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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/547,982	08/26/2009	Harinath Garudadri	QC082800	6249

12371 7590 06/13/2019
Muncy, Geissler, Olds & Lowe, P.C./QUALCOMM
4000 Legato Road, Suite 310
Fairfax, VA 22033

EXAMINER

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ART UNIT	PAPER NUMBER
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3791

NOTIFICATION DATE	DELIVERY MODE
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06/13/2019

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte HARINATH GARUDADRI,
FEDERICO S. CATTIVELLI, and PAWAN K. BAHETI

Appeal 2018-004964
Application 12/547,982
Technology Center 3700

Before JENNIFER D. BAHR, MICHAEL L. HOELTER, and
BRENT M. DOUGAL, *Administrative Patent Judges*.

BAHR, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants¹ appeal under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1–7, 9, 10, 12, 16–22, 24, 25, 27, 31–37, 39, 40, 42, and 46–52 under 35 U.S.C. § 101 as directed to a judicial exception without significantly more.² We have jurisdiction under 35 U.S.C. § 6(b). We AFFIRM.

¹ According to Appellants, the real party in interest is QUALCOMM Incorporated. Appeal Br. 3.

² Claims 8, 15, 23, 30, 38, 45, 53, and 54 have been cancelled, and claims 11, 13, 14, 26, 28, 29, 41, 43, and 44 have been withdrawn from consideration. *See* Amendment filed March 2, 2016.

THE CLAIMED SUBJECT MATTER

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

1. A method for estimating a systolic blood pressure (SBP) and a diastolic blood pressure (DBP) of a subject, comprising:
 - generating a photoplethysmogram (PPG) signal with one or more sensors placed on the subject;
 - generating an electrocardiogram (ECG) signal with the one or more sensors placed on the subject;
 - estimating, by an apparatus, a pulse arrival time (PAT) based on the PPG signal;
 - estimating, by the apparatus, a heart rate (HR) based on the ECG signal;
 - estimating, by the apparatus, the SBP and DBP in accordance with the following equations:

$$SBP = a_1 \cdot PAT + b_1 \cdot HR + c_1$$
$$DBP = a_2 \cdot PAT + b_2 \cdot HR + c_2$$

wherein a_1 , b_1 , c_1 , a_2 , b_2 , and c_2 are constants; and
providing a user-perceptible indication of the estimated SBP and DBP.

PRINCIPLES OF LAW

An invention is patent-eligible if it claims a “new and useful process, machine, manufacture, or composition of matter.” 35 U.S.C. § 101. However, the Supreme Court has long interpreted 35 U.S.C. § 101 to include implicit exceptions: “[l]aws of nature, natural phenomena, and abstract ideas” are not patentable. *E.g.*, *Alice Corp. v. CLS Bank Int’l*, 573 U.S. 208, 216 (2014).

In determining whether a claim falls within an excluded category, we are guided by the Supreme Court’s two-step framework, described in *Mayo*

and *Alice*. *Id.* at 217–18 (citing *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 75–77 (2012)). In accordance with that framework, we first determine what concept the claim is “directed to.” *See Alice*, 573 U.S. at 219 (“On their face, the claims before us are drawn to the concept of intermediated settlement, *i.e.*, the use of a third party to mitigate settlement risk.”); *see also Bilski v. Kappos*, 561 U.S. 593, 611 (2010) (“Claims 1 and 4 in petitioners’ application explain the basic concept of hedging, or protecting against risk.”).

Concepts determined to be abstract ideas, and thus patent ineligible, include certain methods of organizing human activity, such as fundamental economic practices (*Alice*, 573 U.S. at 219–20; *Bilski*, 561 U.S. at 611); mathematical formulas (*Parker v. Flook*, 437 U.S. 584, 594–95 (1978)); and mental processes (*Gottschalk v. Benson*, 409 U.S. 63, 69 (1972)). Concepts determined to be patent eligible include physical and chemical processes, such as “molding rubber products” (*Diamond v. Diehr*, 450 U.S. 175, 192 (1981)); “tanning, dyeing, making waterproof-cloth, vulcanizing India rubber, smelting ores” (*id.* at 184 n.7 (quoting *Corning v. Burden*, 56 U.S. 252, 267–68 (1854))); and manufacturing flour (*Benson*, 409 U.S. at 69 (citing *Cochrane v. Deener*, 94 U.S. 780, 785 (1876))).

