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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte YOSHIHISA TERADA
and KOJI MORIKAWA

Appeal 2017-006102
Application 13/224,452
Technology Center 3700

Before: DEMETRA J. MILLS, ERIC B. GRIMES and JOHN G. NEW,
Administrative Patent Judges.

MILLS, *Administrative Patent Judge.*

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134. The Examiner has rejected the claims for indefiniteness, obviousness, and as directed to patent ineligible subject matter. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM-IN-PART.

NATURE OF INVENTION

The present invention is directed to an electroencephalogram measurement (EEG) system which determines a state of attachment of the electrodes which are utilized for electroencephalogram measurement. Spec.

¶ 2.

STATEMENT OF CASE

We select claims 1, 3, 5, 8, and 14 as representative claims.

1. An electrode attachment state determination system comprising:

an electroencephalogram measurement unit for measuring an electroencephalogram signal of a user by using at least one set of electrodes, the set including a ground electrode, a reference electrode, and a measurement electrode;

a frequency analysis unit for performing a frequency analysis of the electroencephalogram signal;

an insufficient electrode determination unit for extracting at least one parameter of a total frequency power across all bands and at least one parameter of a noise amount from a result of the frequency analysis, and through a comparison of a value of the at least one noise parameter against a predetermined noise threshold value and through a comparison of a value of the at least one total frequency power parameter against a predetermined total frequency power threshold value, determining whether the ground electrode, the reference electrode, or the measurement electrode has an insufficient state of attachment; and

an output unit for, when an insufficient state of attachment is determined, presenting information indicating the insufficient state of attachment of the electrode to the user.

App. Br., Claims App. 1.

3. The electrode attachment state determination system of claim 2, wherein the insufficient electrode determination unit further extracts the total

frequency power parameter from the result of the frequency analysis, and if the total frequency power parameter has a value exceeding a predetermined second threshold value as the total frequency power threshold value, determines that one of the reference electrode and the measurement electrode has an insufficient state of attachment.

5. The electrode attachment state determination system of claim 1, wherein the electroencephalogram measurement unit measures a first potential difference between the ground electrode and the reference electrode and a second potential difference between the ground electrode and the measurement electrode, and measures the electroencephalogram signal based on a difference between the second potential difference and the first potential difference.

8. The electrode attachment state determination system of claim 5, wherein, as the total frequency power parameter, the insufficient electrode determination unit extracts an average value of a power of the electroencephalogram signal in an analyzable frequency band.

14. The electrode attachment state determination system of claim 1, further comprising an electroencephalogram processing unit for distinguishing an intent of the user by utilizing a characteristic component contained in the measured electroencephalogram signal, and executing a process which is in accordance with the intent of the user, wherein,
from a result of the frequency analysis, the insufficient electrode determination unit extracts at least one parameter of a total frequency power and a noise amount, and through a comparison of a value of the at least one parameter against a predetermined threshold value, determines a state of attachment of the ground electrode, the reference electrode, or the measurement electrode to be sufficient or insufficient; and
if the state of attachment is determined to be insufficient, the output unit presents information indicating the insufficient state of attachment of the electrode to the user, and if the state of attachment is determined to be sufficient, the output unit outputs a result of the process which is in accordance with the intent of the user.

Cited References

| | | |
|---------------------------------|----------------------|----------------|
| Strobl et al. ("Strobl") | U.S. 4,579,125 | Apr. 1, 1986 |
| Bibian et al. ("Bibian") | U.S. 8,538,512 B1 | Sept. 17, 2013 |
| John et al. ("John") | U.S. 2006/0241562 A1 | Oct. 26, 2006 |
| Yasushi ("Yasushi") | U.S. 5,495,853 | Mar. 5, 1996 |
| Morikawa et al. ("Morikawa") | U.S. 2009/0247895 A1 | Oct. 1, 2009 |

Grounds of Rejection¹

1. Claims 1–16 are rejected under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor regards as the invention.
2. Claims 1–16 are rejected under 35 U.S.C. § 101 because the claimed invention is directed to a judicial exception (i.e., a law of nature, abstract idea).
3. Claims 1, 2, 15 and 16 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Strobl in view of Bibian.

