

The Patent Lawyer

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Unlocking value with NatWest's pioneering approach to IP-backed lending



Neil Bellamy, Sector Head at NatWest Group, sits down with *The Patent Lawyer* to discuss the evolving landscape of IP finance and its impact on innovation, exploring the critical role of funding, the challenges startups face in securing financial backing, and the importance of IP driving economic growth.

New USPTO volume based fee structure

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Quantum computing patents: early 101 guidance from PTAB decisions

Victoria Carrington and Michael Mauriel of Maschoff Brennan explore recent Patent Trial and Appeal Board decisions to provide insights into quantum computing patents under US patent law, focusing on the complexities of abstract ideas and subject matter eligibility.

Quantum computing progress from theory to commercial reality is accelerating – and, in parallel, so is quantum computing patenting. In 2016, only 71 new US patent publications referenced quantum computing in their abstracts. However, for *each* of the past four years (2021-2024), over 500 new US patent publication abstracts have referenced quantum computing, a 700% increase relative to 2016.¹

The growth in patent filings mirrors the broader momentum of the quantum computing industry. In the first 10 months of 2024, venture capital investments into early stage quantum computing companies nearly doubled the total investments in quantum computing seen in all of 2023.² The Sutor Group recently reported that there are 80 companies worldwide offering quantum processors.³ Given accelerating growth in the field, companies and patent practitioners naturally seek to position themselves strategically in the quantum computing intellectual property landscape. Understanding how patent law is being applied to quantum computing-related inventions is therefore a timely endeavor.

One expects prior art principles regarding novelty and non-obviousness to be relatively consistent across technology areas, including in newly emerging areas such as quantum computing. However, it is often less clear how the principles of subject matter eligibility under



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35 U.S.C. § 101 and those of enablement, written description, and definiteness under 35 U.S.C. § 112 will be applied to new technology areas until a sufficient body of case law is established.

The upsurge in quantum computing patenting is still relatively new and, therefore, very few, if any, cases have reached the US Court of Appeals for the Federal Circuit. However, the Patent Trial and Appeal Board (PTAB) has addressed several quantum computing cases on appeals from examiner decisions rejecting claims. For now, these PTAB decisions are presumably shaping the US Patent and Trademark Office's approach to quantum computing patent prosecution. Here is a look at a few of them in the context of the subject matter eligibility doctrine under §101.

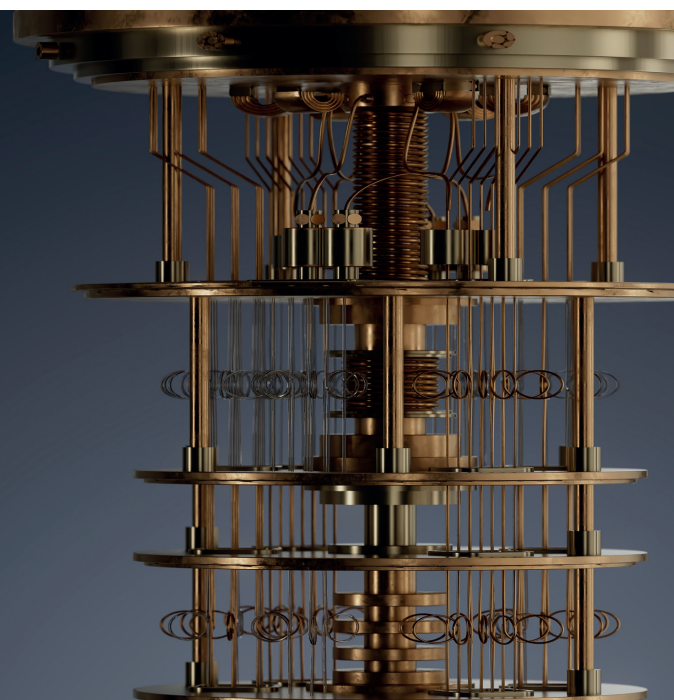
Subject matter eligibility and qubit computations