In *Diehr*, the claim at issue recited a mathematical formula, but the Supreme Court held that “[a] claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula.” *Diehr*, 450 U.S. at 176; *see also id.* at 191 (“We view respondents’ claims as nothing more than a process for molding rubber products and not as an attempt to patent a mathematical formula.”). Having said that, the Supreme Court also indicated that a claim “seeking patent

protection for that formula in the abstract . . . is not accorded the protection of our patent laws, . . . and this principle cannot be circumvented by attempting to limit the use of the formula to a particular technological environment.” *Id.* (citing *Benson* and *Flook*); *see, e.g., id.* at 187 (“It is now commonplace that an *application* of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection.”).

If the claim is “directed to” an abstract idea, we turn to the second step of the *Alice* and *Mayo* framework, where “we must examine the elements of the claim to determine whether it contains an ‘inventive concept’ sufficient to ‘transform’ the claimed abstract idea into a patent-eligible application.” *Alice*, 573 U.S. at 221 (quotation marks omitted). “A claim that recites an abstract idea must include ‘additional features’ to ensure ‘that the [claim] is more than a drafting effort designed to monopolize the [abstract idea].’” *Id.* (quoting *Mayo*, 566 U.S. at 77). “[M]erely requir[ing] generic computer implementation[] fail[s] to transform that abstract idea into a patent-eligible invention.” *Id.*

The PTO recently published revised guidance on the application of § 101. USPTO’s January 7, 2019 Memorandum, *2019 Revised Patent Subject Matter Eligibility Guidance* (“2019 Eligibility Guidance”). Under that guidance, we first look to whether the claim recites:

- (1) any judicial exceptions, including certain groupings of abstract ideas (i.e., mathematical concepts, certain methods of organizing human activity, such as a fundamental economic practice, or mental processes); and

(2) additional elements that integrate the judicial exception into a practical application (*see* MPEP § 2106.05(a)–(c), (e)–(h)).

Only if a claim (1) recites a judicial exception and (2) does not integrate that exception into a practical application, do we then look to whether the claim:

(3) adds a specific limitation beyond the judicial exception that are not “well-understood, routine, conventional” in the field (*see* MPEP § 2106.05(d)); or

(4) simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception.

See 2019 Eligibility Guidance.

DISCUSSION

Appellant presents arguments directed generally to all of the independent claims, namely, claims 1, 16, 31, 46, 47, 48, and 49. *See* Appeal Br. 6–11. Appellant also presents arguments directed specifically to independent claim 16. *See id.* at 8–11. Appellant does not present any separate arguments for the dependent claims. *See id.* 6–11. Thus, we decide this appeal on the basis of claims 1 and 16, with claims 2–7, 9, 10, 12, 31–37, 39, 40, 42, and 46–52 standing or falling with claim 1, and claims 17–22, 24, 25, and 27 standing or falling with claim 16. *See* 37 C.F.R. § 41.37(c)(1)(iv) (permitting the Board to select a single claim to decide the appeal as to a single ground of rejection of a group of claims argued together).

(1) Do the claims recite a judicial exception?

The Examiner found that claims 1 and 16 recite mathematical formulas used in determining systolic and diastolic blood pressure, which is an abstract idea. Final Act. 3–4.

Appellants argue that “the language ‘the equation for determining the systolic and diastolic blood pressure’ is not directly recited in any of independent claims.” Appeal Br. 7 (boldface omitted). This argument lacks merit because the Examiner did not find that any of the claims recite such language.

