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Paper No. 30
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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 IPR2017-00109
Patent RE45,725 E

Before KARL D. EASTHOM, TREVOR M. JEFFERSON, and TIMOTHY J. GOODSON, *Administrative Patent Judges*.

JEFFERSON, *Administrative Patent Judge*.

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

INTRODUCTION

On October 19, 2016, General Electric Co. ("GE") filed a Petition (Paper 1, "Pet.") requesting *inter partes* review of claims 47–80 ("the challenged claims") of U.S. Patent No. RE45,725 E (Ex. 1001, "the '725 Patent"). Patent Owner University of Virginia Patent Foundation ("UVAPF") timely filed a Preliminary Response (Paper 7, "Prelim. Resp.").

We instituted an *inter partes* review on all challenged claims. Paper 10, "Inst. Dec."). UVAPF filed a Patent Owner Response (Paper 13, "PO Resp."), and GE filed a Petitioner Reply (Paper 18, "Pet. Reply"). UVAPF filed a sur-reply to GE's reply (Paper 21, PO SR") and GE filed a response to UVAPF's sur-reply (Paper 23, "Pet. Resp. to SR"). The parties filed a Motion to Seal that is addressed below. An oral hearing was held on December 13, 2017. Paper 29 ("Tr.").[1]

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 explained below, GE has shown by a preponderance of the evidence that the challenged claims of the '725 Patent are unpatentable.

A. Related Proceedings

GE identifies the following matters as related to its Petition: (1) *Univ. of Va. Patent Found. v. Gen. Elec. Co.*, No. 3:14-cv-00051-nkm (W.D. Va.); and (2) three *inter partes* reviews (IPR2016-00357, IPR2016-00358, and IPR2016-00359) of U.S. Patent No. RE44,644 E ("the '644 Patent"), a related patent. Pet. 1–2. Final Written Decisions have issued in IPR2016-00357, IPR2016-00358, and IPR2016-00359. *Gen. Elec. Co. v. Univ. of Va.*

[1] The parties raised objections to demonstrative exhibits presented at the oral hearing. Papers 26, 28. Upon review, all such objections are denied.

Patent Found., Case IPR2016-00357 (PTAB June 21, 2017) ("IPR2016-00357 FWD"); *Gen. Elec. Co. v. Univ. of Va. Patent Found*., Case IPR2016-00358 (PTAB June 21, 2017) ("IPR2016-00358 FWD"); *Gen. Elec. Co. v. Univ. of Va. Patent Found*., Case IPR2016-00359 (PTAB June 21, 2017) ("IPR2016-00359 FWD"). A decision denying rehearing in IPR2017-00357 was issued. *Gen. Elec. Co. v. Univ. of Va. Patent Found*., Case IPR2016-00357 (PTAB Sep. 19, 2017) ("IPR2016-00357 Reh. Dec.")

B. The '725 Patent

The '725 Patent relates to nuclear magnetic resonance imaging ("MRI") technology. Ex. 1001, 1:52–56. In particular, the '725 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 1:62–67.

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 2:1–6. 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), using gradient magnetic fields for spatial encoding, to produce an image of the subject. *See id.* at 2:25–54. The spin echoes are generated using RF "refocusing" pulses, which are characterized by, among other things, a "flip angle." *See id.* at 2:64–3:12. 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 2:64–3:24.

Unlike most conventional spin echo techniques, which used constant flip angles, the '725 Patent describes the use of variable flip angles for the refocusing RF pulses. *Id.* at 3:66–4:6. According to the '725 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 4:6–11. Further, the variable flip angle sequences of the '725 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 5:55–67.

C. Prosecution History of the '725 Patent

The '725 Patent is a reissue patent from U.S. Patent Application No. 14/053,190, which is a continuation of U.S. Patent Application No. 12/354,471 ("the '471 Application"). Ex. 1001, at [21], [63]. The '471 Application issued as the '644 Patent, which was a reissue of U.S. Patent No. 7,164,268 ("the '268 Patent"). *Id.* at [63]. The '268 Patent was issued on January 16, 2007, from a PCT application filed on December 21, 2001. *Id.* at [64]. The '268 Patent—and, thus, the '725 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].

D. Instituted Grounds of Unpatentability and Illustrative Claim

We instituted *inter partes* review on the grounds that claims 47–80 of the '725 Patent are unpatentable under 35 U.S.C. § 102 as anticipated by

Mugler 2000;[2] and that claims 47–80 of the '725 Patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Mugler 2000 and Mugler Overview.[3] GE also relies on the Declaration of Professor Norbert J. Pelc (Ex. 1009).

UVAPF submits the Declarations of Dr. John P. Mugler, III (Ex. 2007), Dr. Berthold Kiefer (Ex. 2013), and Dr. Klaus Jürgen Hennig (Ex. 2023[4] and Ex. 2025) as well as other evidence.

Claims 47, 57, 67, 73, 79, and 80 are independent claims, and all other challenged claims depend, directly or indirectly, from those independent claims. Independent claim 47 (Ex. 1001, 21:53–22:44) is illustrative:

> 47. A method of generating a spin-echo-train pulse sequence used in operating a magnetic resonance imaging apparatus configured for imaging an object, said method comprising:
>
> providing a data-acquisition step based on said spin-echo-train pulse sequence, said data-acquisition step comprises:
>
> providing an excitation radio-frequency pulse;
>
> providing at least two refocusing radio-frequency pulses, each having a flip angle and phase angle,
>
> wherein, in order to permit during said data-acquisition step lengthening usable echo-train duration, reducing power deposition and

[2] John 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").

[3] 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").

[4] Dr. Hennig's Declaration (Ex. 2023) is a copy of a declaration filed in *inter partes* review proceedings related to the '644 Patent, and does not address directly the '725 Patent.

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