike most conventional spin-echo techniques, which used constant flip angles, the ’644 Patent describes the use of variable flip angles for the refocusing RF pulses. *Id.* at 3:48–55. According to the ’644 Patent, variable flip angle pulse sequences according to the claimed invention can extend the duration of usable spin-echo trains, which in turn can improve spatial resolution and/or reduce the time needed to acquire images. *Id.* at 3:55–60. Further, the variable flip angle sequences of the ’644 Patent use flip angles that, typically, are less than the 180° flip angles common in conventional spin-echo techniques, permitting less power to be applied to human subjects and, thus, enhancing patient safety. *Id.* at 5:35–47.

C. *Challenged Claims*

GE challenges claims 75, 76, 78–82, 84–92, 94–102, 107–109, 111, 113–115, 118, 128–130, 132–136, 138–140, 157, 158, 169–178, 180–184, 186–194, 196–204, 209–211, 213, 215–17, 220, 230–232, 234–238, 240,

241, and 254–260 of the '644 Patent. Pet. 3–4, 23–59. Claims 75, 140, 157, 158, 176, and 177 are independent claims, and all other challenged claims depend, directly or indirectly, from those independent claims. Independent claim 75 is illustrative:

75. A method for generating a spin-echo pulse sequence for operating a magnetic resonance imaging apparatus for imaging an object, said method comprising:

providing a data-acquisition step based on a spin-echo-train pulse sequence, said data-acquisition step comprises:

providing an excitation radio-frequency pulse having a flip angle and phase angle;

providing at least two refocusing radio-frequency pulses, each having a flip angle and phase angle,

wherein, to permit during said data-acquisition step at least one of lengthening usable echo-train duration, reducing power deposition and incorporating desired image contrast into the signal evolutions, at least one of said angles is selected to vary among pulses to yield a signal evolution for the associated train of spin echoes for at least one first substance of interest in said object, with corresponding T1 and T2 relaxation times and spin density of interest, and to yield a signal evolution for the associated train of spin echoes for at least one second substance of interest in said object, with corresponding T1 and T2 relaxation times and spin density of interest,

wherein said signal evolutions result in T2-weighted contrast in the corresponding image(s) that is substantially the same as T2-weighted contrast that would be provided by imaging said object by using a turbo-spin-echo or fast-spin-echo spin-echo-train pulse sequence that has constant flip angles, with values of 180 degrees, for the refocusing radio-frequency pulses, and

wherein at least one of the duration of the spin-echo trains for said signal evolutions for said substances is at least twice the duration of the spin-echo train for said turbo-spin-echo or fast-spin-echo spin-echo-train pulse sequence and an effective echo time corresponding to said spin-echo trains for said signal evolutions for said substances is at least twice an effective echo time for said turbo-spin-echo or fast-spin-echo spin-echo-train pulse sequence;

providing magnetic-field gradient pulses that perform at least one of encoding spatial information into at least one of the radio-frequency magnetic resonance signals that follow at least one of said refocusing radio-frequency pulses and dephasing transverse magnetization associated with undesired signal pathways to reduce or eliminate contribution of said transverse magnetization to sampled signals; and

providing data sampling, associated with magnetic-field gradient pulses that perform spatial encoding; and

repeating said data-acquisition step until a predetermined extent of spatial frequency space has been sampled.

D. Instituted Grounds of Unpatentability

This *inter partes* review was instituted on the following alleged grounds of unpatentability:

Claims	Basis	Prior Art
75, 76, 78–82, 84–92, 94–96, 107, 111, 139, 140, 157, 158, 169–178, 180–184, 186–194, 196–198, 209, 213, 241, 254–260	§ 102(a) § 102(b)	Mugler 2000 ³

³ J. P. Mugler III et al., *Three-Dimensional T2-Weighted Imaging of the Brain Using Very Long Spin-Echo Trains*, Proceedings of the Int’l Soc. for Magnetic Resonance in Med., 8th Meeting (Apr. 2000) (Ex. 1002, “Mugler 2000”).

Claims	Basis	Prior Art
75, 76, 78–82, 84–92, 94–102, 107–109, 111, 113, 114, 118, 128–130, 132–134, 139, 140, 157, 158, 169–178, 180–184, 186–194, 196–204, 209–211, 213, 215, 216, 220, 230–232, 234–236, 241, 254–260	§ 103(a)	Mugler 2000 and Mugler Overview ⁴
115, 217	§ 103(a)	Mugler 2000, Mugler Overview, and Hennig 1986 ⁵
135, 136, 237, 238	§ 103(a)	Mugler 2000, Mugler Overview, and Rydberg ⁶
138, 240	§ 103(a)	Mugler 2000, Mugler Overview, and Stuber ⁷

⁴ John P. Mugler III, *Overview of MR Imaging Pulse Sequences*, in MAGNETIC RESONANCE IMAGING CLINICS OF NORTH AMERICA: PHYSICS OF MR IMAGING 661–697 (Scott A. Mirowitz and J. Paul Finn eds., 1999) (Ex. 1005, “Mugler Overview”).

⁵ J. Hennig et al., *RARE Imaging: A Fast Imaging Method for Clinical MR*, 3 MAGNETIC RESONANCE IN MED. 823–833 (1986) (Ex. 1034, “Hennig 1986”).

⁶ John N. Rydberg et al., *Comparison of dual-echo breathhold fast spin echo and dual-echo conventional T2-weighted spin echo imaging of liver lesions*, Proceedings of the Int’l Soc. for Magnetic Resonance in Med., 5th Meeting (Apr. 1997) (Ex. 1036, “Rydberg”).

⁷ Matthias Stuber et al., *Submillimeter Three-dimensional Coronary MR Angiography with Real-time Navigator Correction: Comparison of Navigator Locations*, 212 RADIOLOGY 579–587 (1999) (Ex. 1007, “Stuber”).

ANALYSIS

A. *Claim Construction*

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *see Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). In the Decision on Institution, we construed preliminarily the term “effective echo time” as “the time period from the excitation RF pulse to the collection of data corresponding to substantially zero-spatial frequency (the center of k space).” Inst. Dec. 9–10. Neither party disputed this preliminary construction during trial, or provided any further argument or evidence regarding the proper construction of this term. For the same reasons explained in the Decision on Institution, we maintain our earlier construction of this term. No other claim terms require express construction for purposes of this Final Written Decision. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (holding that those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy).

B. *Level of Ordinary Skill*

According to GE’s expert⁸ witness, Dr. Norbert J. Pelc, a person of ordinary skill in the art would have had “significant working knowledge of MR spin-echo imaging, especially fast-spin-echo imaging,” as well as “a Ph.D. in a physical science (e.g., electrical or biomedical engineering or medical physics) with experience in the development of MR imaging

⁸ UVAPF did not move to exclude Dr. Pelc’s testimony or otherwise challenge his testimony as insufficient under Federal Rule of Evidence 702.

techniques, or an M.D. degree or an M.S. degree in a physical science with significant (3–5 years) of work experience in the development of MR imaging techniques.” Ex. 1009 ¶ 105. The expert⁹ witness proffered by UVAPF, Dr. Klaus Jürgen Hennig, concurs generally with Dr. Pelc’s description, but adds that a person of ordinary skill would have been knowledgeable about particular aspects of spin-echo imaging techniques. Ex. 2019 ¶ 20.