Claim 1 recites estimating the systolic blood pressure (SBP) and diastolic blood pressure (DBP) in accordance with the mathematical equations “ $SBP = a_1 \cdot PAT + b_1 \cdot HR + c_1$ ” and “ $DBP = a_2 \cdot PAT + b_2 \cdot HR + c_2$.” Appeal Br. 12 (Claims App.). Likewise, claim 16 recites a third estimating circuit configured to estimate the SBP and DBP in accordance with the mathematical equations “ $SBP = a_1 \cdot PAT + b_1 \cdot HR + c_1$ ” and “ $DBP = a_2 \cdot PAT + b_2 \cdot HR + c_2$.” *Id.* at 14 (Claims App.). Thus, the Examiner’s finding that claims 1 and 16 recite mathematical formulas is correct. Further, mathematical formulas are a type of mathematical concept, which is one of the groupings of abstract ideas set forth in the 2019 Eligibility Guidance.

Claim 1 also recites estimating a pulse arrival time (PAT) based on a photoplethysmogram (PPG) signal and estimating a heart rate (HR) based on an electrocardiogram (ECG) signal. These are evaluations that can be performed in the human mind,³ which are mental processes, one of the

³ See Spec. ¶ 81 (disclosing that PAT captures the time for a blood pressure wave to travel from the heart to a certain point in the body, and that the PAT signal may be calculated from ECG and photoplethysmogram signals obtained using a pulse oximetry sensor).

groupings of abstract ideas enumerated in the 2019 Eligibility Guidance. Similarly, claim 16 recites a first estimating circuit for estimating a pulse arrival time (PAT) based on a photoplethysmogram (PPG) signal and a second estimating circuit for estimating a heart rate (HR) based on an electrocardiogram (ECG) signal. Thus, claim 16, like claim 1, recites evaluations that can be performed in the human mind, which are mental processes, one of the groupings of abstract ideas enumerated in the 2019 Eligibility Guidance.

For the above reasons, the Examiner correctly determined that claims 1 and 16 recite abstract ideas, which is a judicial exception to patent-eligibility.

(2) Do the claims recite additional elements that integrate the judicial exception into a practical application?

Following our Office guidance, having found that claims 1 and 16 recite a judicial exception, namely, mathematical formulas and mental processes, which are abstract ideas, we are instructed next to determine whether the claims recite “additional elements that integrate the judicial exception into a practical application (*see* MPEP § 2106.05(a)–(c), (e)–(h)).” *See* 2019 Eligibility Guidance. This evaluation requires us to determine whether an additional element or a combination of additional elements in the claim applies, relies on, or uses the judicial exception in a manner that imposes a meaningful limit on the judicial exception, such that the claim is more than a drafting effort designed to monopolize the exception. If the recited judicial exception is integrated into a practical application, the claim is not “directed to” the judicial exception.

The additional elements of claim 1 include generating a PPG signal with one or more sensors placed on the subject, generating an ECG signal with the one or more sensors placed on the subject, an apparatus for performing the estimating steps, and providing a user-perceptible indication of the estimated SBP and DBP. *See* Appeal Br. 12 (Claims App.). The additional limitations of claim 16 include one or more sensors configured to be placed on the subject to generate a PPG signal and an ECG signal; first, second, and third estimating circuits for performing the estimating functions; and a user interface device to provide a user-perceptible indication of the estimated SBP and DBP. *Id.* at 14–15 (Claims App.).

The steps of generating SBP and DBP signals with one or more generic sensors are simply generic steps of data collection, which is insignificant extra-solution activity. *See, e.g., CyberSource*, 654 F.3d at 1370 (“We have held that mere ‘[data-gathering] step[s] cannot make an otherwise nonstatutory claim statutory.’” (alterations in original) (quoting *In re Grams*, 888 F.2d 835, 840 (Fed. Cir. 1989))); *see also* 2019 Eligibility Guidance (identifying “add[ing] insignificant extra-solution activity to the” abstract idea as an example of when an abstract idea has not been integrated into a practical application). Likewise, claim 16 recites the one or more sensors configured for generating the SBP and DBP signals so generically that this recitation amounts to no more than generic data collection, which is insignificant extra-solution activity. *See* Ans. 2 (finding that the sensors “are merely used in extra-solution, data gathering steps”). Claims 1 and 16 do not recite, and the Specification does not disclose, the sensors with any specificity. *See, e.g., Spec.* ¶¶ 75–76 (describing the sensors in only a generic manner), ¶ 81 (disclosing that the ECG and PPG signals *may* be