As patent practitioners in the computer arts well know, a patent claim covering mathematical operations, without more, is typically considered an "abstract idea" and, therefore, not patent-eligible subject matter. And merely adding language to the claim invoking use of a computer to perform the operations does not, by itself, render the claim eligible subject matter. But we also know that many patents covering software rather than hardware have issued and been found by courts to cover patentable subject

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matter. At the same time, the courts, and therefore the USPTO, have had difficulty defining what types of computer processing algorithms are patentable subject matter and what other types are ineligible “abstract ideas.” If a claim recites processing that, on its own, would be considered an abstract idea (one of the judicial exceptions to statutory categories of eligible subject matter), then the USPTO asks whether the claim as a whole “integrates the exception into a practical application.”⁴ If so, then the claim is considered to be subject matter eligible. One way of showing that the claim integrates an abstract idea into a practical application is showing that the claimed invention “improves the functioning of a computer or improves another technology or technical field.”⁵

These principles would seem applicable to the claimed invention considered in a 2017 PTAB decision, *Ex Parte Alexei Ashikhmin*.⁶ The PTAB’s decision contained little reasoning, but the case’s subject matter, quantum error correction, gives the result significance. The patent application in question dates to 2013, well before quantum computing patents were being filed in significant volumes. The application covered an apparatus for improved quantum error identification and correction. The improvement related to a technique of checking whether an error measurement (known in the art as a “syndrome”) itself contained error. The claim considered on appeal included a quantum circuit that transformed preset states of one or more qubits based on the physical state of a set of qubits for whom error is being tested. The circuit was “configured” such that the transformed preset states can be measured to obtain “bits of a syndrome” and at least one

“parity check bit” for checking the syndrome bits.

The Examiner had found the claimed invention to be “directed to the abstract idea of generating abstract mathematical quantities call syndromes.”⁷ The PTAB reversed, noting: “Quantum processing using quantum bits or ‘qubits’ and measuring physical states and syndromes associated therewith, may be esoteric technology, but this does not make the claimed invention abstract . . .”⁸

¹ Based on Westlaw research.

² See, <https://news.crunchbase.com/venture/quantum-computing-funding-record-high-ai-quantinuum/>.

³ Sutor Group, *Quantum Processing Unit (QPU) Market Landscape (Abridged)*, April 3, 2025 (<https://sutorgroupintelligenceandadvisory.com/wp-content/uploads/2025/04/2025-04-03-Sutor-Group-QPU-Market-Landscape-Abridged.pdf>).

⁴ MPEP § 2106.04(d)(1).

⁵ *Id.*

⁶ Decision in PTAB Appeal 2017006572, December 4, 2017.

⁷ *Id.* at 4.

⁸ *Id.*

Résumés

Victoria Tomoko Carrington helps clients protect and promote innovation from Maschoff Brennan’s Salt Lake City Office. Her practice focuses on patent and trademark prosecution for clients in tech-heavy industries. She is an active member of many legal, technological, and medical organizations and is also a published researcher.

Michael Mauriel is a Partner in Maschoff Brennan’s New York Office. He prepares and prosecutes patent applications covering cutting-edge technologies including machine vision, AI, optics, integrated circuits, superconductors, and quantum computing. Michael currently serves as co-chair of the firm’s patent prosecution department.

Unfortunately, the PTAB did not elaborate on its reasoning. However, in the art of data error correction generally, "syndromes" by definition have practical application for identifying errors in stored and/or transmitted data. In its broadest respects, a "syndrome" simply refers to one or more values that identify/measure whether error is present in a data signal. It is borrowed from the medical term "syndrome," meaning a collection of symptoms suggesting presence of an illness.

Techniques for such things as data compression, virus detection, and data integrity checking have well-established practical applications in telecommunications, data processing, and data storage generally. Therefore, it is not surprising that the subject matter eligibility of inventions that improve upon such techniques is not generally questioned. And one would naturally expect that an invention for improving quantum error correction, like the one addressed in *Ex Parte Alexei Ashikhmin*, would be found acceptable under 35 U.S.C. § 101.

