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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte STEFANIE REMMELE and CHRISTIAN STEHNING

Appeal 2019-001600
Application 13/819,097
Technology Center 3700

Before JENNIFER D. BAHR, BRANDON J. WARNER, and
LEE L. STEPINA, *Administrative Patent Judges.*

BAHR, *Administrative Patent Judge.*

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant[1] appeals from the Examiner's decision rejecting claims 1–3, 7, 10, and 13–18. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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[1] 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 KONINKLIJKE PHILIPS, N.V. Appeal Br. 1.

CLAIMED SUBJECT MATTER

Appellant's "invention relates to magnetic resonance imaging, in particular to the simultaneous control of a magnetic resonance imaging system and an anesthesia system." Spec. 1:2–3. Claim 1, reproduced below, is illustrative of the claimed subject matter.

> 1. A magnetic resonance imaging system for controlling delivery of breathing gas, the system comprising
>
> a magnet adapted for generating a magnetic field for orientating the magnetic spins of nuclei of a subject located within an imaging volume;
>
> a radio frequency system for acquiring magnetic resonance data, wherein the radio frequency system comprises a radio frequency transceiver adapted to connect to a radio frequency coil;
>
> a magnetic field gradient coil for spatial encoding of the magnetic spins of nuclei within the imaging volume;
>
> a magnetic field gradient coil power supply for supplying current to the magnetic field gradient coil;
>
> a breathing gas system interface adapted for sending control messages to an breathing gas system; and
>
> a processor and a non-transitory computer readable memory, wherein the memory contains instructions for execution by the processor, wherein execution of the instructions causes the processor to perform the steps of:
>
> controlling the operation of the magnetic resonance imaging system to acquire magnetic resonance data,
>
> sending control messages to the breathing gas system via the breathing gas system interface, and
>
> wherein the memory contains a pulse sequence for planning an acquisition of magnetic resonance data, wherein the instructions control the operation of the magnetic resonance imaging system in accordance with the pulse sequence,
>
> wherein the memory comprises a gas sequence for planning the temporal control of the composition of the breathing gas provided to the subject for respiration by the

breathing gas system during the acquisition of magnetic resonance data,

wherein execution of the instructions further causes the processor to perform the steps of:

acquiring magnetic resonance data which may be reconstructed into tissue oxygenation level dependent contrast images,

reconstructing the magnetic resonance data into tissue oxygenation level dependent contrast images,

determining a set of tissue oxygenation level measures, wherein the set of tissue oxygenation level measures is constructed by determining a tissue oxygenation measure for an oxygenation test volume in each of the tissue oxygenation level dependent contrast images,

analyzing the magnetic resonance data in accordance with a respiratory challenge algorithm wherein the respiratory challenge algorithm analyzes the magnetic resonance data by at least performing a statistical analysis of a subset of the set of tissue oxygenation level measures, and wherein the subset is determined in accordance with the gas sensor data,[2]

wherein the instructions send control messages to the breathing gas system in accordance with the gas sequence, and

wherein each tissue oxygenation level measure is calculated during the acquisition of magnetic resonance data, wherein the instructions further cause the processor to perform the step of modifying at least one of the pulse sequence and the gas sequence during the acquisition of magnetic resonance data in accordance with the set of the tissue oxygen level measures.

EVIDENCE

The prior art relied upon by the Examiner is:

Bolam	US 2004/0230113 A1	Nov. 18, 2004
Griffiths	US 2009/0177050 A1	July 9, 2009

[2] Claim 1 lacks antecedent basis for "the gas sensor data."

Seung-Schik Yoo et al., *Real-Time Adaptive Functional MRI*, 10 NeuroImage 596–606 (1999) (Yoo).

Lawrence W. Hedlund et al., *MR-compatible ventilator for small animals: computer-controlled ventilation for proton and noble gas imaging*, 18 Magnetic Resonance Imaging 753–59 (2000) (Hedlund).

N. Jane Taylor, PhD et al., *BOLD MRI of Human Tumor Oxygenation During Carbogen Breathing*, 14 J. Magnetic Resonance Imaging 156–63 (2001) (Taylor).

Mark S. Cohen, *Real-Time Functional Magnetic Resonance Imaging*, 25 METHODS 201–20 (2001) (Cohen).