Based on Dr. Pelc’s credible testimony, we find that a person of ordinary skill in the art would have met Dr. Pelc’s description. We further find that Dr. Hennig’s testimony on this issue does not differ materially from that of Dr. Pelc, and, in any event, our analysis in this Decision would be unchanged were we to apply Dr. Hennig’s description.

C. Asserted Prior Art

1. Mugler 2000

Mugler 2000 is an abstract published in the Proceedings of the International Society for Magnetic Resonance in Medicine (“ISMRM”), Eighth Meeting, which was held in April 2000. *See* Ex. 1009 ¶ 139 (citing Ex. 1018, 72). Mugler 2000 describes research in which the authors applied variable flip angle pulse sequences to obtain T2-weighted images of human brain tissue. Ex. 1002, 1. The authors “achieved T2-weighted single-slab 3D imaging of the brain with effective-TEs [(effective echo times)] and echo-train durations of greater than 300 and 600ms, respectively.” *Id.* Figure 1 of Mugler 2000 is reproduced below:

⁹ GE did not move to exclude Dr. Hennig’s testimony or otherwise challenge his testimony as insufficient under Federal Rule of Evidence 702.

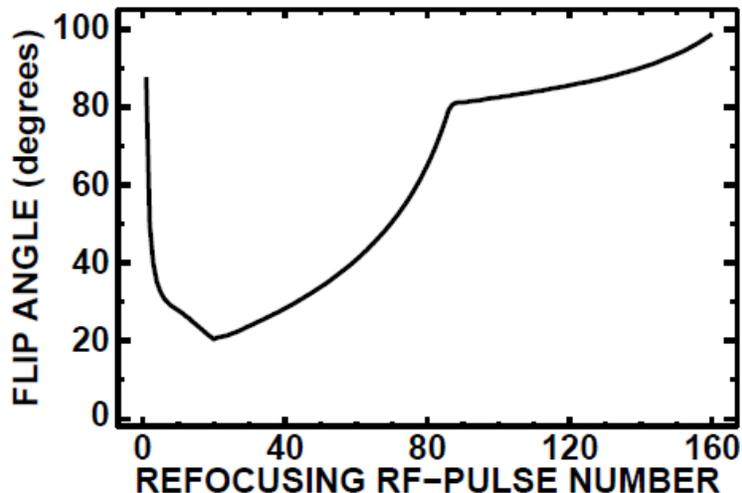


Figure 1 is a graph showing the flip angles of the refocusing pulses of a pulse sequence that yielded a 160-echo spin-echo train. Ex. 1002, 1. The “very long” spin-echo train produced by the pulse sequence of Figure 1 had an effective echo time of 328 ms. *Id.* According to Mugler 2000, the disclosed technique could “permit brain imaging with both adequate [signal-to-noise ratio] and useful contrast properties, and thus provide a vehicle for substantially reducing the imaging time.” *Id.*

GE contends that Mugler 2000 is prior art under 35 U.S.C. § 102(a)¹⁰ and § 102(b). Pet. 12–13. UVAPF disputes both contentions. PO Resp. 17–58. Based on the full record, we conclude Mugler 2000 is not prior art under § 102(a), but that it qualifies as prior art under § 102(b), as explained in more detail below.

¹⁰ UVAPF argues that the Petition did not properly identify § 102(a) as a basis to consider Mugler 2000 because the listing of asserted grounds on pages 3–4 of the Petition does not identify any ground as based on § 102(a). PO Resp. 17–18. We conclude, however, that the Petition provided enough notice to UVAPF of GE’s contention that Mugler 2000 is prior art under § 102(a), and that GE did not violate 37 C.F.R. § 42.104(b). *See* Pet. 12–13 (asserting “Mugler 2000 is also prior art to the ’644 patent under 35 U.S.C. § 102(a)”). Moreover, UVAPF had sufficient opportunity to respond to that contention in its Patent Owner Response, and did so. *See* PO Resp. 18–21.

a. § 102(a)

It is undisputed that Mugler 2000 was publicly presented at the April 2000 meeting of the ISMRM and published as part of the proceedings of that conference. *See* Ex. 1009 ¶ 139 (citing Ex. 1018, 72). The published proceedings were distributed to the attendees of the conference. *Id.* Based on these undisputed facts, GE contends that Mugler 2000 is prior art under § 102(a). Pet. 12–13.

UVAPF argues, however, that Mugler 2000 cannot be prior art to the '644 Patent because it is the work of the named inventors of the '644 Patent, Dr. Mugler and Dr. Brookeman. PO Resp. 18–20 (citing *In re Katz*, 687 F.2d 450, 454 (CCPA 1982)). Mugler 2000 lists three authors: Dr. Mugler, Dr. Brookeman, and Dr. Berthold Kiefer. Ex. 1002, 1; Ex. 2020 ¶ 4. Dr. Kiefer is not a named inventor of the '644 Patent, but UVAPF argues that his contribution to the subject matter of Mugler 2000 was minimal, and that he was listed as an author “merely to acknowledge the support he provided” to Dr. Mugler and Dr. Brookeman. PO Resp. 20.

An inventor’s own work is not prior art under § 102(a). *See Allergan, Inc. v. Apotex Inc.*, 754 F.3d 952, 968 (Fed. Cir. 2014); *Katz*, 687 F.2d at 454. In determining whether a reference is the work of the named inventor(s), the relevant inquiry is whether the relevant content of the reference—such as “the methods, detailed results, statistical analysis and discussion,” or “the design, trial, and analysis of results”—was solely the work of the inventor(s). *See Allergan*, 754 F.3d at 969. For example, an article may be solely the work of an inventor if the remaining co-authors were merely students performing tasks under the inventor’s direction and supervision. *See Katz*, 687 F.2d at 455–56.

Before turning to the evidence to apply these precepts, we first address the applicable burdens of proof on the parties. As an initial matter, the overall burden of persuasion of proving unpatentability on the asserted grounds based on Mugler 2000 lies with GE, and that burden never shifts. *See In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1375 (Fed. Cir. 2016); *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). Therefore, GE bears the burden to establish that Mugler 2000 qualifies as prior art. The burden of *production*, however, may shift between the parties. *See Magnum Oil Tools*, 829 F.3d at 1375–76; *Dynamic Drinkware*, 800 F.3d at 1379–80.