obtained using a pulse oximetry sensor, but not requiring such a sensor or providing any details or technical specifications thereof). Thus, the nominal reference to or recitation of one or more sensors for generating the SBP and DBP signals that will be used in the estimating steps does not tie the abstract idea (the evaluations and mathematical formulas) to a specific machine. *See, e.g., In re Grams*, 888 F.2d 835, 840 (Fed. Cir. 1989) (“The presence of a physical step in the claim to derive data for the algorithm will not render the claim statutory.”)

Based on the current record, the recitation of “estimating, by an apparatus” in claim 1 and “estimating circuit[s]” in claim 16, are so generic that they do not add anything significant to the abstract ideas (mental processes and mathematical formulas). Although the reference to “an apparatus” and “circuit[s]” may connote physical structure broadly, this is insufficient to integrate the abstract idea into a practical application, as that terminology is used in the 2019 Eligibility Guidance. The mere reference to “an apparatus” and “circuit[s]” does not tie the abstract idea to a specific machine.

The step of providing a user-perceptible indication of the estimated SBP and DBP in claim 1, and the recitation of a user-interface for doing so in claim 16, amount to nothing more than insignificant post-solution activity. *See Elec. Power Grp.*, 830 F.3d at 1354 (pointing out “that merely presenting the results of abstract processes of collecting and analyzing information, without more (such as identifying a particular tool for presentation), is abstract as an ancillary part of such collection and analysis”).

Further, we find no indication in the Specification that the claimed invention effects a transformation or reduction of a particular article to a different state or thing. Nor do we find anything of record, short of attorney argument, that attributes any improvement in computer technology and/or functionality, or any other technology, to the claimed invention or that otherwise indicates that the claimed invention integrates the abstract idea into a “practical application,” as that phrase is used in the 2019 Eligibility Guidance.

Appellants argue that the claims integrate the abstract “ideas into a process of producing the SBP and DBP (for medical diagnosis purpose) in a power efficient manner.” Appeal Br. 10. According to Appellants, the claimed invention is an improvement over auscultatory and oscillometric methods that use “cuff type devices.” Reply Br. 5. Appellants urge that “using the sensors and the sensed parameters as recited in the present claims allows the use of less power, which is attractive in low power environments.” *Id.* Appellants also contend that “operation of an **apparatus** is improved by **providing a third estimating circuit that estimates systolic blood pressure (SBP) and diastolic blood pressure (DBP) based on both an estimated pulse arrival time (PAT) and an estimated heart rate (HR)**, similar to the self-referential table improving memory performance as discussed in” *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016). Appeal Br. 8.

Appellants’ Specification discloses that cuffs required for auscultatory and oscillometric methods of measuring blood pressure are bulky, costly, and usually require large amounts of power for automatic operation (i.e., when automatically inflated). *See* Spec. ¶ 4. Appellants’ Specification also

discloses that sensors used in the invention “*may* need to be small, lightweight, [and] have long battery life and low cost,” which results in “very low power requirements for sensing and communication, as well as [in] low complexity processing at the nodes.” *Id.* ¶ 75 (emphasis added). The Specification further discloses that ECG and PPG signals “may be obtained non-invasively utilizing low-power and low-cost electronics” and that “[a]n important issue addressed in the present disclosure is also synchronization (i.e., skew requirement) among wireless sensors . . . for accurate estimation of the PAT.” *Id.* ¶ 76.

In short, Appellants’ Specification discloses that automatic inflation of cuffs used for auscultatory and oscillometric methods of measuring blood pressure requires large amounts of power, and that there may be sensors available for measuring ECG and PPG signals that use low power and low-cost electronics and low complexity processing. However, the Specification does not disclose that sensors for measuring ECG and PPG necessarily require less power than sensors for measuring other parameters used for measuring/determining blood pressure, nor do Appellants provide any evidence showing that this would be the case. Further, as discussed above, claims 1 and 16 do not specify any particular type of sensor for measuring ECG or PPG signals, but, rather, recite the “one or more sensors” generically.