¹ Claims 10–13 have been indicated by the Examiner to be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. § 112(b) or 35 U.S.C. §§ 112 (pre-AIA), 2nd paragraph and the 101 rejections. Non-Final Act. 11.

4. Claims 3 and 4 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Strobl, Bibian, and John.
5. Claims 5–7 and 9 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Strobl, Bibian and Yasushi.
6. Claim 8 is rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Strobl, Bibian, Yasushi and John.
7. Claim 14 is rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Strobl, Bibian, and Morikawa.

FINDINGS OF FACT

The Examiner’s findings of fact are set forth in the Non-Final Action at pages 2–11.

PRINCIPLES OF LAW

In making our determination, we apply the preponderance of the evidence standard. *See, e.g., Ethicon, Inc. v. Quigg*, 849 F.2d 1422, 1427 (Fed. Cir. 1988) (Explaining the general evidentiary standard for proceedings before the Office.).

“[The] combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

Indefiniteness Rejection

The Examiner argues that the claim 1 language, “across all bands,” “does not make clear what bands are being referred to specifically. It is unclear if this means the standard EEG bands, the EEG signal as a whole across the whole signal or something else.” Non-Final 3.

Appellants argue that

It should clear even from the current claim language that the bands is a reference to the measured EEG signal that is measured by the electroencephalogram measurement unit. To further prosecution, however, Applicant is willing to amend independent claim 1 in accordance with the Examiner's comments to recite "an insufficient electrode determination unit for extracting at least one parameter of a total frequency power across all bands of an EEG signal measured by the electroencephalogram measurement unit."

App. Br. 7.

We find that Appellants have the better argument. Section 112(b) requires the Specification to "conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention." As our reviewing court has explained, section 112(b) requires the claims "to be cast in clear—as opposed to ambiguous, vague, indefinite—terms." *In re Packard*, 751 F.3d 1307, 1313 (Fed. Cir. 2014). The rationale for requiring such "reasonable precision" in claim language is because "[i]t is the claims that notify the public of what is within the protections of the patent, and what is not." *Id.*

Accordingly, the language of the claims, when read in light of the Specification, must allow skilled artisans to distinguish, as clearly as possible, between activities which are covered by the claims, and activities which fall outside the claims. *See Miles Laboratories, Inc. v. Shandon Inc.*, 997 F.2d 870, 875 (Fed. Cir. 1993) ("The test for definiteness is whether one skilled in the art would understand the bounds of the claim when read in light of the [S]pecification."). Thus, "[a] claim is indefinite if, when read in light of the [S]pecification, it does not reasonably apprise those skilled in the

art of the scope of the invention.” *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1342 (Fed. Cir. 2003).

According to the Specification,

As the total frequency power, “an average value of power in the analyzable frequency band” was determined. More specifically, 1 second of data was extracted from the measured electroencephalogram, and this was subjected to a fast Fourier transform (FFT) to determine a power value of each frequency; and a total frequency power was calculated as an average value of the power in a frequency band which is greater than 0 but equal to or less than 100 Hz. The reason for adopting “greater than 0 but equal to or less than 100 Hz” is that, given the fact that electroencephalogram measurements were taken with a sampling frequency of 200 Hz in this experiment, the sampling theorem dictates that the available frequency band is up to 100 Hz. The range of “greater than 0 but equal to or less than 100 Hz” is only exemplary. An available frequency band may be determined, and an electroencephalogram may be measured with a sampling frequency that is twice as large as the maximum frequency thereof.

Spec. ¶ 91. We agree with Appellants that one of ordinary skill in the art of conventional electroencephalogram technology, when read in light of the present Specification, would understand the meaning of the claim language, “a total frequency power across all bands” to include a defined range of frequencies obtained from the EEG signal.