Here, GE satisfied the initial burden of production by asserting that Mugler 2000 is § 102(a) prior art, and presenting evidence that it was published and publicly available before the priority date of the '644 Patent.¹¹ *See* Pet. 12–13. The burden of production then shifted to UVAPF, and UVAPF met that burden by producing evidence to demonstrate that the relevant content of Mugler 2000 was solely the work of the inventors of the '644 Patent, i.e., the declarations of Dr. Mugler and Dr. Kiefer.¹² *See* PO Resp. 18–20; *Magnum Oil Tools*, 829 F.3d at 1376 (“[T]he shifting of the burden of production is warranted [when] the patentee affirmatively seeks to establish a proposition not relied on by the patent challenger and not a necessary predicate for the unpatentability claim asserted.”). Consequently,

¹¹ As discussed further herein, the parties dispute the applicable priority date of the '644 Patent for purposes of determining whether Mugler 2000 is prior art under § 102(b). The parties do not dispute, however, that Mugler 2000 was published before either of the dates advanced by the parties.

¹² UVAPF initially submitted a defective version of Dr. Kiefer's Declaration (Exhibit 2021), but was authorized to file an amended version of the Declaration (Exhibit 2035) to correct the defect. *See* Paper 51.

the burden returned to GE to prove that the evidence of record does not establish that Mugler 2000 was solely the work of the named inventors. *See Dynamic Drinkware*, 800 F.3d at 1380. GE did not carry this burden.

Mugler 2000, on its face, lists Dr. Kiefer as an author. Ex. 1002, 1. Dr. Mugler testifies in his Declaration, however, that Dr. Kiefer's contribution to Mugler 2000 was limited *only* to providing certain resources to Dr. Mugler for his research, such as “access to the latest released pulse-sequence programming environment, access to Siemens MR scanners, and access to experts on Siemens hardware and software.” Ex. 2020 ¶ 4. Dr. Kiefer provides essentially the same testimony in his Declaration. *See* Ex. 2035 ¶ 3. We find the testimony of both witnesses to be credible.

The record also includes four e-mails that GE asserts are relevant to Mugler 2000. *See* Pet. Reply 21–22 (citing Exs. 2025–2028).¹³ Exhibit 2028 is an e-mail exchange involving Dr. Mugler and Dr. Kiefer in January 1999, which refers to multiple trips that Dr. Mugler took to Erlangen, Germany, for MRI-related research. Ex. 2028, 1–2. It addresses an upcoming trip for work “on the implementation and optimization of 3d-techniques (3d-tse, 3d-grase, 3d-GRE) for Neuro and especially for neck imaging.” *Id.* at 1. Dr. Kiefer remarks that this upcoming trip “should be a good opportunity for transfer of knowledge in both directions.” *Id.*

¹³ Exhibits 2025–2028 were filed originally under seal. As discussed below, these exhibits will be unsealed in conjunction with this Decision. We note that the public version of the Petitioner Reply (Paper 27) cited herein includes redactions relating to these exhibits. As set forth below, GE shall file an amended Petitioner Reply removing redactions consistent with this Decision. Our citations herein to redacted portions of Paper 27, thus, should be understood to refer to this amended Petitioner Reply, once filed.

Exhibit 2025 is a November 1999 e-mail in which Dr. Kiefer writes to Dr. Mugler that he is “very pleased that you remembered on me [sic] and put me on your paper.” Ex. 2025, 1. The subject of the e-mail is “ISMIRM Abstract.” *Id.* He states, “I read your paper very carefully and like the content and the results of the variable flip angle approach.” *Id.* Thus, to the extent Dr. Kiefer was referring to Mugler 2000, the paper appears to have been already written. Dr. Kiefer further indicates that others in his company (Siemens) are “very excited” about Dr. Mugler’s results and that many have expressed “wishes . . . for a WIP sequence.” *Id.*

Exhibit 2026 is a November 1999 e-mail exchange between Dr. Kiefer and Dr. Mugler in which Dr. Mugler consults Dr. Kiefer about a technical problem he has run into on a Siemens Symphony MR scanner, and Dr. Kiefer responds with a suggested solution. Ex. 2026, 1–2. This e-mail exchange occurred after the e-mail of Exhibit 2025. *See id.*

Finally, Exhibit 2027 is a February 2000 e-mail exchange involving Dr. Kiefer and Dr. Mugler regarding a “3D TSE WIP package” that they have been collaborating on. Ex. 2027, 1–2. The scientists discuss technical details regarding the documentation for the package, and an image artifact observed during tests of the package’s sequences. *Id.*

GE’s contention that Dr. Kiefer contributed sufficiently to Mugler 2000 such that it qualifies as prior art is principally based on (1) Mugler 2000 itself, which lists Dr. Kiefer as a co-author; and (2) the four e-mails discussed above. *See* Pet. Reply 21–23. Whether a reference lists non-inventor co-authors, however, is not dispositive in itself. *Allergan*, 754 F.3d at 969. Further, none of the four e-mails relied on by GE sufficiently rebut the credible testimony of Dr. Mugler and Dr. Kiefer, both of whom testify

that Dr. Kiefer's contribution was limited to providing access to equipment and related resources. *See* Ex. 2020 ¶ 4; Ex. 2035 ¶ 3.

The e-mails indicate that Dr. Mugler and Dr. Kiefer collaborated on *multiple* projects, at least some of which were *not included* in Mugler 2000. Thus, the probative value of those e-mails is questionable at best because it is unclear whether, or how, they pertain to Mugler 2000.¹⁴ For example, Dr. Kiefer's January 1999 e-mail referred to potential work on "3d-grase" and "neck imaging." Ex. 2028, 1. Mugler 2000 makes no mention of GRASE imaging or neck imaging. In addition, Dr. Kiefer indicated in November 1999, *after* Mugler 2000 was already written, that his colleagues were requesting a turbo spin-echo "WIP sequence." *See* Ex. 2025, 1. That appears to have led to the work described in the February 2000 e-mail exchange, which suggests that the work occurred *after* Mugler 2000 was written. *See* Ex. 2027, 1–2. The technical issues discussed in Exhibit 2026 also appear to relate to work done *after* Mugler 2000 was written because an earlier e-mail (Exhibit 2025) indicates Mugler 2000 had already been written. *See* Ex. 2026, 1–2; Ex. 2025, 1.

The arguments that GE advances are unpersuasive. As discussed above, GE's reliance on the above e-mails is unconvincing because they have limited probative value, at best. GE's reliance on authorship guidelines that allegedly applied to Dr. Mugler (Pet. Reply 22) also is unavailing because the guidelines in question date from 2009, nearly a decade after Mugler 2000 was published, and GE does not identify any evidence that

¹⁴ GE deposed Dr. Mugler but does not identify in its briefing any deposition testimony bearing on these e-mails. GE did not depose Dr. Kiefer. *See* Paper 51, 4–5 (discussing GE's decision not to depose Dr. Kiefer).

similar guidelines applied to Dr. Mugler (or Dr. Brookeman) in 2000.
See Ex. 1048, 1.