Michal Neeman et al., *In Vivo BOLD Contrast MRI Mapping of Subcutaneous Vascular Function and Maturation: Validation by Intravital Microscopy*, 45 Magnetic Resonance in Medicine 887–98 (2001) (Neeman).

Benedikt A. Poser et al., *BOLD Contrast Sensitivity Enhancement and Artifact Reduction With Multiecho EPI: Parallel-Acquired Inhomogeneity-Desensitized fMRI*, 55 Magnetic Resonance in Medicine 1227–35 (2006) (Poser).

Nikolaus Weiskopf et al., *Real-time functional magnetic resonance imaging: methods and applications*, 25 Magnetic Resonance Imaging 989–1003 (2007) (Weiskopf).

S. Winkelmann et al., *Measuring the Effect of Hyperoxia and Hypercapnia on R2* and the Balanced SSFP Signal at 3T*, Proc. Int'l. Soc. Reson. Med. 16 (2008) (Winkelmann).

Ning Jin et al., *Carbogen Gas-Challenge BOLD MR Imagining in a Rat Model of Diethylnitrosamine-induced Liver Fibrosis*, 254 Radiology 129–137 (2010) (Jin).

J.P. Hornak, *The Basics of MRI*, Ch. 9—Imaging Hardware (2014) (Hornak).

REJECTIONS

I. Claims 1–3 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Winkelmann, Hornak, Hedlund, Bolam, Griffiths, Taylor, Weiskopf, Cohen, and Yoo.

II. Claim 7 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Winkelmann, Hornak, Hedlund, Bolam, Griffiths, Taylor, Weiskopf, Cohen, Yoo, and Neeman.

III. Claims 10 and 13 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Winkelmann, Hornak, Hedlund, Bolam, Griffiths, Taylor, Weiskopf, Cohen, Yoo, and Poser.

IV. Claim 14 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Winkelmann, Hornak, Hedlund, Bolam, Griffiths, Taylor, Weiskopf, Cohen, Yoo, Neeman, and Poser.

V. Claims 15–18 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Griffiths and Jin.

OPINION

Rejection I—Claims 1–3

The Examiner finds:

> Winkelmann discloses a system comparing MRI imaging sensitivity of the brain using the blood/tissue oxygenation level dependence (BOLD) imaging and the balanced steady-state free precession (bSSFP) sequence imaging where the functional imaging with an MRI scanner is performed during the patient free breathing following a chosen gas sequence with either normal air or with modified gas where 70% of the oxygen of the air has been replaced by 70% nitrogen.

Final Act. 11–12. The Examiner finds that Winkelmann does not explicitly disclose all the details of the MRI apparatus and the anesthesia system (i.e., breathing gas system), or proceeding to an oxygenation test volume, analyzing with statistical means a subset of the MRI data for correlating them with gas sensor data, sending control messages to the breathing gas system in accordance with a gas sequence, or calculating the tissue oxygenation level during the acquisition of MR data and using it to modify at least one of the pulse sequence for acquiring MR data and the gas sequence during the acquisition of MR data, as called for in independent claim 1. *See id.* at 12.

The Examiner relies on Hornak for its teachings regarding the details of the MRI apparatus, including the magnet, the radio frequency coil and transceiver, the gradient coil, power supplies for the coils, and a computer for controlling at least all of the MRI components and communicating with other systems interacting with the MRI function, such as for triggering or gating the acquisition of images. Final Act. 12–13.

The Examiner relies on Hedlund for its teaching of a computer-controlled system for delivering noble gas, air, or pure oxygen to a patient within an MRI system, wherein different triggering processes are available for switching between noble gas, air, and pure oxygen, and "the controller for the ventilation/gas delivery generates signals for synchronizing the ventilation process according to external events such as imaging." Final Act. 14. In particular, the Examiner determines it would have been obvious to modify the system of Winkelmann and Hornak by providing a breathing gas delivery system in a manner to induce contrast, with an interface for communicating between the MR imaging device and the gas delivery

system. According to the Examiner, such a "modification would have provided predictable results since both Hedlund and Winkelman[n] teach MRI imaging with extraneous chemical perfusion," and the motivation for the modification "would have been to provide input and/or output communications for synchronizing the imaging sequences and the gas injection sequences in relation with external events in order to optimize the timing of the application of the gas exchange sequence and the imaging sequence by the MRI" and "to optimize the imaging contrast of tissue providing a differential response from hyperoxia or/and hypercapnia induced by respiratory challenge with different gases using a bidirectional feed-back between the gas delivery system and the MRI imaging device as suggested by Hedlund." *Id.* (citing Hedlund, Fig. 5; 754, col. 2).

