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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ROBERT H. CAMERON

Appeal 2018-005673
Application 15/137,100
Technology Center 2800

Before CATHERINE Q. TIMM, JEFFREY T. SMITH, and
MICHAEL G. McMANUS, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant¹ appeals from the Examiner's decision to reject claims 1–20 under 35 U.S.C. § 101 as non-statutory and 35 U.S.C. § 112(a) or 112 ¶ 1 (pre-AIA) as lacking enablement. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

¹ Appellant is the Applicant, Robert H. Cameron, who, according to the Brief, is the real party in interest. Appeal Br. 2.

The claims are directed to a system for measuring the volume of a substance in a container. *See, e.g.*, claims 1 and 11. Figure 14 illustrates the system of claim 1. We reproduce Figure 14 below:

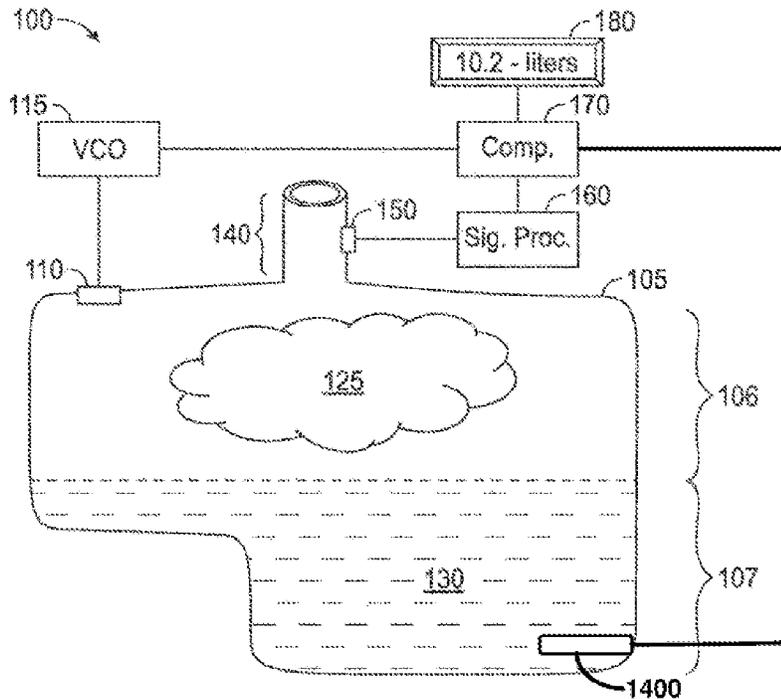


FIG. 14

Figure 14 is a cross-sectional illustration of an embodiment of Appellant's measurement system.

Claim 1 with reference numerals from Figure 14 is reproduced below:

1. A system for measuring the volume of a substance [130] in a container [105], comprising:

an emitting transducer [110] providing a signal generated by a variable frequency oscillator [115] to excite acoustic resonance of an acoustic circuit represented by a container [105] having an unfilled space [106] filled with a vapor [125] analogous to a capacitor of an acoustic circuit, and a tube [140] analogous to an inductor of an acoustic circuit, wherein the vapor [125] experiences friction as it moves within the tube [140], which is analogous to a resistor of an acoustic circuit;

a sensing transducer [150] measuring amplitude of the signal as it changes as the circuit achieves resonance and as the container [105] is filled or emptied;

a speed of sound transducer [e.g., Fig. 6 (605, 610, 615)²] configured to emit and detect a signal ping inside said container [105] to determine a speed of sound in said container [105];

a temperature sensor [1400] for measuring a temperature of said substance [130]; and

a signal processing unit [160] coupled to the sensing transducer [150] and the variable frequency oscillator [115] driving the emitting transducer [110], said signal processing unit [160] processing the signal sensed by the sensing transducer [150] to extract it from background noise by referencing the signal generated by the variable frequency oscillator [115] and shifting said sensed signal by one or more cycles according to a cross-correlation technique, and wherein a frequency decrease in the sensed signal is indicative of a decrease in the volume of the substance [130] in the container [105].

Appeal Br. 21 (claims appendix).

Claim 11, the only other independent claim, is similar in scope to claim 1 except that it recites a deflector baffle instead of the combination of a variable frequency oscillator and an emitting transducer. Figure 11 depicts this alternative embodiment.

² The Specification states that Figure 6 shows a speed of sound detector 600. Spec. ¶ 51. But Figure 6 does not have a reference numeral 600. It appears that the combination of tube 605, conduit 610, and piezoelectric transducer 615 make up the speed of sound detector of Figure 6. Spec. ¶¶ 48–49. Figures 7A–C depict other alternative speed of sound detectors that may be used. Spec. ¶ 51.