GE also attempts to undermine Dr. Mugler's testimony by noting that Dr. Mugler may not have reviewed the e-mails between himself and Dr. Kiefer prior to providing the testimony in his Declaration, relying primarily on his memory instead. Pet. Reply 21. GE does not, however, identify evidence indicating that Dr. Mugler's memory may have been flawed or unreliable. To the contrary, the recollections he provides in his Declaration were corroborated by Dr. Kiefer's testimony. For similar reasons, GE's argument that Dr. Mugler's testimony should be discounted because of an alleged personal financial interest in the outcome of this proceeding is unpersuasive. *See id.* at 22. Even assuming GE's allegations as to Dr. Mugler's potential bias are correct, GE does not allege any similar bias in Dr. Kiefer's testimony, which is the same as Dr. Mugler's testimony in substance.¹⁵

Additionally, GE notes that Mugler 2000 itself refers to "we" when describing the work it discusses. *Id.* We are not persuaded, however, that this phrasing should be understood to indicate any particular contributions by particular co-authors. Nor is GE's argument persuasive that Dr. Mugler's testimony should be disbelieved because of an alleged violation of a duty of candor to the Patent Office. *Id.* Again, his testimony was corroborated by Dr. Kiefer.

¹⁵ GE also argues in its Petitioner Reply that Dr. Kiefer's Declaration should be given no weight because it is not properly sworn. Pet. Reply 20–21. UVAPF, however, subsequently submitted an amended version of the Declaration correcting that defect. *See* Paper 51; Ex. 2035.

Although GE is correct that, under *Allergan*, the correct inquiry is whether the methods, detailed results, statistical analysis, and discussion of Mugler 2000 were solely the work of the named inventors (Pet. Reply 22–23), the evidence of record fails to support GE’s contention that they were not. Merely providing access to equipment and related resources does not indicate sufficient contribution to the design, trial, or analysis of the results of the research for purposes of § 102(a). *See Allergan*, 754 F.3d at 969. Thus, GE has failed to carry its burden of proving that Mugler 2000 is prior art under § 102(a).

b. § 102(b)

Although GE failed to demonstrate that Mugler 2000 is § 102(a) prior art, GE established sufficiently that Mugler 2000 is prior art under § 102(b). GE contends that the ’644 Patent should not receive the benefit of the filing date of the ’182 Application and, thus, its effective priority date should be its filing date, i.e., December 21, 2001. Pet. 6–7. As a result, according to GE, the Mugler 2000 reference is prior art under 35 U.S.C. § 102(b) because it was published in April 2000, more than one year earlier. *Id.* at 12–13.

UVAPF contends that Mugler 2000 is not § 102(b) prior art. PO Resp. 21–58. More specifically, UVAPF argues the ’182 Application provides sufficient written description support for the challenged claims such that they are entitled to the priority date of the ’182 Application, i.e., December 21, 2000. *Id.* Based on the full record, however, the challenged claims have not been shown to have sufficient support in the written description of the ’182 Application and, thus, priority has not been established earlier than December 21, 2001.

As with § 102(a), GE bears the burden to prove that Mugler is prior art under § 102(b) as part of its overall burden of persuasion to prove unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. GE also bears the initial burden of production, but satisfied that burden by asserting that Mugler 2000 is prior art under § 102(b). *See id.* at 1379. The burden then shifted to UVAPF to produce evidence that the challenged claims of the '644 Patent are entitled to an earlier priority date. *See id.* at 1380. UVAPF met that burden by producing arguments and evidence to attempt to prove that the disclosure of the '182 Application provides sufficient written description support for the challenged claims. *See PO Resp.* 22–58. Thus, the burden shifted back to GE to prove that the '182 Application does not support the claims. *See Dynamic Drinkware*, 800 F.3d at 1380. GE met that burden successfully, as explained below.

For a patent to claim priority to the filing date of its provisional application, the written description of the provisional application must be sufficient to support the relevant claims of the patent under 35 U.S.C. § 112. *Dynamic Drinkware*, 800 F.3d at 1378 (citing *New Railhead Mfg., L.L.C. v. Vermeer Mfg. Co.*, 298 F.3d 1290, 1294 (Fed. Cir. 2002)). Sufficient written description support requires providing enough information in the application to indicate to a person of ordinary skill that the inventor had possession of the full scope of the claims. *In re Wertheim*, 541 F.2d 257, 262–64 (C.C.P.A. 1976). The disclosure need not recite the claimed invention *in haec verba*, but a disclosure that “merely renders the invention obvious” is insufficient. *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1352 (Fed. Cir. 2010) (en banc).

Independent claim 75 recites that “an effective echo time” for the claimed spin-echo pulse sequence is “at least twice an effective echo time”

for a turbo spin-echo or fast spin-echo pulse sequence with constant 180° flip angles that provides substantially the same T2-weighted contrast. Independent claim 176 recites that the effective echo time is “at least twice an echo time” for a “conventional spin-echo pulse sequence” that provides substantially the same T2-weighted contrast. Both Dr. Pelc and Dr. Hennig testify that these limitations may be considered essentially the same (the “echo time ratio limitation”). *See* Ex. 1009 ¶ 90; Ex. 2019 ¶¶ 47–48. All challenged claims recite the echo time ratio limitation.

According to UVAPF, the ’182 Application provides sufficient written description support for this limitation because a person of ordinary skill in the art would have been able to derive the full “at least twice” range of effective echo times recited in the claims. PO Resp. 55–58 (citing *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1566 (Fed. Cir. 1991)). UVAPF notes that the ’182 Application describes one embodiment with an effective echo time (328 ms) that is approximately four times larger than the echo time of a conventional spin-echo sequence (80 ms) that provided similar T2-weighted contrast. *Id.* at 57–58; *see* Ex. 1014, 9–10, Fig. 4. Relying on the testimony of its expert, Dr. Hennig, UVAPF asserts that a person of ordinary skill would have understood that other echo time ratios could be obtained by modifying the echo train duration (such as by selecting a different echo train length) while maintaining the same signal evolution shape. PO Resp. 56–58 (citing Ex. 2019 ¶¶ 64, 67–71). Dr. Hennig testifies that such modifications would have been routine for a person of ordinary skill in the art, and that the artisan could, thus, derive effective echo times that are “at least twice” the echo time of a conventional spin-echo sequence, as recited in the claims. *See* Ex. 2019 ¶¶ 64–71.

GE contends, however, that the single disclosed embodiment in the '182 Application, with an echo time ratio of about four, is insufficient to “delineate a range with a boundary of ‘at least twice’ that of any other echo time.” Pet. 11. Further, GE argues that the '182 Application lacks any “blaze marks” that would direct skilled artisans to the echo time ratio, or any particular range for that ratio. Pet. Reply 13–15 (citing *Purdue Pharma L.P. v. Faulding Inc.*, 230 F.3d 1320, 1326–28 (Fed. Cir. 2000)).