The Examiner relies on Bolam as teaching "a processor/controller of the anesthetic/respiratory/hyperpolarized gas delivery system capable to sequence or generate signals to an NMR/MRI system, during or prior to signal acquisition, therefore providing a feedback control to the imaging system . . . according to recorded or received physiological signals such as oxygen saturation levels." Final Act. 15 (citing Bolam ¶ 79). The Examiner also finds that Bolam "teaches that the controller can control the gas delivery valve with controlling the ventilation sequence" and that "the controller receiv[es] gas sensor pressure data for monitoring the gas delivery . . . and therefore the gas concentration delivered using the gas flow and the volume of gas delivered." *Id.* (citing Bolam ¶¶ 81–82; Figs. 1, 8).

The Examiner relies on Griffiths as teaching an integrated system comprising an "MRI and a fluid contrast injector[,] with an interface connector between the injector interface . . . and the imager interface . . . for

allowing bidirectional communication between the MRI and the injector . . . for timing and automatic adjustments." Final Act. 15–16 (citing Griffiths ¶¶ 3, 8, 9; Fig. 1B). The Examiner finds that Griffiths teaches "that both 'the imaging system and the injector system can share a common control system [and] can integrate imaging parameter and fluid delivery protocols'" and that having the imaging system and the injector system share processors and functions "simplifies the algorithms needed to monitor and control both systems with the same experimental conditions." *Id.* at 16 (citing Griffiths ¶ 24).

The Examiner determines it would have been obvious to modify the system of Winkelmann, Hornak, and Hedlund by providing an interface and controller for communication between the MR imaging device and the gas delivery system "for controlling the gas sequence as a function of the physiological responses as taught by Bolam in order to synchronize the contrast delivery sequence and the pulsed imaging sequences as suggested by Hedlund . . . with a controlled delivery of gas as suggested by Bolam." Final Act. 16. The Examiner also determines it would have been obvious to integrate both the anesthesia (breathing gas delivery) system and the BOLD MR imaging system into a single integrated medical device as taught by Griffiths in order to simplify the bidirectional communications between these systems, as well as reduce response time of the imaging analysis and gas delivery systems and eliminate potential communication problems between independent imaging and delivery systems, thereby "increasing efficiency and capability as suggested by Griffiths." *Id.* at 16–17 (citing Griffiths ¶ 32).

The Examiner relies on Taylor "to teach the oxygen test volume with the analysis of the MRI data and statistical means for correlation analysis with gas sensor data" and to evidence that it was known in the art of BOLD/TOLD MRI contrast imaging to use images taken during breathing of carbogen in comparison to images taken during breathing of normal air for the identification and localization of human tumors. Final Act. 17. The Examiner additionally relies on Taylor's teaching of a protocol for monitoring a patient's breathing and developing gas inhalation protocols "with monitoring the basal level of the imaging followed with the intermediate gas mixture response to the targeted level of oxygenation . . . with the performance of statistical analysis of the MRI imaging according to the different level of oxygenation from the respiratory challenge protocol." *Id.*

The Examiner determines it would have been obvious to further modify the system of Winkelmann, Hornak, Hedlund, Bolam, and Griffiths by determining different oxygenation levels for reconstructing corresponding BOLD/TOLD MRI imaging contrasting both normal and pathological diseased tissues using the T2 MRI response imaging of Taylor to analyze the images using statistical analysis on subsets of images to better determine the pathologic state of the diseased tissue as suggested by Taylor. Final Act. 18.