Moreover, even assuming that sensors for measuring ECG and PPG consume less power than sensors used in other types of blood pressure measurement apparatus, such as those that use automatically inflated cuff type devices, Appellants do not point to any evidence, or disclosure in their Specification, that the claimed invention improves the operation of the ECG

and PPG signal sensors themselves, or causes them to function in any different manner, only that low power sensors may be used. This is in contrast to, for example, the claims in *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016). In *Enfish*, the court found that “the self-referential table recited in the claims on appeal is a specific type of data structure designed to improve the way a computer stores and retrieves data in memory.” *Id.* at 1339. The *Enfish* court found they were “not faced with a situation where general-purpose computer components are added post-hoc to a fundamental economic practice or mathematical equation,” but “[r]ather, the claims are directed to a specific implementation of a solution to a problem in the software arts.” *Id.*

Appellants also argue that their disclosure, particularly Figures 5 and 9–16 and the accompanying text in the Specification, “provides clear evidence that the recited elements provide an improved estimation with increased accuracy.” Reply Br. 5. Figure 5 illustrates the PAT, which is the delay between a particular point (such as the *R* peak) of the ECG signal and a particular point in the PPG signal. Spec. ¶ 82. Figures 9–16 illustrate or tabulate standard deviations of error in PAT, and SBP and DBP, for various algorithms. *See id.* ¶¶ 109–126. At best, these portions of Appellants’ disclosure may show that the particular algorithms (formulas) used in Appellants’ invention may provide improved accuracy over other algorithms (formulas). To the extent that this represents an improvement, the asserted improvement is in the abstract idea itself. However, it could not be clearer from *Alice*, that under step two of the *Mayo/Alice* framework, the elements of each claim are considered both individually and “as an ordered combination” to determine whether the additional elements, i.e., the

elements *other* than the abstract idea itself, “transform the nature of the claim” into a patent-eligible application. *Alice*, 573 U.S. at 217. *See Mayo*, 566 U.S. at 72–73 (requiring that “a process that focuses upon the use of a natural law also contain *other* elements or a combination of elements, sometimes referred to as an ‘inventive concept,’ sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the natural law itself” (emphasis added)).

Appellants argue that “[t]he recited elements and specific correlation of the elements to arrive at an improved estimation of blood pressure is analogous to the cure time calculations . . . in *Diamond v. Diehr*.” Reply Br. 4. Appellants’ reliance on *Diehr* is misplaced. In *Diehr*, the Court found that the “claims involve the transformation of an article, in [that] case raw, uncured synthetic rubber, into a different state or thing” and “describe in detail a step-by-step method for accomplishing such, beginning with the loading of a mold with raw, uncured rubber and ending with the eventual opening of the press at the conclusion of the cure.” *Diehr*, 450 U.S. at 184. The fact that a mathematical equation and a programmed digital computer are used in several steps of the process did not alter the Court’s conclusion that the claims in that case recited an industrial process of the type that has historically been eligible for patent protection is not applicable to the claims before us. *Id.* at 185. Unlike the claims in *Diehr*, Appellants’ claims 1 and 16 do not involve a transformation of an article into a different state or thing.

For the above reasons, we determine that no additional element or combination of additional elements in claim 1 or claim 16 applies, relies on, or uses the judicial exception (mental processes and mathematical formulas) in a manner that imposes a meaningful limit on the judicial exception, such

that the claim is more than a drafting effort designed to monopolize the exception. In other words, claims 1 and 16 do not recite additional elements that integrate the judicial exception into a practical application and, thus, are “directed to” an abstract idea.

(3) Do the claims add any specific limitations beyond the judicial exception that are not “well-understood, routine, and conventional” in the field?

Because we determine that claims 1 and 16 fail to recite additional elements that integrate the judicial exception into a practical application, in accordance with the 2019 Eligibility Guidance we next consider whether the claim adds a specific limitation beyond the judicial exception that is not “well-understood, routine, conventional” in the field or instead “simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception.” *See* 2019 Eligibility Guidance.