In *Purdue Pharma*, the patent at issue claimed a method of treating pain by administering an opioid only once a day in an oral sustained release dosage form. *Purdue Pharma*, 230 F.3d at 1322. The relevant claims recited a ratio of “more than twice” between maximum plasma concentration of the opioid (C_{\max}) and the plasma level of the opioid 24 hours after administration (C_{24}). *Id.* The patentee argued the written description provided adequate support under § 112 because of two examples in the specification in which the C_{\max}/C_{24} ratio was greater than two. *Id.* at 1326. The court, however, upheld the district court’s finding that the written description was insufficient:

Although the examples provide the data from which one can piece together the C_{\max}/C_{24} limitation, neither the text accompanying the examples, nor the data, nor anything else in the specification in any way emphasizes the C_{\max}/C_{24} ratio. The district court therefore reasonably concluded that one of ordinary skill in the art would not be directed to the C_{\max}/C_{24} ratio as an aspect of the invention. . . . [T]he disclosure of the '360 patent discloses a multitude of pharmacokinetic parameters, with no blaze marks directing the skilled artisan to the C_{\max}/C_{24} ratio or what value that ratio should exceed.

Id. The court held that the written description requirement was not met, stating that “[b]ecause the specification does not clearly disclose to the

skilled artisan that the inventors of the '360 patent considered the C_{\max}/C_{24} ratio to be part of their invention, it is immaterial what range for the C_{\max}/C_{24} ratio can be gleaned from the examples when read in light of the claims.” *Id.* at 1328.

Similarly, the '182 Application does not emphasize echo time ratios, ascribe any significance to them, or even identify any such ratios. Although the specification reports an effective echo time of 328 ms for a variable flip angle sequence and an echo time of 80 ms for a conventional spin-echo sequence (among several other parameters), the '182 Application does not compare those values, nor does it specify any ratio or other relationship between them. *See* Ex. 1014, 10, Fig. 4. Similar to *Purdue Pharma*, the '182 Application “discloses a multitude of . . . parameters, with no blaze marks directing the skilled artisan” to the echo time ratio, “or what value that ratio should exceed.” *See* 230 F.3d at 1326. Thus, it is “immaterial what range for the [recited ratio] can be gleaned from the examples” because the specification does not clearly indicate that the specific ratios recited in the claims are part of the invention. *See id.* at 1328. In other words, UVAPF’s assertion that a skilled artisan would have been able to derive easily the claimed range of echo time ratios is immaterial because the specification does not sufficiently direct the artisan to do so in the first place.

At the oral hearing, UVAPF argued that *Purdue Pharma* is inapposite because the C_{\max}/C_{24} ratio “wasn’t even discussed at all . . . not even discussed in passing in the disclosure and they made it the basis of their claims.” Tr. 34:10–16. In contrast, according to UVAPF, “the whole objective” of the invention described in the '182 Application was to increase the effective echo time compared to prior art pulse sequences with 180° flip angles. *Id.* at 34:17–25. This purported distinction is unpersuasive. The

patent in *Purdue Pharma* emphasized a rapid initial rise to peak concentration (C_{\max}) with an absorption half-life of about 1–8 hours. 230 F.3d at 1327. The court did not consider that disclosure to support sufficiently the specific claimed C_{\max}/C_{24} ratio. *Id.* The '182 Application describes its objective as lengthening usable echo train durations while still achieving desired image contrast and limiting artifacts. *See* Ex. 1014, 4. This disclosure does not direct a skilled artisan to the claimed echo time ratio any more than the disclosure in *Purdue Pharma* directed an artisan to the claimed C_{\max}/C_{24} ratio.

UVAPF also argued at the hearing that the specification identifies prior art references that disclose an echo time ratio of “almost twice” (Tr. 35:12–36:14), which it contends supports the “at least twice” ratio recited in the claims (*see id.* at 40:18–41:3). This argument also is unavailing. As UVAPF acknowledged, the '182 Application does not identify or highlight the effective echo times or echo time ratios of any of the prior art references. *See* Tr. 37:24–38:14. As discussed above, whether an artisan could have derived such ratios from the '182 Application—whether from examples or its discussion of prior art references—is “immaterial.” *See Purdue Pharma*, 230 F.3d at 1328.

For the above reasons, we find that the '182 Application does not provide adequate written description support for the echo time ratio limitations of the challenged claims. The challenged claims of the '644 Patent, thus, are not entitled to the priority date of the '182 Application. As a result, GE has demonstrated sufficiently that Mugler 2000 is prior art under § 102(b) because it was published in April 2000, which is more than one year before the applicable priority date of the '644 Patent, i.e., December 21, 2001.

2. *Mugler Overview*

Mugler Overview is an article titled “Overview of MR Imaging Pulse Sequences,” which was published in November 1999. *See* Ex. 1005, 1–2, 661. The parties do not dispute that it is prior art under § 102(b). The article “reviews general pulse-sequence properties and the pulse-sequence techniques most commonly used for clinical MR imaging.” *Id.* at 693. For example, Mugler Overview provides a discussion of “conventional [spin-echo] imaging” as well as “turbo spin-echo (TSE) or fast spin-echo (FSE) imaging.” *Id.* at 669–674. Figure 6 is reproduced below:

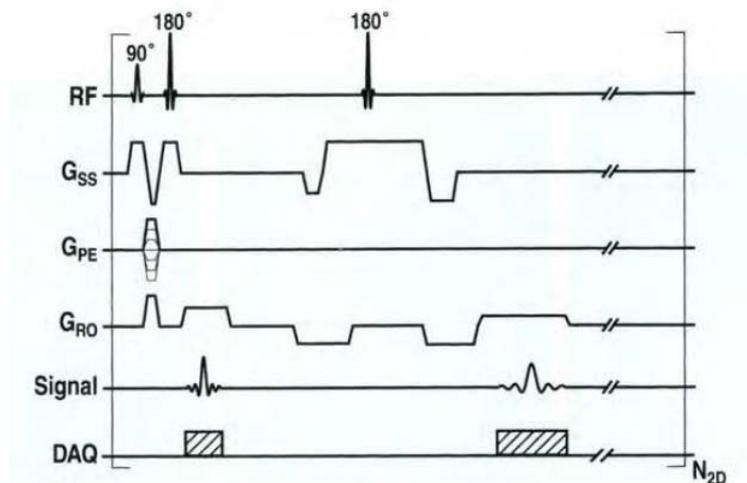


Figure 6. Pulse-sequence timing for a double spin-echo technique. RF = radiofrequency pulses; G_{SS} = section-select gradient; G_{PE} = phase-encoding gradient; G_{RO} = readout gradient; DAQ = data acquisition; and N_{2D} = number of in-plane phase-encoding lines.

Figure 6 depicts a timing diagram for a conventional spin-echo pulse sequence. *Id.* at 669. The sequence comprises an excitation RF pulse with a flip angle of 90° followed by refocusing RF pulses with a flip angle of 180° . *Id.* Also shown are three gradient pulses (G_{SS} , G_{PE} , and G_{RO}) used to encode spatial information, the MR signals from the subject being imaged, and the times at which data acquisition steps occur (DAQ). *See id.* at 661–662.