The Examiner relies on Weiskopf for teaching real-time functional MRI (i.e., rtfMRI) "applied with BOLD-MRI for real time statistical analysis during acquisition of the MRI data," which is "therefore applied to the analysis of real-time physiological responses such as blood oxygen levels or oxygenation levels implicitly measured by BOLD-MRI or other

physiological responses such as vasoreactivity as also implicitly disclosed for a BOLD-MRI with BOLD activity . . . with feedback from functional maps." Final Act. 18 (citing Weiskopf, Figs. 4, 5). The Examiner notes that Weiskopf cites Cohen "for the real-time statistical analysis of the BOLD-MRI images[,] with Cohen further disclosing the set-up for the feed-back signal (Fig. 11 with a real-time behavior stimuli signal) for monitoring in real-time physiological responses." *Id.* The Examiner determines it would have been obvious to further modify the system of Winkelmann, Hornak, Hedlund, Bolam, Griffiths, and Taylor to provide real-time analysis of the MR data as taught by Weiskopf, as well as feedback for providing a real-time stimuli signal as taught by Cohen, "in order to monitor in real time during image acquisition the physiological response of the patient such as the blood oxygen level or vasoreactivity in tissue measured by MRI as suggested by Cohen[,] with possible feedback from functional map as suggested by Weiskopf." *Id.* at 19 (citing Cohen, Fig. 11; Weiskopf, Fig. 4).

The Examiner finds that "Winkelmann, [Hornak], Hedlund, Bolam, Griffiths, Taylor, Weiskopf and Cohen do not explicitly disclose the processor modifying the pulse sequence during the acquisition of the MR data." Final Act. 19. However, the Examiner relies on Yoo for teaching "the real-time adaptive functional MRI . . . with a real time adaptation of the spatial and temporal sampling for the MRI acquisition . . . with a conditional analysis based on the functional results such as BOLD signal . . . for the approach of multiresolution." *Id.* (citing Yoo, Title; Abstract; 597, col. 1, para. 2). According to the Examiner, this "broadly reads on the processor modifying the MRI pulse sequence during acquisition of the data according to the functional, oxygenation level measures or gas delivered as claimed."

Id. The Examiner determines it would have been obvious to further modify the system of Winkelmann, Hornak, Hedlund, Bolam, Griffiths, Taylor, Weiskopf, and Cohen by configuring the processor "to modify the MRI pulse sequence during the data acquisition according to oxygenation level or external signals since real time adaptive functional MRI was known in the art as taught by Yoo." *Id.*

Appellant argues that the references applied in the rejection are not analogous art. Appeal Br. 11. Our reviewing court has explained that "[t]he analogous art inquiry is a factual one, requiring inquiry into the similarities of the problems and the closeness of the subject matter as viewed by a person of ordinary skill." *Scientific Plastic Prods., Inc. v. Biotage AB*, 766 F.3d 1355, 1360 (Fed. Cir. 2014).

> Criteria for determining whether prior art is analogous may be summarized as "(1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved."

Id. at 1359 (quoting *In re Clay*, 966 F.2d 656, 658–59 (Fed. Cir. 1992)).

The field of endeavor of Appellant's invention is the field of magnetic resonance imaging. Spec. 1:2–3 ("The invention relates to magnetic resonance imaging . . . ."). All of the references applied in the rejection are in the field of magnetic resonance imaging and, thus, are analogous art. Thus, Appellant's argument that the references are not analogous art is unsound.

Appellant next argues that "[n]one of the cited references teach or fairly suggest control of equipment based on tissue oxygen level measures determined from magnetic resonance images." Appeal Br. 11. In particular,

Appellant submits that Winkelmann evidences that it was known in the art "that elevated levels of oxygen or carbon dioxide affect magnetic resonance images," but fails to recognize the problems identified on page 2 of Appellant's Specification, much less propose a solution to these problems. *Id.* Appellant then proceeds to discuss perceived deficiencies in Hornak, Hedlund, Bolam, Griffiths, Taylor, Weiskopf, Cohen, and Yoo. *See id.* at 11–13. Appellant's arguments in this regard amount essentially to individual attacks on each of the references. "Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references." *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (citing *In re Keller*, 642 F.2d 413, 425 (CCPA 1981).

