APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/693,999	04/23/2015	Thomas ROELLE	074023-0407-01-US-525452	7478

123223 7590 06/03/2019		

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EXAMINER
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ART UNIT	PAPER NUMBER
1631	

NOTIFICATION DATE	DELIVERY MODE
06/03/2019	ELECTRONIC

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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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Ex parte THOMAS ROELLE, FRIEDRICH-KARL BRUDER,
THOMAS FÄCKE, MARC-STEPHAN WEISER, DENNIS HÖNEL, and
CHRISTIAN DIEDRICH[1]

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Appeal 2017-011336
Application 14/693,999
Technology Center 1600

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Before ERIC B. GRIMES, RYAN H. FLAX, and DAVID COTTA,
Administrative Patent Judges.

GRIMES, *Administrative Patent Judge.*

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 involving claims to a method
of preparing a photopolymer formulation, which have been rejected as being
directed to patent-ineligible subject matter. We have jurisdiction under 35
U.S.C. § 6(b).

We reverse.

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[1] Appellants identify the Real Party in Interest as Covestro Deutschland AG.
Appeal Br. 2.

STATEMENT OF THE CASE

"The invention relates to a method for selecting compounds which can be used as additives in photopolymer formulations for the production of light holographic media." Spec.[2] 1:10–11. More specifically, "[i]t was an object of the present invention to provide a selection method for additives in photopolymer formulations which permit production of holograms having a relatively high brightness." *Id.* at 4:3–5.

Claims 12–19 and 31–33 are on appeal. Claim 12 is the only independent claim and reads as follows (emphasis added):

> 12.   *A method for preparing a photopolymer formulation comprising selecting at least one plasticizer* by
>
> a) selecting a compound to be tested,
>
> b) carrying out a conformer analysis of the compound to be tested,
>
> c) generating an optimization of the geometry of all conformers with the aid of a force field method and the conformer space is then further reduced with the aid of a similarity analysis,
>
> d) effecting a quantum chemical optimization of the geometry of the conformers which are energetically most favourable according to the force field optimization with the use of the B-P86 density functional and a triple ζ valence basis set, and of the *Conductor Like Screening Model* (COSMO) in combination with the optimized COSMO radii or, if no optimized COSMO radii exists for a given element, with 1.17 times the Bondi valence radius,
>
> e) calculating the area (A) in $Å^2$ and the enclosed volume (V) in $Å^3$ of the three-dimensional COSMO shielding charge density surfaces of the conformers having the lowest energy, which are

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[2] Substitute Specification filed June 22, 2015.

obtained as result of the quantum chemical optimization of the geometry,

f) dividing into segments, the COSMO shielding charge density surfaces of the conformers having the lowest energy with the aid of a suitable software package, the mean surface shielding charge density (σ) of these segments are plotted in the form of a frequency distribution $P(\sigma)$ and the second moments (M^2) of this distribution, defined according to the equation:

$$M^2 = 10 \cdot \sum_i P(\sigma_i) \cdot \sigma_i^2 \cdot \Delta\sigma$$

are determined, $\Delta\sigma$ being the interval width of the discrete frequency distribution and the charge densities σ being stated in the unit e/nm^2,

g) averaging the volumes, areas and second moments of all conformers considered according to their weight in the Boltzmann distribution on the basis of the energies obtained from the quantum chemical optimizations of the geometries,

h) estimating the volatility of the substance according to the computational rule:

$$TGA95 \approx 207.015 \cdot \frac{M^2}{A} + 41.405 \cdot \sqrt[3]{V} - 253.2 \quad ,$$

i) estimating the density of the compound at room temperature with the aid of the equation:

$$\rho = 0.89 \cdot \frac{M}{V \cdot N_A} - 0.2 \cdot \frac{A}{V} + 0.01 \cdot \sqrt{M^2}$$

ρ being the density of the pure substance in g/cm^3, M being the molar mass in g/mol, N_A being the Avogadro number, A being the COSMO shielding charge density surface in Å^2, V being the volume in Å^3 enclosed by the surface and M^2 being the second moment of the surface shielding charge density frequency distribution,

j) using the estimated density in order, with the aid of the Lorentz-Lorenz equation:

$$n_D = \sqrt{\frac{2 \cdot \dfrac{\rho \cdot MP}{M} + 1}{1 - \dfrac{\rho \cdot MP}{M}}},$$

to convert the molar polarizability (*MP*) estimated according to a QSPR approach as accurately as possible into a refractive index at 589 nm (n_D^{20})

k) determining whether the volatility of the compound to be tested is > 100°C and the refractive index thereof is ≤ 1.4600, and

providing a matrix polymer, a writing monomers and a photoinitiators, and

preparing a photopolymer formulation by *incorporating the compound to be tested as the at least one plasticizer into the photopolymer formulation.*

DISCUSSION

The Examiner has rejected all of the claims on appeal under 35 U.S.C. § 101 as being directed to non-statutory subject matter. Ans. 2. The Examiner finds that, while "[t]he claims are directed to a process, i.e. to one of [the] statutory categories of invention," *id.*, the process is one of "processing information and converting one form of numerical representation into another by organizing information through mathematical concepts such as mathematical algorithms, mathematical relationships, mathematical formulas, and calculations. Therefore, the claims are directed to an abstract idea." *Id.* at 3.