3. *Hennig 1986*

Hennig 1986 is an article published in 1986, which is titled, “RARE Imaging: A Fast Imaging Method for Clinical MR.” Ex. 1034, 823. The parties do not dispute that it is prior art under § 102(b). The article describes “[d]isastrous phase errors” resulting from gradient field inhomogeneities, and indicates such errors can be solved “by respecting the CPMG [(Carr-Purcell-Meiboom-Gill)] conditions regarding the phase of the magnetization” with respect to the gradient fields. *Id.* at 824.

4. *Rydberg*

Rydberg is an abstract published in the Proceedings of the ISMRM, Fifth Meeting, in April 1997. Ex. 1036, 1. The parties do not dispute that it is prior art under § 102(b). Rydberg describes a technique called “dual-echo breathhold” fast spin-echo in which the data for both images of a dual echo image pair are acquired within the same breathhold. *Id.* at 921.

5. *Stuber*

Stuber is an article titled “Submillimeter Three-dimensional Coronary MR Angiography with Real-time Navigator Correction: Comparison of Navigator Locations,” which was published in August 1999. Ex. 1007, 579–580. The parties do not dispute that it is prior art under § 102(b). Stuber discusses the use of MR navigator pulses as a motion-compensation technique to enable data acquisition of MR signals while the subject is breathing freely. *Id.* at 579.

D. *Anticipation by Mugler 2000*

GE contends that Mugler 2000 anticipates claims 75, 76, 78–82, 84–92, 94–96, 107, 111, 139, 140, 157, 158, 169–178, 180–184, 186–194, 196–198, 209, 213, 241, and 254–260. Pet. 24–38. To anticipate a claim, a

single prior art reference must disclose each and every limitation of the claim, either expressly or inherently. *Verdegaal Bros. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). A feature is disclosed inherently if it is *necessarily* present in the single anticipating reference. *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991).

The Petition sets forth detailed contentions and supporting evidence demonstrating that Mugler 2000 discloses each limitation of the above claims either expressly or inherently. Pet. 24–38. GE’s analysis is persuasive and unrebutted. In its Patent Owner Response, UVAPF does not dispute that Mugler 2000 discloses each limitation of these claims and, thus, UVAPF has waived any such argument.¹⁶ Based on the full record, GE has shown by a preponderance of the evidence that the above claims are anticipated by Mugler 2000.

For example, Figure 1 of Mugler 2000 and its accompanying explanation disclose flip angles for a sequence of 160 refocusing RF pulses. *See* Ex. 1002, 1, Fig. 1. Dr. Pelc testifies that all refocusing RF pulses necessarily have both a flip angle and phase angle. Ex. 1009 ¶¶ 166, 168. Thus, Mugler 2000 discloses the step of “providing at least two refocusing radio-frequency pulses, each having a flip angle and phase angle,” as recited in independent claim 75.

Mugler 2000 also discloses selecting at least one of the flip and phase angles of the refocusing RF pulses “to vary among pulses to yield a signal evolution for the associated train of spin echoes” for a first and second

¹⁶ The only arguments presented by UVAPF with regard to the asserted grounds of unpatentability relate to whether Mugler 2000 qualifies as prior art to the ’644 Patent. *See generally* PO Resp. As discussed above, GE has shown sufficiently that Mugler 2000 qualifies as prior art under § 102(b).

substance of interest, each with “corresponding T1 and T2 relaxation times and spin density of interest,” as recited in claim 75. *See* Pet. at 28–29. As the Petition notes (*id.*), Mugler 2000 discloses that “variable-flip-angle refocusing RF-pulse series were calculated for several prescribed signal evolutions” for brain tissues. Ex. 1002, 1. Further, according to Dr. Pelc, Mugler 2000 discloses that the calculations for these signal evolutions “explicitly consider the T1s and T2s of interest,” i.e., the T1 and T2 relaxation times of the imaged tissues. Ex. 1009 ¶ 173 (quoting Ex. 1002, 1). Dr. Pelc further testifies that the contrast between light and dark areas shown in the MR images in Mugler 2000 discloses signal evolutions for multiple different brain tissues, and that each of these tissues necessarily have an inherent T1 relaxation time, T2 relaxation time, and spin/proton density. *Id.* ¶¶ 174–75 (citing Ex. 1002, Fig. 2).

With respect to the limitation of claim 75 that the contrast in a resultant T2-weighted image be “substantially the same” as the contrast that would be provided by imaging the same object using a turbo spin-echo or fast spin-echo sequence with constant 180° flip angles, Mugler 2000 discloses that the variable flip angle sequence may “provide clinically useful contrast characteristics that appear very similar to those for conventional T2-weighted [spin-echo] images.” Ex. 1002, 1; *see id.* at Fig. 2. Dr. Pelc testifies that a person of ordinary skill would understand the conventional spin-echo sequence (echo time of 80 ms) disclosed in Mugler 2000 to correspond to a fast spin-echo sequence with a comparable effective echo time (i.e., 80 ms), providing substantially the same contrast. Ex. 1009 ¶ 176.

Mugler 2000 further discloses that the variable flip angle sequence yielded an effective echo time of over 300 ms with an echo train duration of over 600 ms. Ex. 1002, 1, Fig. 2; *see* Ex. 1009 ¶ 177. According to

Dr. Pelc, a person of ordinary skill would understand the conventional spin-echo sequence with an 80 ms echo time in Mugler 2000 to disclose a corresponding fast spin-echo sequence using constant 180° flip angles with an 80 ms effective echo time and 160 ms echo train duration. Ex. 1009 ¶ 177. Consequently, Mugler 2000 discloses the limitations of claim 75 that require an effective echo time and echo train duration that are each “at least twice” those of the recited fast spin-echo sequence with constant 180° flip angles. *See* Pet. 29–30.

The “magnetic-field gradient pulses” limitations of claim 75 are disclosed in the description in Mugler 2000 of a “phase-encoding direction” corresponding to the variable flip angle pulse sequence’s echo train. *See* Ex. 1002, Fig. 2. According to Dr. Pelc, a person of ordinary skill would understand Mugler 2000 to be referring to magnetic field gradient pulses encoding spatial information into the MR signals following the refocusing RF pulses in the echo train. Ex. 1009 ¶ 178. Dr. Pelc also testifies that all MRI pulse sequences necessarily involve encoding spatial information into the MR signals using magnetic field gradient pulses. *Id.* ¶ 179 (citing Ex. 1005, 661).

For the reasons explained above and set forth in the Petition, GE has demonstrated by a preponderance of the evidence that Mugler 2000 discloses each limitation of claim 75 either expressly or inherently. We further conclude that the un rebutted arguments and evidence presented by GE establish by a preponderance of the evidence that Mugler 2000 also discloses each limitation of claims 76, 78–82, 84–92, 94–96, 107, 111, 139, 140, 157, 158, 169–178, 180–184, 186–194, 196–198, 209, 213, 241, and 254–260, for the reasons set forth in the Petition. *See* Pet. 32–38.