In particular, Appellant argues that Hornak "does not recognize the problems listed in Section (iii) of [Appellant's Appeal] Brief and on page 2 of the [Specification] nor propose any solution to them." Appeal Br. 11. This argument is unavailing because the Examiner does not rely on Hornak for this. As we mention above, the Examiner relies on Hornak for the details of the MRI hardware and an interface with satellite systems interacting with the MRI, such as triggering or gating of images. *See* Final Act. 12–13.

Appellant argues that there is no suggestion in Hedlund that the external trigger signal used to start a breathing sequence in Hedlund "be the result of the analysis of magnetic resonance images." Appeal Br. 11. This argument is unavailing because the Examiner does not rely on Hedlund for this aspect of the claim. The Examiner relies on a combination of Bolam, Griffiths, Weiskopf, Cohen, and Taylor for the concept of using real-time feedback from the MRI data, as indicative of oxygen saturation levels of the

tissue, to control the timing of both the breathing gas delivery system and the MR imaging. *See* Final Act. 15–19.

Appellant argues that Bolam shows no recognition of the problems listed in Section (iii) of Appellant's Appeal Brief and on page 2 of the Specification, "much less a[] proposed solution." Appeal Br. 11. This argument is not persuasive because obviousness does not require that the prior art recognize the same problems identified by Appellant. In determining whether the subject matter of a claim is obvious, "neither the particular motivation nor the avowed purpose of the [applicant] controls. What matters is the objective reach of the claim. If the claim extends to what is obvious, it is [unpatentable] under § 103." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 419 (2007).

Appellant submits that Griffiths's injection pump injects liquids into a patient's blood flow and argues that no competent medical professional would inject breathing gases into a patient's blood flow because this would cause embolisms to be formed, leading to "strokes, heart attacks, and the like." Appeal Br. 12. This argument is unavailing because the Examiner does not propose combining the prior art references in this manner. The Examiner relies on Griffiths merely for teaching integrating systems that need to work together (such as an MR imaging system and a contrast agent delivery system) and be timed together, but not for the particular contrast agent injection taught by Griffiths, and certainly not for injecting a gas into the blood. *See* Final Act. 15–16. Rather, the Examiner's combination of references retains the breathing gas delivery system of Winkelmann and Hornak.

Appellant also argues that "Griffiths does not control the MRI pulse sequence or the breathing gas sequence[] based on tissue oxygenation levels measured with MRI images." Appeal Br. 14. This argument is also unavailing because the Examiner does not rely on Griffiths for this. *See* Final Act. 15–16.

Appellant argues that Taylor does not use MR image analysis to control the respiratory challenge cycle, much less maintain synchronization of the MR cycle and the respiratory challenge cycle. Appeal Br. 12. This argument is unavailing because the Examiner does not rely on Taylor for this. *See* Final Act. 17–18. Appellant makes similar arguments about Weiskopf and Cohen. Appeal Br. 12. These arguments are similarly unavailing because the Examiner does not rely on Weiskopf and Cohen for teaching synchronizing MR cycles and respiratory challenge cycles; rather, the Examiner finds that Weiskopf and Cohen teach real-time analysis of BOLD MRI images. *See* Final Act. 18–19.

Appellant argues that Yoo does not disclose a breathing gas system, much less coordination between a breathing gas system and an MRI system. Appeal Br. 12. This argument is unavailing because the Examiner does not rely on Yoo for a breathing gas system or for coordination between a breathing gas system and an MRI system. As discussed above, the Examiner relies on Yoo for teachings directed to real-time functional MRI with a real-time adaptation of the spatial and temporal sampling for the MRI acquisition, and determines that it would have been obvious, in view of Yoo, to modify the MRI pulse sequence during the data acquisition according to oxygenation level or external signals. Final Act. 19.

Appellant contends that "[n]one of the applied references teach or fairly suggest that the tissue oxygenation level measurement can or should be used to determine either the gas sequence of the breathing gas system or the timing of the magnetic resonance system." Appeal Br. 13–14. This contention fails to consider the totality of the reference teachings in combination, including Bolam's teaching to use oxygen saturation levels as feedback to a controller interface module (controller 15) for controlling, including triggering, both a breathing gas delivery system and an imaging system such as an MRI in combination with the teachings of Weiskopf, Cohen, and Taylor relied on by the Examiner directed to analysis of BOLD MRI data in the context of blood oxygen level or vasoreactivity in tissue. *See* Bolam ¶¶ 79, 81; Final Act. 17–19.