The claim indefiniteness rejection is reversed.

Lack of Patent Eligible Subject Matter

The Examiner finds that

Claim(s) 1-16 is/are directed to the abstract idea itself of calculating the frequency spectrum and a noise determination comparing the noise parameter to a threshold and then from that determining if a ground, common or reference electrode has an insufficient state of attachment. The claim(s) does/do not include additional elements that are sufficient to mount to significantly more than the judicial exception because the additional sensors is/are merely for data input, are well-known, routine, and conventional in the art, and are used in extra-solution activity. As any additional elements in the claims do not amount to significantly more than the abstract idea itself, the claims when considered individually or as a whole do not amount to more than the abstract idea itself. Furthermore, the subject matter's ineligibility is confirmed by the machine-or-transformation test, under which the claims are not tied to any specific machine and do not transform the nature of the subject matter into something more than the abstract mathematics behind it. At its core, the application is seeking protection for the idea of correlating the frequency determinations to electrode attachment.

Non-Final Act. 3.

We do not find that the Examiner has established a prima facie case of lack of patent eligible subject matter.

“Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.” 35 U.S.C. § 101. Supreme Court precedents, however, provide three specific exceptions to the broad categories of 35 U.S.C. § 101: laws of nature, natural phenomena, and abstract ideas. *Bilski v. Kappos*, 561 U.S. 593, 601 (2010). “The ‘abstract ideas’ category embodies []the longstanding rule that ‘[a]n idea of itself is not patentable.’” *Alice Corp. Pty. Ltd. v. CLS Bank Int’l*, 134 S.Ct. 2347, 2355 (2014) (citing *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972)).

In *Alice*, the Supreme Court referred to the two-step analysis set forth in *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, (2012), as providing “a framework for distinguishing patents that claim laws of nature, natural phenomena, and abstract ideas from those that claim patent-eligible applications of those concepts.” *Alice*, 134 S.Ct. at 2355 (citing *Mayo*, 566 U.S. at 66). Under *Mayo*, “[w]e must first determine whether the claims at issue are directed to a patent-ineligible concept.” *Id.* Next, “we consider the elements of each claim both individually and ‘as an ordered combination’ to determine whether the additional elements ‘transform the nature of the claim’ into a patent-eligible application.” *Id.* (citing *Mayo*, 566 U.S. at 78–80).

Under *Mayo*, to be patentable, a claim must do more than simply state the law of nature or abstract idea and add the words “apply it.” *Mayo*, 566 U.S. at 72; *Benson*, 409 U.S. at 67. For example, “the mere recitation of a generic computer cannot transform a patent-ineligible abstract idea into a patent-eligible invention.” *Alice*, 134 S.Ct. at 2358. “Thus, if a patent’s recitation of a computer amounts to a mere instruction to ‘implemen[t]’ an abstract idea ‘on . . . a computer,’ that addition cannot impart patent eligibility.” *Id.* (citation omitted).

In addition, the “notion that [extra]-solution activity, no matter how conventional or obvious in itself, can transform an unpatentable principle into a patentable process exalts form over substance.” *Parker v. Flook*, 437 U.S. 584, 590 (1978). *See also Mayo*, 566 U.S. at 80 (“Purely ‘conventional or obvious’ ‘[pre]-solution activity’ is normally not sufficient to transform an unpatentable law of nature into a patent-eligible application of such a law.”).

A challenged patent claim, properly construed, must incorporate enough meaningful limitations to ensure that it claims more than just an abstract idea and not just a mere “drafting effort designed to monopolize the [abstract idea].” *Alice*, 134 S.Ct. at 2357 (quoting *Mayo*, 566 U.S. at 78). “Simply appending conventional steps, specified at a high level of generality,” is not “*enough*” for patent eligibility. *Id.* (quoting *Mayo*, 566 U.S. at 83).