The Examiner notes that "[t]he claimed method is limited by the step providing components of a photopolymer formulation and preparing the

photopolymer formulation," but photopolymer formulations commonly include "such components as matrix polymer, writing monomers, photoinitiators and plasticizers" and "[a]dding a known ingredient into [a] formulation to test its intended properties is a well-understood, routine, conventional activity of testing a compound of interest already engaged in by the scientific community." *Id.* The Examiner therefore concludes that the additional steps of the claimed method do not make the recited judicial exception patent-eligible. *Id.* at 3–4.

Appellants argue that the claimed method "does not fit under any of the types of concepts courts have found to be abstract ideas," such as "'fundamental economic practices, certain methods of organizing human activities, an idea "of itself," and mathematical relationships/formulas.'" Appeal Br. 9–10 (quoting 29 Fed. Reg. 74622). "In contrast . . . , the method of claims 12–19 and 31–33 is directed to preparing a photopolymer formulation for the production of light holographic media." *Id.* at 10.

Appellants also argue that "[t]he claimed method allows a more accurate method of identifying suitable plasticizers for photopolymer formulations which permit production of holograms having a relatively high brightness than previous methods." *Id.* at 11. Thus, Appellants argue, "the instant claim is not merely limiting an abstract idea to a computer environment by simply performing the idea via a computer, but rather is an improvement in another technology, namely obtaining compounds useful as plasticizers for brighter holograms." *Id.* at 11–12.

Finally, Appellants argue that the facts here are similar to those of *Diamond v. Diehr*, 450 U.S. 175 (1981), where "a computer-implemented

process for curing rubber was patent <u>eligible</u>, regardless of its use of a mathematical equation, i.e., an abstract idea." *Id.* at 12. Appellants argue that, similarly, "[t]he method of claim 12 allows a more accurate method of identifying suitable plasticizers for photopolymer formulations which permit production of holograms having a relatively high brightness than previous methods" even though a computational algorithm is used in the method. *Id.*

The issue in this appeal is whether the Examiner erred in concluding that the claims are directed to an abstract idea without significantly more. 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 concluded that "[l]aws of nature, natural phenomena, and abstract ideas" are not patentable under 35 U.S.C. § 101. *See, e.g., Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208, 216 (2014).

To determine if a claim falls into an excluded category, we apply a 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)). We first determine what 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.").

Patent-ineligible abstract ideas 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)). In contrast, patent-eligible inventions include physical and chemical processes, such as "molding rubber products" (*Diamond v. Diehr*, 450 U.S. 175, 192 (1981)); "tanning, dyeing, making water-proof cloth, vulcanizing India rubber, smelting ores" (*id.* at 182 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 claimed method employed 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 192 ("We view respondents' claims as nothing more than a process for molding rubber products and not as an attempt to patent a mathematical formula."). The Supreme Court noted, however, 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, and "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 (alterations in original)). "[M]erely requir[ing] generic computer implementation[] fail[s] to transform that abstract idea into a patent-eligible invention." *Id.*

We agree with Appellants that the Examiner erred in concluding that the claims are directed to an abstract idea without significantly more. The PTO recently published revised guidance on the application of § 101. *2019 Revised Patent Subject Matter Eligibility Guidance*, issued January 7, 2019 ("Revised Guidance").[3] Under that guidance, we first determine whether the claim recites:

> (1) any judicial exceptions, including certain groupings of abstract ideas (i.e., mathematical concepts; certain methods of organizing human activities 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 determine whether the claim:

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

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[3] *2019 Revised Patent Subject Matter Eligibility Guidance*, 84 Fed. Reg. 50–57 (Jan. 7, 2019).

(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 Memorandum.

Revised Guidance Step 2(A), Prong 1

Here, steps f), h), i), and j) of claim 12 recite the following calculations:

$$M^2 = 10 \cdot \sum_i P(\sigma_i) \cdot \sigma_i^2 \cdot \Delta\sigma$$

,

$$TGA95 \approx 207.015 \cdot \frac{M^2}{A} + 41.405 \cdot \sqrt[3]{V} - 253.2$$

,

$$\rho = 0.89 \cdot \frac{M}{V \cdot N_A} - 0.2 \cdot \frac{A}{V} + 0.01 \cdot \sqrt{M^2}$$

, and

$$n_D = \sqrt{\frac{2 \cdot \frac{\rho \cdot MP}{M} + 1}{1 - \frac{\rho \cdot MP}{M}}}$$

.

Thus, claim 12 recites "mathematical concepts—mathematical relationships, mathematical formulas or equations, mathematical calculations," which are abstract ideas. Revised Guidance, 84 Fed. Reg. at 52.