For example, Mugler 2000 states that its “variable-flip-angle refocusing RF-pulse series were calculated for several prescribed signal evolutions,” which discloses the recited step of “calculating flip angles and phase angles” for the refocusing RF pulses in independent claim 140. *See* Ex. 1002, 1. With respect to the “conventional spin-echo pulse sequence” of claim 176, Mugler 2000 discloses a conventional spin-echo sequence, including its relative contrast and echo time of 80 ms, as discussed above with respect to claim 75. *See* Pet. 33–34 (citing Ex. 1002, 1). The remaining limitations of claims 140 and 176 are similar to those of claim 75, and are disclosed by Mugler 2000 for similar reasons. *See id.* at 32–34. Claims 157, 158, and 177 are similar to claims 75, 140, and 176 respectively, but are apparatus claims that further recite several components of an MRI apparatus. Dr. Pelc explains how each of the recited components is disclosed at least inherently in Mugler 2000. Ex. 1009 ¶¶ 190–196. We find this testimony to be credible and persuasive. Additionally, the Petition presents specific arguments and evidence for the limitations of each dependent claim challenged on this ground, and we conclude GE’s showing is sufficient to prove anticipation of those claims by a preponderance of the evidence for the reasons set forth in the Petition. Pet. 35–38.

In sum, based on the full record, GE has proven by a preponderance of the evidence that Mugler 2000 anticipates claims 75, 76, 78–82, 84–92, 94–96, 107, 111, 139, 140, 157, 158, 169–178, 180–184, 186–194, 196–198, 209, 213, 241, and 254–260 of the ’644 Patent.

E. Obviousness in View of Mugler 2000 and Mugler Overview

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject

matter as a whole would have been obvious at the time the invention was made to a person of ordinary skill in the art. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations.¹⁷ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

GE contends that all of the challenged claims are obvious in view of the combined teachings of Mugler 2000 and Mugler Overview. Pet. 38–42. Except for its argument that Mugler 2000 does not qualify as prior art, which we addressed above, UVAPF does not dispute that the combined teachings of Mugler 2000 and Mugler Overview render obvious each of these claims. Thus, UVAPF has waived any such argument.

For the claims that GE challenges as anticipated by Mugler 2000, GE further challenges them as obvious in light of Mugler 2000 and Mugler Overview and asserts that Mugler Overview teaches expressly each limitation that Mugler 2000 discloses inherently for anticipation purposes. Pet. 38–40. Based on the complete record, we agree with GE's analysis. For example, as GE explains, Mugler Overview includes express teachings of a data acquisition step (Ex. 1005, 661–662, Fig. 1), excitation RF pulses (*id.* at 661), RF pulses with flip angles and phase angles (*id.* at 684), applying gradient pulses to encode spatial information (*id.* at 661), and data sampling (*id.*). See Pet. 39–40; Ex. 1009 ¶¶ 213–217.

¹⁷ The record does not include any evidence of secondary considerations, and UVAPF did not argue during trial that any challenged claim is not obvious due to secondary considerations.

In addition, the Petition presents detailed arguments and evidence to support GE's contention that the combination of Mugler 2000 and Mugler Overview teaches each limitation of dependent claims 97–102, 108, 109, 113, 114, 118, 128–130, 132–134, 199–204, 210, 211, 215, 216, 220, 230–232, and 234–236. *See* Pet. 40–42. Based on the full record, we agree with this analysis in the Petition.

Further, according to Dr. Pelc, a person of ordinary skill would have been motivated to combine the relevant teachings of Mugler 2000 and Mugler Overview because both references are in the same field, both relate to fast spin-echo MRI, both share a common author, and Mugler Overview provides a general overview of MRI pulse sequences that a person of ordinary skill would have been motivated to consult for background information relating to the MRI pulse sequences of Mugler 2000. *See* Pet. 38–39; Ex. 1009 ¶ 212. Based on Dr. Pelc's credible testimony, we find that these reasons would have supplied ample motivation for a person of ordinary skill to combine the teachings of these references in the manner GE asserts.

In sum, based on the full record, GE has proven by a preponderance of the evidence that the combination of Mugler 2000 and Mugler Overview render obvious the challenged claims of the '644 Patent.

F. Other Obviousness Grounds

GE contends dependent claims 115 and 217 would have been obvious in light of Mugler 2000, Mugler Overview, and Hennig 1986. Pet. 42. Both claims recite the additional limitation, “wherein during at least one said data-acquisition step, the phase difference between the phase angle for the excitation radio-frequency pulse and the phase angles for all refocusing radio-frequency pulses is substantially 90 degrees.” Dr. Pelc testifies that

Hennig 1986 teaches this limitation in its discussion of “CPMG conditions regarding . . . the phase of the transmitter signals,” which a person of ordinary skill would understand to involve applying a 90° difference in phase angle between the excitation pulse and refocusing pulses. Ex. 1009 ¶ 231 (citing Ex. 1034, 824). According to Dr. Pelc, a person of ordinary skill would have been motivated to combine Hennig 1986 with Mugler 2000 and Mugler Overview because Hennig 1986 also relates to improvements in fast spin-echo pulse sequences for MRI. *Id.* UVAPF does not dispute this evidence. Based on Dr. Pelc’s testimony, which we find credible, and the prior art disclosures explained above, GE has proven by a preponderance of the evidence that claims 115 and 217 are obvious in light of Mugler 2000, Mugler Overview, and Hennig 1986.

Additionally, GE contends dependent claims 135, 136, 237, and 238 would have been obvious in light of Mugler 2000, Mugler Overview, and Rydberg. Pet. 42–43. These claims recite that the temporal order in which spatial-frequency data is collected (claims 135 and 237), or the extent of the spatial-frequency data collected (claims 136 and 238), differ in one data-acquisition step as compared to another. Dr. Pelc testifies that Rydberg’s teachings regarding “dual-echo breathhold fast spin echo” techniques teach those limitations. Ex. 1009 ¶ 233 (citing Ex. 1036, 921). In addition, Dr. Pelc indicates that a person of ordinary skill would have been motivated to combine Rydberg with the Mugler references because Rydberg also relates to improvements in fast spin-echo MRI. *Id.* UVAPF again argues only that Mugler 2000 is not prior art, which is unpersuasive for the same reasons as discussed above. Based on the complete record, and particularly the evidence discussed above, GE has proven by a preponderance of the

evidence that claims 135, 136, 237, and 238 are obvious in view of Mugler 2000, Mugler Overview, and Rydberg.

Finally, GE contends dependent claims 138 and 240 would have been obvious in light of Mugler 2000, Mugler Overview, and Stuber. Pet. 43–44. Both claims recite the additional limitation, “wherein at least one navigator radio-frequency pulse is incorporated into the pulse sequence for the purpose of determining the displacement of a portion of the object.” As GE notes (*id.*), Stuber teaches “MR navigator techniques” used for “real-time navigator motion-correction” to compensate for the movement of the heart during image acquisition, for which a “model that incorporates . . . coronary displacement” may be used. Ex. 1007, 579. Dr. Pelc testifies that a person of ordinary skill would have been motivated to combine Stuber with the Mugler references because Stuber relates to improvements in 3D MRI methods, and the Mugler references also concern 3D MRI. Ex. 1009 ¶ 235. Again, UVAPF only argues that Mugler 2000 is not prior art. Based on these arguments and evidence, GE has proven by a preponderance of the evidence that claims 138 and 240 are obvious in view of Mugler 2000, Mugler Overview, and Stuber.