On the other hand, in *Enfish, LLC v. Microsoft Corp*, 822 F.3d 1327 (Fed. Cir. 2016), the Federal Circuit determined that claims to a data storage and retrieval system for a computer memory are not directed to an abstract idea. *Id.* at 1336. The system at issue incorporated a self-referential logical model, which allowed faster searching and more effective storage of data. As an initial matter, the court declined to “read *Alice* to broadly hold that all improvements in computer-related technology are inherently abstract and, therefore, must be considered at step two.” *Id.* at 1335. Analyzing the claimed invention under the first step of the *Alice* inquiry, the court found that the claims “are not directed to an abstract idea within the meaning of *Alice*,” but rather “to a specific improvement to the way computers operate, embodied in the self-referential table.” *Id.* at 1336.

Therefore, we first determine whether the claims at issue are directed to a patent-ineligible concept. We do not find that the examiner has established that the claims are directed to a patent-ineligible concept. As argued by Appellants,

In the claimed invention, therefore, the notification pertains to the ***state of the device itself, and not to a natural phenomenon***. As such, the claimed invention has a technical effect of improving the performance of the EEG analysis device -- outputting a notification to

the user indicating a position and a type of electrode that has become insufficient permits correction of electrode positioning (which is done by the user) to improve the performance of the EEG analysis device itself. Without the invention, deficient data may be gathered unknown to the user, yielding a poor EEG assessment.

App. Br. 8–9. Appellants further argue that

the Examiner ignores that the analysis is limited to a particular type of signal that can only be measured with an electronic device: “an electroencephalogram measurement unit for measuring an electroencephalogram signal of a user by using at least one set of electrodes, the set including a ground electrode, a reference electrode, and a measurement electrode.” Accordingly, the sensor system is a particular system that measures a particular type of signal. In addition, the frequency analysis is performed on this signal. Again, as the type of signal at issue cannot be measured without a specific electronic device, the invention does not perform the type of analysis that can be done by hand or by mental exercise.

Reply Br. 3.

We find that the claimed electrode attachment state determination system, which includes an electroencephalogram measurement unit for measuring an electroencephalogram signal, using at least one set of electrodes, (including a ground electrode, a reference electrode, and a measurement electrode); a frequency analysis unit, an insufficient electrode determination unit, and an output unit to indicate an insufficient state of attachment of an electrode to the user, is directed to a patent eligible device improvement. The improved operation of the EEG device uses both a noise parameter and a total frequency power parameter to determine whether an individual electrode is insufficiently attached in a multi-component EEG

system. We do not find that the Examiner established with evidence² that use of both a noise parameter and a total frequency power parameter to determine insufficient electrode attachment in a multi-component EEG device/system, as claimed, is conventional. We conclude that the Examiner has not established that the claims are directed to a patent ineligible abstract idea.

The patent ineligible subject matter rejection is reversed.

Obviousness Rejection — Strobl and Bibian

The Examiner finds that Strobl teaches each element claimed, except a ground electrode, which the Examiner finds is well known in the art. Non-Final Act. 5. In addition, the Examiner finds that, “Strobl also does not specifically disclose determin[ing] a noise amount compared to a threshold to determine a loose lead just the frequency power determinations.” Non-Final Act 5. The Examiner therefore relies on Bibian as teaching “an EEG measuring system that monitors noise ([C26 L54-65]).” *Id.* The Examiner concludes that, “it would have been obvious to one of ordinary skill in the art at the time of invention to combine the device of Strobl with the teachings of Bibian in order to collect a more accurate signal.” *Id.*

Appellants contend that, in Strobl, “a processor converts the digitized time domain waveforms into the frequency domain by Fast Fourier Transform (FFT) for further analysis. ***Prior to the FFT***, however, epochs of the time domain signal containing artefacts are removed so as not to be part

² *Berkheimer v. HP Inc.*, 881 F.3d 1360, 1369 (Fed. Cir. 2018) (“[w]hether something is well-understood, routine, and conventional to a skilled artisan at the time of the patent is a factual determination.”).

of the spectral analysis, and the artefact epochs are not subjected to the FFT or frequency analysis at all (Strobl at col. 7, lines 32-40[]).” App. Br. 11.