Appellant argues, in the Reply Brief, that Griffiths synchronizes only the start of the injector and the imaging device, and does not teach modifying at least one of the MRI pulse sequence and a gas sequence during the acquisition of the MR data in accordance with tissue oxygenation level or other measures, and also that "Yoo uses an operator adjustment, not a measurement-based adjustment." Reply Br. 4–5 (citing Griffiths ¶ 14; Yoo 597). Appellant argues that Griffiths synchronizes only the start of the injector and the imaging device, and that "[t]here is no feedback in real time based on the images." *Id.* at 4. For the reasons that follow, these arguments are not persuasive.

Paragraph 14 of Griffiths, which Appellant cites in support of the argument that Griffiths only synchronizes the start of the injector and imaging device, discloses that "[c]urrent injector and imager interaction is primarily limited to start synchronization." However, Griffiths also teaches

that technology is known in which the user can "cause or make changes in the injection based upon the image observed" and suggests, alternatively, setting up the injector and the imager to cooperate such that digital information transmitted from the imager to the injector can be used to adjust the injection "if the images can be created in a sufficiently short period of time that the feedback can be effective." Griffiths ¶ 72. This suggestion, considered in conjunction with the teachings of real-time analysis and feedback of BOLD MR images in Weiskopf, Cohen, and Taylor, would have provided ample motivation to a person having ordinary skill in the art to modify the system of Winkelmann, Hornak, Hedlund, and Bolam to use information generated by the BOLD MRI analysis to adjust the gas delivery and/or imager timing to synchronize these two functions.

Appellant is correct that Yoo teaches providing feedback from the MR images to the operator (rather than a processor or controller) to advance the imaging. *See* Yoo 597. However, the Examiner does not rely on Yoo for teaching feedback to a processor or controller to synchronize the breathing gas delivery and the imaging. Rather, the Examiner relies on Hedlund, Griffiths, and Bolam for teachings directed to providing an integrated system with a common controller for controlling the timing of both the imaging and the delivery of the contrast-inducing agent (breathing gas delivery). Final Act. 14–16.

For the above reasons, Appellant does not apprise us of error in the rejection of claim 1. Accordingly, we sustain the rejection of claim 1, as well as claims 2 and 3, for which Appellant relies on the same arguments presented for claim 1. *See* Appeal Br. 14–15.

Rejections II and IV—Claims 7 and 14

In contesting the rejections of claims 7 and 14, Appellant essentially reiterates the argument presented for claim 1, namely, that the prior art does not teach or suggest modifying an MR pulse sequence or a respiratory challenge sequence based on the analysis of MRI data. Appeal Br. 16. This line of argument fails to apprise us of error for the reasons set forth above in discussing the rejection of claim 1. Accordingly, we sustain the rejections of claims 7 and 14.

Rejection III—Claims 10 and 13

Appellant relies on the arguments presented for claim 1 in contesting the rejections of claims 10 and 13. Appeal Br. 13–15. For the reasons discussed above, these arguments fail to apprise us of error in the rejection of claim 1 and, likewise, fail to apprise us of error in the rejections of claims 10 and 13, which we, thus, sustain.

Rejection V—Claims 15–18

In rejecting claim 15, the Examiner finds that Griffiths discloses a magnetic resonance imaging system for controlling delivery of a contrast-inducing fluid, substantially as recited in claim 15, comprising a computer system including at least one computer processor configured to generate a series of contrast images, determine from the contrast images whether the contrast fluid delivery protocol and the scan protocol are synchronized, and control at least one of the contrast fluid delivery system to adjust the contrast fluid delivery protocol and the magnetic resonance imaging system to adjust the scan protocol. *See* Final Act. 24–25. However, the Examiner finds that

Griffiths does not teach the contrast-inducing fluid being a breathing gas or the contrast images being oxygen level dependent contrast images. *Id.* at 25.