OPINION

Patent Eligibility

Section 101 states that “[w]hoever 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.” But even if a claim at first blush appears to be directed to one of the statutory classes of invention listed in § 101, it may be not eligible for a patent. “Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work.” *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 70–72 (2012) (quoting *Diamond v. Diehr*, 450 U.S. 175, 185 (1981) (quoting *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972))). Thus, a claim that would wholly pre-empt others from making and using those basic tools is not patentable. *Alice Corp. Pty. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2354–55 (2014); *see, e.g., Gottschalk v. Benson*, 409 U.S. 63, 71–72, 93 S. Ct. 253, 257, 34 L. Ed. 2d 273 (1972) (holding claims directed to a mathematical formula for converting BCD numerals to pure binary numerals in a digital computer would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself.); and *O'Reilly v. Morse*, 56 U.S. 62, 113, 15 How. 62, 14 L.Ed. 601 (1853) (rejecting a claim that would have broadly conferred “a monopoly” in the use of electromagnetism, “however developed, for the purpose of printing at a distance”).

In *Alice*, the Court extended a framework that had been used in *Mayo* for distinguishing claims pre-empting laws of nature, natural phenomena, and abstract ideas from claims amounting to patent-eligible applications of those concepts. *Alice*, 134 S. Ct. at 2355. As stated in *Alice*:

First, we determine whether the claims at issue are directed to one of those patent-ineligible concepts. If so, we then ask, “what else is there in the claims before us?” To answer that question, 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. We have described step two of this analysis as a search for an “inventive concept”—i.e., an element or combination of elements that is sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the ineligible concept itself.

Alice, 134 S. Ct. at 2355 (internal quotations and citations to *Mayo* omitted).

Because “[a]t some level, ‘all inventions . . . embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas,’” one must take care to strike the correct balance when considering the question of patent eligibility. *Alice*, 134 S. Ct. at 2354.

The *Alice* analysis begins with the question: “whether the claims at issue are directed to a patent-ineligible concept.” *Alice*, at 2355. This “first-stage filter is a meaningful one, sometimes ending the § 101 inquiry.” *Thales Visionix Inc. v. United States*, 850 F.3d 1343, 1346 (Fed. Cir. 2017) (quoting *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1353 (Fed. Cir. 2016).

To answer the question, it is useful to consider other cases that have held claims eligible. The Supreme Court’s decision in *Diamond v. Diehr*, 450 U.S. 175 (1981) is particularly informative here. *Diehr*’s claims were directed to a method of operating a rubber-molding press. *Id.* at 177 n.2 (1981). *Diehr* characterized the improvement as residing in the process of constantly measuring the actual temperature inside the mold, recalculating the ideal cure time, and automatically opening the press when the ideal cure time equaled the actual time elapsed. *Id.* at 178–79. Although *Diehr*’s

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claims employed a mathematical formula (Arrhenius equation) that was run on a programmed digital computer, the claims in *Diehr* covered patent-eligible subject matter because they did not pre-empt the use of the equation itself, but only foreclosed others from applying that equation with all the other steps in their claimed process: Steps of “installing rubber in a press, closing the mold, constantly determining the temperature of the mold, constantly recalculating the appropriate cure time through the use of the formula and a digital computer, and automatically opening the press at the proper time.” *Id.* at 187. The Court explained that claims are patent eligible under § 101 “when 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.” *Id.* at 192.

Like *Diehr*'s claims, Appellant's claims are directed to an improvement in an apparatus that performs a function that the patent laws were designed to protect: An apparatus that measures the volume of a substance in a container, such as the volume of fuel in a gas tank. The improvement is to the measurement apparatus itself, not to the mathematical techniques used in the signal processing unit.

“[T]he ‘directed to’ inquiry applies a stage-one filter to claims, considered in light of the specification, based on whether ‘their character as a whole is directed to excluded subject matter.’” *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1335 (Fed. Cir. 2016) (quoting *Internet Patents Corp. v. Active Network, Inc.*, 790 F.3d 1343, 1346 (Fed. Cir. 2015)). One way to determine what the claim is “directed to” is to focus on the claimed advance over the prior art. *Genetic Techs. Ltd. v. Merial L.L.C.*, 818 F.3d 1369, 1375 (Fed. Cir. 2016).

The Specification explains that systems for measuring the fuel level in automobiles usually use a float connected to a potentiometer, but this method of liquid measurement has many problems. Spec. ¶¶ 6–7. Instead of the float/potentiometer system previously used, Appellant’s system harnesses the natural phenomenon of Helmholtz resonance. Spec. ¶ 8. Helmholtz resonance is the phenomenon of air resonance within a cavity. *Id.* The noise that occurs when one blows across the top of a soda pop bottle is due to Helmholtz resonance. *Id.* Appellant harnesses the Helmholtz resonance phenomenon by creating a system that uses a variable frequency oscillator and emitting transducer (claim 1) or deflector baffle (claim 11) to create acoustic resonance, uses a sensor to sense that resonance, and delivers the sensed signal to a signal processing unit. Although the claims harness the natural phenomenon of Helmholtz resonance and the signal processing unit uses a cross-correlation technique to shift the signal and extract it from noise, the Examiner has not established that those basic tools are pre-empted by the claims.