Appellants further argue that

Strobl in particular describes that artefacts with significantly high frequency components may be associated with artefacts caused by muscle movement, and amplitude and frequency values may be detected that typically are indicative of a loose lead. (See Strobl at col. 7, line 23 to col. 8, line 44.) ***Strobl never links abnormalities in the power spectrum with poor attachment of any of the electrodes.***

App. Br. 11.

We are not persuaded by Appellants’ arguments. In the EEG analyzer of Strobl, a

[d]igital computer 20 also checks the frequency spectra for unusually high amplitudes at 60 Hz, *which also indicate loose lead artifacts.*³ Digital computer 20 rejects the epochs which contain artifacts caused by loose leads, and also provides a diagnostic message to the operator through display 24 or printer 26, so that the loose lead can be corrected.

Digital computer 20 averages the frequency spectra from a number of artifact-free epochs over a predetermined update period.

After the frequency spectra for each channel have been averaged for the update period, digital computer 20 calculates an amplitude value for each frequency band for each channel. This frequency band amplitude value is produced by summing the amplitude values of each

³ “The computer converts the stored digital data from the time domain to the frequency domain by means of a Fast Fourier Transform (FFT) algorithm. The transformed data represents a frequency spectrum (i.e. amplitude or power of the EEG signal as a function of frequency).” Strobl 1:60–65.

frequency within the particular frequency band. The result is a data, a theta, an alpha and a beta amplitude value for each channel. Digital computer 20 then provides an output through display 24 and/or printer 26 based upon the frequency band amplitude values for the various channels.

Strobl 8:37–62; italicized emphasis added. Thus, Strobl describes abnormalities in the power spectrum are associated with poor attachment of the electrodes or loose electrode leads. Furthermore, consistent with the Examiner’s argument, we recognize that a grounding electrode is well known in the EEG art. *See, e.g.*, Yasushi 4:11–15.

Appellants further argue that

Bibian relates generally to the use of power spectrum parameters in the analysis of brain dysfunction through EEG monitoring. Bibian relates to power spectrum parameters *as a measure of brain function, not device function*. Accordingly, Bibian does not teach the recognized deficiencies of Strobl because the combined references still do not teach any link between abnormalities in the power spectrum with poor electrode attachment.

App. Br. 11–12. We are not persuaded. Bibian discloses an EEG that includes

SQ [signal quality] circuitry [that] monitors the front-end amplifiers in order to detect eventual saturation that occurs *when leads . . . are disconnected*. This information, along with the digitized brainwave signals, is relayed to the processing means **8-14**. . . . The Signal Quality Assessment Module **8** is used to check whether each signal acquired by the system is of sufficient enough quality to be used in the subsequent analysis. This is done by measuring continuously the electrode impedance of each brainwave channel, and by quantifying the levels of 50 and 60 Hz noise in the signal. High levels of 50 or 60 Hz indicate either a poor electro-magnetic environment, or a poor connection to the patient which will result in a heightened sensitivity

of the system for any other environmental noise (e.g., lead movement, vibration, etc.). *High levels of 50 or 60 Hz noise* are usually indicative of poor signal quality.

Bibian 26:49–65 (emphasis added). Thus, Bibian teaches an EEG measuring system that monitors noise to determine if a signal acquired by the EEG system is of sufficient enough quality to be used in the subsequent analysis, and determines if the poor quality is associated with disconnected leads. Non-Final Act. 5. Appellants have not provided sufficient rebuttal argument to the Examiner’s established prima facie case of obviousness.

On balance, the preponderance of the evidence supports the findings of the Examiner, and the obviousness rejection over Strobl and Bibian is affirmed.