G. UVAPF’s Motion to Seal (Paper 26)

UVAPF moved initially to seal (1) Exhibits 2024–2028, and (2) portions of the transcript of the November 10, 2016 deposition of Dr. Mugler (Exhibit 2029). Paper 26, 1. GE filed an opposition to UVAPF’s motion. Paper 30 (redacted public version); Paper 31 (filed under seal). Subsequently, UVAPF filed a reply and withdrew its motion to seal Exhibits 2024–2028. Paper 45, 3. Thus, these exhibits shall be made public.

With respect to Dr. Mugler's deposition testimony, the parties agree that the following portions of Exhibit 2029 should be sealed: 142:10–12, 149:12–14, 195:11–199:4. Paper 26, 5; Paper 30, 6–7. Upon review, we agree these portions should be sealed because they contain confidential information with minimal relevance to this proceeding, and they were not relied on for any determination in this case. For similar reasons, we agree with UVAPF that the following additional portions of Exhibit 2029 should be sealed: 134:3–136:25, 140:7–142:9, 142:14–149:10, 149:15–150:5, 150:11–12, 156:3–157:8, 191:21–195:10. This information relates generally to settlement negotiations between the parties and the personal finances of Dr. Mugler. *See* Paper 26, 5–7. GE's argument that this information should be public—because it bears on the credibility and alleged bias of Dr. Mugler—is unpersuasive. *See* Paper 30, 8. As discussed earlier, we determined Dr. Mugler's testimony to be credible, *even assuming GE's allegations regarding his financial interests are correct*, because the testimony was corroborated by the testimony of an uninterested witness, Dr. Kiefer. Thus, we determine that UVAPF's and Dr. Mugler's confidentiality and privacy interests outweigh any public interest in the information in question.

Considering our rulings above, GE shall file an amended public version of the Petitioner Reply that removes all redactions relating to unsealed material, but retaining the redactions to sealed material.

In addition, because there is an expectation that information will be made public where the information is identified in a final written decision, confidential information that is subject to a protective order ordinarily would become public 45 days after final judgment in a trial, unless a motion to expunge is granted. 37 C.F.R. § 42.56; Office Patent Trial Practice Guide,

77 Fed. Reg. 48,756, 48,761 (Aug. 14, 2012). A party who is dissatisfied with this Final Written Decision, however, may appeal this Decision pursuant to 35 U.S.C. § 141(c), and has 63 days after the date of this Decision to file a notice of appeal. 37 C.F.R. § 90.3(a).

In view of the above, the time period for filing a motion to expunge is extended to 90 days after final judgment in this trial. *See* 37 C.F.R. § 42.5(b). If an appeal is taken, this time period shall be further extended to 45 days after the appeal process has concluded. *See id.* During this period, all information sealed in this case shall remain under seal. The record for the instant proceeding will be preserved in its entirety, and the confidential documents will not be expunged or made public, pending possible appeal.

H. UVAPF's Motion to Exclude (Paper 36)

UVAPF moves to exclude certain portions of deposition testimony by Dr. Mugler. Paper 36, 1–11. GE filed an opposition to UVAPF's motion (Paper 39 (redacted public version); Paper 40 (filed under seal)), and UVAPF filed a reply (Paper 44).

According to UVAPF, the testimony at issue should be excluded because (1) it is cross-examination testimony that exceeds the scope of Dr. Mugler's direct testimony in violation of 37 C.F.R. § 42.53(d)(5)(ii); (2) it is irrelevant evidence under Rules 401 and 402; (3) its probative value is outweighed by the danger of unfair prejudice under Rule 403; and (4) it is inadmissible hearsay under Rule 801. Paper 36, 1–2. GE argues it was proper cross-examination testimony directed at the credibility of Dr. Mugler's direct testimony. Paper 39, 1–2.

We note that none of the testimony at issue was relied on for any determination in this case. In fact, as discussed above, we found

Dr. Mugler's testimony to be credible, *even assuming GE's allegations of financial interest are correct*, because the testimony was corroborated by the testimony of an uninterested witness, Dr. Kiefer. Thus, whether this testimony is excluded would have no effect on the outcome of this proceeding or on any aspect of the present Decision. Consequently, we *dismiss* UVAPF's motion as moot.

CONCLUSION

For the foregoing reasons, Petitioner has shown by a preponderance of the evidence that the challenged claims of the '644 Patent are unpatentable.

ORDER

It is

ORDERED that the challenged claims of the '644 Patent are held unpatentable as follows:

- (1) claims 75, 76, 78–82, 84–92, 94–96, 107, 111, 139, 140, 157, 158, 169–178, 180–184, 186–194, 196–198, 209, 213, 241, and 254–260 as anticipated under 35 U.S.C. § 102(b) by Mugler 2000;
- (2) claims 75, 76, 78–82, 84–92, 94–102, 107–109, 111, 113, 114, 118, 128–130, 132–134, 139, 140, 157, 158, 169–178, 180–184, 186–194, 196–204, 209–211, 213, 215, 216, 220, 230–232, 234–236, 241, and 254–260 as obvious under 35 U.S.C. § 103(a) in view of Mugler 2000 and Mugler Overview;
- (3) claims 115 and 217 as obvious under 35 U.S.C. § 103(a) in view of Mugler 2000, Mugler Overview, and Hennig 1986;

(4) claims 135, 136, 237, and 238 as obvious under 35 U.S.C. § 103(a) in view of Mugler 2000, Mugler Overview, and Rydberg; and

(5) claims 138 and 240 as obvious under 35 U.S.C. § 103(a) in view of Mugler 2000, Mugler Overview, and Stuber;

FURTHER ORDERED that UVAPF's Motion to Seal (Paper 26) is *granted-in-part* as set forth above;

FURTHER ORDERED that Exhibits 2024, 2025, 2026, 2027, and 2028 be made public;

FURTHER ORDERED that the proposed Protective Order (Paper 26, Appendix A) is entered;

FURTHER ORDERED that GE shall file an amended public version of the Petitioner Reply within 14 days that removes all redactions relating to information made public, but retains all redactions relating to sealed information, consistent with this Decision, and otherwise makes no changes;

FURTHER ORDERED that UVAPF's Motion to Exclude (Paper 36) is *dismissed* as moot;

FURTHER ORDERED that the information sealed in this Decision remain under seal, and the record preserved, until 90 days after final judgment in this trial or, if an appeal is taken, until 45 days after the appeal process has concluded; and

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

IPR2016-00357
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