Perhaps less clear is whether inventions directed to solving a general class of mathematical equations using quantum processing are eligible subject matter for patenting. One such case was recently addressed by the PTAB earlier this year in *Ex Parte Yudong Cao*.⁹

The patent application at issue in *Ex Parte Yudong Cao* involved using a hybrid quantum-classical computer system for estimating an objective function to solve a linear system of equations. In its decision, the PTAB provided a full 101 analysis and ultimately found the subject matter to be patent eligible based on the claims integrating the abstract idea into a practical application, specifically, "enabling noisy quantum computers, which have limited circuit depths, to practically solve linear systems – a technology improvement."¹⁰

While not dispositive, it seemed significant to the PTAB that the invention involved a mix of quantum and classical hardware and that this interaction allowed the discovery of a set of quantum circuit parameters that enabled a practical use of the quantum computer in solving linear systems. Whether reciting steps that combine use of a classical computer and a quantum computer will prove important to finding a claim to be subject-matter eligible remains to be seen. However, many current and proposed applications of quantum computing involve performing some computations on a classical computer before and/or after performing operations on a quantum computer. The result in *Ex Parte Yudong Cao* suggests that a wide variety of algorithms used with quantum computers will be treated as eligible by the USPTO, as long as those algorithms are clearly articulated in the patent application and help improve a quantum

computer's ability to solve a particular class of problems having practical applications.

However, in *Ex Parte Yili Zhang*,¹¹ the mere presence of quantum processing in the claims was insufficient, in the PTAB's view, to transform an otherwise "abstract idea" regarding financial analysis into patent eligible subject matter. The independent claim in question involved calculating credit risk factors by calculating, at a first time step (and then at a second time step), "a discrete probabilistic wave function representing a superposition state of scores."¹²

Notably, the independent method claim implied the use of quantum hardware for at least some of the steps because it referenced both "a superposition state" and "measuring . . . the discrete probabilistic wave function." However, the claim did not recite such hardware expressly. In evaluating the claim, the PTAB noted that "claim 1 only requires 'a number of processors.' These components are described in the Specification at a high level of generality."¹³ Dependent claim 9 did reference qubits, but this failed to impact the PTAB's decision.¹⁴

The claims in question in *Ex Parte Yili Zhang* are perhaps an imperfect test of whether use of a quantum computer to solve a non-technological problem (e.g., risk analysis) can transform an invention that the USPTO would normally consider too abstract for patent protection into a patent-eligible one. Those familiar with the USPTO's 101 guidance, the jurisprudence underlying that guidance, and the USPTO's application of it in prosecution would find it unsurprising that the PTAB readily dismissed the generic reference to "a number of processors" as insufficient. A claim directed to use of a quantum computing system (or a hybrid classical quantum computing system) for processing financial (or other non-technological data) that more fully detailed the utilized quantum processing (e.g., by reciting details of an applicable quantum circuit) might or might not pass muster with the PTAB and/or the Federal Circuit. That remains to be seen.

⁹ Decision in PTAB Appeal 2024002159, February 13, 2025.

¹⁰ *Id.* at 12.

¹¹ Decision in PTAB Appeal 2024000512, November 29, 2024.

¹² *Id.* at 2.

¹³ *Id.* at 9.

¹⁴ See *id.* at 17 (stating that Appellant's arguments regarding representing the credit rating schema by states of a number of assigned qubits "fails because a quantum bit is an abstract idea because it marks a location of information."). Note that the questionable technical reasoning used by the PTAB here reflects the challenge quantum computing presents to the corps of administrative judges, perhaps especially in this case given that it arose in the USPTO's "business method" Technology Center.

About Maschoff Brennan

Maschoff Brennan provides legal counsel and representation to some of the world's most innovative companies. With almost 50 attorneys and offices in the technology-focused regions of Utah, California, and New York, our attorneys are known for having the breadth of experience and the forward-thinking insight needed to handle complex technological and business issues across all industries and geographic boundaries. In addition, we have extensive experience representing clients before the ITC, PTAB, TTAB, and other administrative agencies in Washington D.C.

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