Obviousness Rejection 4

Claims 3 and 4 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Strobl, Bibian, and John. Claims 3 and 4 share a common feature in relating the total frequency power parameter to an insufficient state of either the reference electrode or the measurement electrode. App. Br. 14. Strobl describes abnormalities in the power spectrum are associated with poor attachment of the electrodes or loose electrode leads. Strobl 8:37–62. The Examiner finds,

[r]egarding claim 3, [that] Strobl discloses the system that determines which electrode may have an attachment problem ([C8 L16-44]) but does not specifically disclose determining it from total frequency power. 562 [John] teaches [to] determine the total frequency power from the calculated spectra ([¶40]). In combination with Strobl that teaches [to] determine an electrode attachment problem when the frequency spectrum has unusually high amplitudes,

in a total power calculation this would be evident as the total power would be higher, the combined device determines if the total power is over a threshold. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to combine the device of Strobl with the teachings of 562 [John] in order to better analyze the frequency distribution.

Non-Final Act. 611.

Appellants argue with respect to rejection 4, that, “the reference in John to calculating a total frequency power . . . is a generalized reference. John specifically does not relate the total frequency power to any artefacts in the EEG signal.” App. Br. 14.

We are not persuaded. John is directed to medical systems and methods and more particularly, to an EEG based system for monitoring or automatic guidance of anesthesia, analgesia, and amnesia during surgical operations. ¶ 2. In John, the “EEG system . . . automatically checks the electrode-skin impedance at each electrode at frequent intervals, (e.g., every minute), and displays a warning (e.g., a red LED light) if any such impedance falls below 5000 ohms.” John ¶ 28. In addition, using a Fast Fourier Transform (FFT), the complex wave diagram of the EEG is divided into underlying oscillation components, followed by a translation from the time domain into the frequency domain. The squared amplitudes of these oscillation components form the “power spectrum.” ¶ 40. John, paragraph 40, discloses that this FFT is the preferred method for calculating a power spectrum of the patients’ brain waves. John discloses that further processing of the results may include the extraction of spectrum parameters and statistical calculations, and that analysis of the relative phase variances at each frequency may be conducted. FFTs of segments containing evoked

potential signals and segments containing only noise samples are analyzed and noise is removed by setting appropriate coefficients to zero and reconstructing evoked potentials with the noise digitally removed. *Id.* Parameters which may be derived from the power spectrum, include, for example, the total power and absolute and relative power in different frequency bands. *Id.* Data are subjected to automatic artifact removal. John ¶ 16.

We find that the Examiner has provided evidence that it would have been obvious to one of ordinary skill in the art at the time of invention to combine the device of Strobl (which describes abnormalities in the power spectrum are associated with poor attachment of the electrodes or loose electrode leads), and Bibian, with the teachings of John (describing artifact removal from EEG signals derived from the power spectrum, and checking of electrode-skin impedance at each electrode at frequent intervals). John describes the analysis of power spectrum signals in an EEG, and total power, absolute and relative power in different frequency bands, and the removal of noise from such data. One of ordinary skill in the art would have understood that noise could be removed from other forms of power spectrum data, including Strobl's power spectrum data associated with poor attachment of the electrodes or loose electrode leads.

Obviousness Rejections 5-7

Appellants do not otherwise argue the merits of obviousness rejections 5–7 on this record, other than the previous arguments presented for the combination of Strobl, Bibian, and John. App. Br. 14–16. Arguments not made are waived. Obviousness rejections 5–7 are summarily affirmed.

DECISION

The cited references support the Examiner's obviousness rejections, which are affirmed for the reasons of record. The lack of patent eligible subject matter and claim indefiniteness rejections are reversed. Because the claim indefiniteness and patent eligible subject matter rejections are reversed, claims 10–13 are not subject to rejection.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1). *See* 37 C.F.R. § 41.50(f).

AFFIRMED-IN-PART