As in *Diehr*, the claims here only foreclose others from using Helmholtz resonance in the specific system claimed, i.e., a system that uses a variable frequency oscillator and an emitting transducer or deflector baffle to generate an acoustic signal in an acoustic circuit (container, tube, and vapor), a sensor to measure the amplitude as it changes with the change in substance level in the container, and a signal processing unit to extract the resonance signal from noise. Although separately, the apparatus uses various components for their known functions, neither the Specification nor any evidence provided by the Examiner shows that the combination of components as claimed was well-understood, routine, and conventional in the art. Instead, the Specification discloses that the system is an

improvement over a completely different system using a float and a potentiometer. The inventive concept here is in the combination of the devices making up the system, and not in the underlying concepts of Helmholtz resonance and cross-correlation.

We note that in coming to this conclusion, we interpret claim 1 as affirmatively requiring a variable frequency oscillator even though this component is not directly recited as a component of the system. This is because the signal processing unit is recited as coupled to this component and this requires that the variable frequency oscillator be present. We also interpret claims 1 and 11 as affirmatively requiring a tube and container because without them the acoustic circuit does not exist and the sensing and signal processing cannot occur.³

Appellant has identified a reversible error in the Examiner's determination that the claims are directed to ineligible subject matter.

Enablement

The Examiner also rejects claims 1–20 under 35 U.S.C. § 112(a) or 35 U.S.C. § 112 ¶ 1 (pre-AIA) as lacking enablement. Final 3–4. The rejection relates to the cross-correlation technique recited in claims 1 and 11 and to the use of acoustic resonance in order to determine liquid level. *Id.* According to the Examiner, the Specification does not identify the

³ There is a problem with claim 11. Claim 11 recites that the signal processing unit is coupled to the sensing transducer and the variable frequency oscillator driving the emitting transducer, but claim 11 does not recite a sensing transducer and variable frequency oscillator. Nor does the Specification disclose such coupling in the embodiment using a baffle. Spec. ¶ 56. The problem, however, does not prevent us from deciding the issues in the case because the issues presented to us focus on other aspects of the claims.

correlation or provide details on how it is programmed into the signal processing unit. Final 4. The Examiner further determines that “the claims are for a system for measuring [the] level of a substance in a container and somehow use an acoustic resonance in order to determine liquid level, but [give] no explanation for how an acoustic resonance is related to liquid level.” Final 4.

We agree with Appellant that the Specification adequately enables the claims. Appeal Br. 16–19.

With regard to cross-correlation, the Specification explains that cross-correlation is the technique for extracting the desired resonant frequency from background noise as recited in the claims. Spec. ¶¶ 39–44. The Specification explains that correlation software 505 (Fig. 5) extracts the signals sensed by the sensing transducer 150 “from any background noise affecting the acoustic resonance system using correlation functions.” Spec. ¶ 39. The Specification further explains that software 505 “can implement a cross-correlation (or auto-correlation) technique” and that “[c]ross-correlation can be understood as a measure of the similarity of two waveforms as a function of time lag applied to one of them.” Spec. ¶ 41. The Specification provides further detail and illustrates how to use the cross-correlation to “lift” the resonant frequency out of the background noise. Spec. ¶¶ 42–44, Figs. 9A–9D. The software delays one of the emitted signal or the recorded signal in time and the signals are integrated or summed. Spec. ¶ 43, Figs. 9B–9D. When the two signals align the integration is additive. *Id.* The noise is random and so it sums more slowly than the resonant signal and this results in the “lifting” of the resonant signal from the noise as shown in Figure 9D. *Id.* The explanation in the Specification supports Appellant’s position that the Specification would inform the

ordinary artisan of how to make and use the correlation without undue experimentation.

With regard to the explanation of how an acoustic resonance is related to liquid level, this is also enabled by the Specification. The Specification explains that the container acts as a Helmholtz resonator that has a resonant signal that changes as the substance level in the container changes. Spec. ¶¶ 8, 36, Figs. 3A–3C. Figures 3A–3C illustrate resonant signals measured when a container is near empty, half empty, and near full. Spec. ¶ 36.

CONCLUSION

In summary:

Claims Rejected	Basis	Reference(s)	Affirmed	Reversed
1–20	§ 101			1–20
1–20	§ 112(a)			1–20
Summary				1–20

DECISION

The Examiner’s decision is reversed.

REVERSED