The Examiner finds that “[t]he sensors while useful for the application are still routine . . . in the art and . . . do not provide an improvement or add significantly more and are merely used in extra-solution, data gathering steps.” Ans. 2. Given the generic manner in which claims 1 and 16 recite the “one or more sensors,” Appellants cannot reasonably contend that the sensors used are other than well-known, routine, and conventional. Moreover, Appellants’ Specification discloses using a pulse oximetry sensor to generate the ECG and PPG signals. Spec. ¶ 81. Appellants do not assert, nor does the Specification disclose, that Appellants have invented the pulse oximetry sensors or improved them in any manner.

Appellants argue that the third estimating circuit in claim 16 “is not ‘well-known, routine and conventional,” and allege that the Examiner’s assertion to the contrary “is insufficient to satisfy the ‘substantial evidence’ standard or the separate reasoned analysis and/or evidentiary requirements explained in the *May 2016 Memorandum.*” Reply Br. 9. This argument is unavailing because it is directed to the abstract idea itself, and not to *other* elements or a combination of elements. Claim 16 generically recites a third estimating circuit configured to estimate the SBP and DBP in accordance with the mathematical equations “ $SBP = a_1 \cdot PAT + b_1 \cdot HR + c_1$ ” and “ $DBP = a_2 \cdot PAT + b_2 \cdot HR + c_2$.” *Id.* at 14 (Claims App.). In other words, the third estimating circuit is nothing more than a generic circuit performing the mathematical formula, which is a mathematical concept and, thus, an abstract idea. *See* 2019 Eligibility Guidance. As discussed above, the inventive concept under step two of the *Mayo/Alice* test cannot be the abstract idea itself:

It is clear from *Mayo* that the “inventive concept” cannot be the abstract idea itself, and *Berkheimer* . . . leave[s] untouched the numerous cases from this court which have held claims ineligible because the only alleged “inventive concept” is the abstract idea.

Berkheimer v. HP, Inc., 890 F.3d 1369, 1374 (Fed. Cir. 2018)

(Moore, J., concurring).

Appellants also argue that “the independent claims do not ‘tie up’ the use of the alleged abstract idea of ‘**the equation for determining the systolic and diastolic pressure.**’” Appeal Br. 8. Appellants misapprehend the controlling precedent to the extent Appellants maintain that the claims are patent-eligible because there is no risk of preemption. Although the Supreme Court has described “the concern that drives [the exclusion of

abstract ideas from patent eligible subject matter] as one of pre-emption,” *Alice*, 573 U.S. at 216, characterizing preemption as a driving concern for patent eligibility is not the same as characterizing preemption as the sole test for patent eligibility. “The Supreme Court has made clear that the principle of preemption is the basis for the judicial exceptions to patentability” and “[f]or this reason, questions on preemption are inherent in and resolved by the § 101 analysis.” *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371, 1379 (Fed. Cir. 2015) (citing *Alice*, 134 S. Ct. at 2354).

“[P]reemption may signal patent ineligible subject matter, [but] the absence of complete preemption does not demonstrate patent eligibility.” *Id.*

For the reasons discussed above, we find no element or combination of elements recited in claim 1 or claim 16 beyond the judicial exception that is not “well-understood, routine, conventional” in the field or that contains any “inventive concept” or adds anything “significantly more” to transform the abstract concept into a patent-eligible application. *Alice*, 573 U.S. at 221. Accordingly, we sustain the rejection of claims 1 and 16, as well as claims 2–7, 9, 10, 12, 31–37, 39, 40, 42, and 46–52, which fall with claim 1, and claims 17–22, 24, 25, and 27, which fall with claim 16, under 35 U.S.C. § 101 as being directed to patent-ineligible subject matter.

DECISION

The Examiner’s decision rejecting claims 1–7, 9, 10, 12, 16–22, 24, 25, 27, 31–37, 39, 40, 42, and 46–52 is AFFIRMED.

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).

Appeal 2018-004964
Application 12/547,982

AFFIRMED