The Examiner finds that "Jin teaches the use of a gas-challenge blood oxygen level dependent (BOLD) MRI imaging combined injection of gas (Title and abstract) for . . . monitoring the progression of hepatic disease." Final Act. 25. The Examiner relies on Jin for its teaching of delivering breathing gas of different mixtures using a preselected breathing protocol and using a preselected MRI scan protocol for generating a series of oxygen level dependent contrast images from the oxygen level dependent contrast image data. *Id.* The Examiner determines it would have been obvious to modify Griffiths by delivering, as the contrast-inducing fluid, breathing gas of different mixtures using a preselected breathing protocol and using a preselected MRI scan protocol to generate a series of oxygen level dependent contrast images from oxygen level contrast image data because "one of ordinary skill in the art would have recognized that providing a time series of alternate carbogen and air to a subject to image the BOLD MRI data for imaging regions of interest was known in the art as taught by Jin." *Id.*

Appellant argues that "Griffiths does not suggest coordinating a breathing protocol and a scan protocol based on a series of MR images, much less based on a series of oxygen level dependent MR images" and, thus, "does not teach or fairly suggest analyzing oxygen level dependent MR images to determine whether a breathing protocol and a scan protocol are synchronized." Appeal Br. 16.

Although the MR images analyzed by Griffiths may not be oxygen level dependent MR images, Griffiths teaches providing a processor

configured to generate a series of contrast images from contrast image data and, based on these contrast images, make any necessary adjustments to at least one of the contrast-inducing fluid delivery protocol and the MR scan protocol to synchronize these functions. *See* Griffiths ¶¶ 8, 9, 25, 63, 72, 108; Final Act. 24–25. Even assuming Appellant is correct that Griffiths does not teach analyzing oxygen level dependent MR images, this argument does not identify error in the rejection because the Examiner relies on Jin, and not Griffiths, for the teaching to analyze oxygen level dependent MR images, as well as to use delivery of different mixtures of breathing gases according to a predetermined breathing protocol as the contrast-inducing fluid. *See* Final Act. 25.

Appellant argues that Jin provides "no suggestion of determining whether the breathing protocol and the scan protocol are synchronized, much less adjusting at least one of the breathing protocol and the scan protocol accordingly." Appeal Br. 16–17. This argument is unavailing because it attacks Jin individually. The Examiner relies on Griffiths for teaching determining, from the MR contrast image data, whether the contrast-inducing fluid delivery protocol and the scan protocol are synchronized. Final Act. 24–25. A person having ordinary skill in the art would have inferred from Griffiths's teaching of using information from the image data to adjust the injection (¶ 72), considered in concert with Griffiths's teaching of the importance of synchronizing the injection and the imaging and using feedback from the imaging to determine and/or adjust the injection to achieve an improved image (¶¶ 8, 9), that the MR contrast image data is analyzed to determine whether the contrast-inducing agent injection and imaging are properly synchronized to achieve a high quality image.

For the above reasons, Appellant does not apprise us of error in the rejection of claim 15. Accordingly, we sustain the rejection of claim 15, as well as claims 16 and 17 for which Appellant does not present any separate arguments for patentability and which, thus, fall with claim 15.

Appellant's argument contesting the rejection of claim 18 merely reiterates the contention that Jin does not teach or suggest "making a determination whether the breathing protocol and the scan protocol are synchronized." Appeal Br. 17. This argument fails to apprise us of error, for the reasons discussed above in regard to claim 15. Accordingly, we also sustain the rejection of claim 18.

DECISION

The Examiner's decision rejecting claims 1–3, 7, 10, and 13–18 is AFFIRMED.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1–3	103	Winkelmann, Hornak, Hedlund, Bolam, Griffiths, Taylor, Weiskopf, Cohen, Yoo	1–3	
7	103	Winkelmann, Hornak, Hedlund, Bolam, Griffiths, Taylor, Weiskopf, Cohen, Yoo, Neeman	7	

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
10, 13	103(a)	Winkelmann, Hornak, Hedlund, Bolam, Griffiths, Taylor, Weiskopf, Cohen, Yoo, Poser	10, 13	
14	103(a)	Winkelmann, Hornak, Hedlund, Bolam, Griffiths, Taylor, Weiskopf, Cohen, Yoo, Neeman, Poser	14	
15–18	103(a)	Griffiths, Jin	15–18	
Overall Outcome			1–3, 7, 10, 13–18	

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