Revised Guidance Step 2(A), Prong 2

The second prong of Step 2(A) is "whether the claim as a whole integrates the recited judicial exception into a practical application of the exception;" i.e., whether the claim "appl[ies], rel[ies] on, or use[s] the judicial exception in a manner that imposes a meaningful limit on the judicial exception." 84 Fed. Reg. at 54. This analysis includes "[i]dentifying

whether there are any additional elements recited in the claim beyond the judicial exception(s)" and "evaluating those additional elements individually and in combination to determine whether they integrate the exception into a practical application." *Id.* at 54–55.

Here, in addition to mathematical concepts, claim 12 recites "selecting a compound to be tested," "providing a matrix polymer, a writing monomers and a photoinitiators," and "preparing a photopolymer formulation by incorporating the compound to be tested as the at least one plasticizer into the photopolymer formulation." Claim 12, step a) and last two steps. Claim 12 also states that the claimed method is "for preparing a photopolymer formulation comprising selecting at least one plasticizer." *Id.*, preamble.

Evaluating these additional elements in combination, we conclude that claim 12 as a whole integrates the recited mathematical concepts into a practical application. In particular, the additional elements "effect[] a transformation or reduction of a particular article to a different state or thing." Revised Guidance, 84 Fed. Reg. at 55; *Diamond v. Diehr*, 450 U.S. 175, 192 (1981) ("[W]hen a claim containing a mathematical formula implements or applies that formula in a structure or process which, when considered as a whole, is performing a function which the patent laws were designed to protect (*e.g.*, transforming or reducing an article to a different state or thing), then the claim satisfies the requirements of § 101.").

Specifically, claim 12 as a whole transforms a set of individual compounds—a matrix polymer, a writing monomer, a photoinitiator, and a plasticizer—into a photopolymer composition. The Specification states that photopolymer formulations for producing light holographic media comprise

matrix polymers, writing monomers, photoinitiators, and a plasticizer. Spec. 1:10–19. The Specification states that photopolymer formulations produced by the claimed method are useful "for the production of holographic media, in particular for the production of in-line holograms, off-axis holograms, full-aperture transfer holograms, white light transmission holograms, Denisyuk holograms, off-axis reflection holograms, edge-lit holograms and holographic stereograms." *Id*. at 19:4–8.

For comparison, in *Diehr*, "[t]he claimed invention [was] a process for molding raw, uncured synthetic rubber into cured precision products." *Diehr*, 450 U.S. at 177. The Court concluded that "a physical and chemical process for molding precision synthetic rubber products falls within the § 101 categories of possibly patentable subject matter. That [the] claims involve[d] the transformation of an article, in this case raw, uncured synthetic rubber, into a different state or thing cannot be disputed." *Id*. at 184. That "conclusion . . . [was] not altered by the fact that in several steps of the process a mathematical equation and a programmed digital computer [were] used." *Id*. at 185.

Similarly here, the claimed process transforms a matrix polymer, a writing monomer, a photoinitiator, and a plasticizer into a photopolymer composition, which is a different state or thing from the separated components. That conclusion is not altered by the fact that a series of mathematical calculations are used to select an appropriate compound for use as a plasticizer in the claimed process.

The Examiner reasons that "the inventive steps of the method . . . are all drawn to processing information and converting one form of numerical

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representation into another by organizing information through mathematical concepts such as mathematical algorithms, mathematical relationships, mathematical formulas, and calculations." Ans. 5. The Examiner also reasons that photopolymer formulations are known to contain a matrix polymer, writing monomers, photoinitiators, and plasticizers, and preparing a photopolymer formulation by adding to it the tested compound as a plasticizer amounts to "appending conventional steps, specified at a high level of generality, to a judicial exemption, such as abstract ideas or laws of nature [which] cannot make those laws, phenomena, and ideas patent-eligible." *Id.*

We conclude that this reasoning is not consistent with the analysis prescribed under the Revised Guidance, which states that Prong 2 of Step 2(A) must "evaluate whether the claim *as a whole* integrates the recited judicial exception into a practical application of the exception." 84 Fed. Reg. at 54 (emphasis added). "When the exception is so integrated, then the claim is not directed to a judicial exception . . . and is eligible. This concludes the eligibility analysis." *Id.*

As stated in the Revised Guidelines, "[b]ecause revised Step 2A does not evaluate whether an additional element is well-understood, routine, conventional activity, examiners are reminded that a claim that includes conventional elements may still integrate an exception into a practical application, thereby satisfying the subject matter eligibility requirement of Section 101." *Id.* at 55. Based on the facts of this case, and for the reasons discussed above, we conclude that claim 12, and dependent claims 13–19

and 31–33, integrate the recited judicial exception into a practical

application, and therefore satisfy the subject matter eligibility of § 101.

SUMMARY

We reverse the rejection of claims 12–19 and 31–33.

REVERSED