EIP

Building a Resilient Quantum Patent Portfolio: Winning the Race to File First

A key question for those working in a fast-paced and complex industry such as quantum technology is when to patent any technological developments. The earlier the filing date of the patent application, the earlier you can start to talk about your invention openly, to potential investors, customers, or other companies seeking to collaborate to commercialise the invention. However, speed is not the sole requirement to win the race: to truly succeed, your patent must be robust too.

A particular challenge of quantum technology is that there can be a significant delay between devising the initial inventive concept and rigorous proof that the invention actually works in practice. At what point should you file your patent application?

There are numerous factors to consider, including how rapidly the technology is evolving and the current priorities of your business, given the funds available. In this article, we will focus on the requirement for patent applications to include a sufficiently detailed explanation of how to carry out the invention, and how this ties into considerations around when to file for patent protection. We will also discuss a sufficiency case study in quantum computing.

~~Requirement of Sufficiency~~

The patent process involves a trade-off: the patentee can prevent others from carrying out their invention for a limited amount of time but, in exchange, they must describe how the invention can be performed. Ironing out the details of a working implementation in order to meet this requirement of sufficiency can take a significant amount of time. This

means that patentees must tread a delicate path between getting a patent application on file as soon as they can, without filing the application so early that they are unable to fully describe how the invention works.

These issues are particularly relevant for emerging technologies, such as quantum technologies, for which there may be a long road from initial idea to a working prototype, let alone to a commercial product, and where the understanding of the physics underlying an innovative concept is often significantly ahead of the understanding of how to implement the innovative concept in practice. For innovators seeking to change the status quo, there will naturally be a desire to get ahead of the curve by patenting innovative concepts as soon as possible. This could lead to businesses opting to patent before working implementations are fully pinned down, potentially leading to patents that are invalid due to lack of sufficiency.

While a description of a plausible way of putting the invention into effect will usually satisfy patent office examiners, issues relating to sufficiency tend to appear when you least want them to, for example during a due diligence exercise for an investment or for a joint venture opportunity, when the issue of sufficiency may be investigated in more detail. We may therefore see an uptick in sufficiency issues arising for quantum tech patents as the technology matures, and as dealmaking increases within the field.

Certain sufficiency issues can't be fixed after a patent application is filed, and a granted patent that insufficiently describes how to perform the invention may be effectively unenforceable and vulnerable to revocation. It is therefore vital to ensure that the technology to implement an innovative concept is adequately understood and described in the patent application at the time of filing. If there is any uncertainty over how to implement an innovative concept in practice, then there is a risk involved in filing a patent application at that time. Whether it is worthwhile taking that risk involves weighing up the level of uncertainty against the possible benefits of filing early.

~~Sufficiency Case Study: Topological Qubits~~

The unveiling by Microsoft in February 2025 of the self-proclaimed "world's first quantum processor powered by topological qubits"[1] raises interesting questions around the validity of patent applications directed towards topological qubits that were filed before this date.

A quick search of published patent applications in the name of Microsoft that mention a "topological qubit" in the title or abstract reveals at least 16 patent families with an earliest effective filing date of before February 2025, with some families filed well before this date. For example, US patent number 8,748,196 has a priority date of way back in

November 2010 and includes claims referring to a topological qubit.

p3 Even now, there is debate within the quantum community about whether the structure presented in the Microsoft Nature paper[2] that accompanied the February 2025 announcement is truly a topological qubit or whether it is instead an Andreev state. Particular caution may be merited given Microsoft's previous pronouncements in this space: they were forced to retract a 2018 Nature paper[3] that claimed evidence of topological qubits due to self-confessed "insufficient scientific rigour".

If it is eventually discovered that the structure described in Microsoft's February 2025 Nature paper is not a topological qubit, there is a significant question mark over whether it would have been possible to produce topological qubits claimed in earlier patents based on the description in these earlier patents and the general knowledge in the field at the time of filing. Put another way, if it weren't possible to implement topological qubits as late as February 2025, how would it be possible for patents filed earlier than this to include a description of a working implementation of topological qubits? If this were the case, the validity of patents filed earlier than February 2025 that claim topological qubits would be in serious doubt.

There is also a more philosophical question regarding the meaning of the term "qubit". To distinguish a qubit from e.g. an arbitrary two-level quantum system, there is a sense that a qubit must be (i) preparable into a given state, (ii) controllable into other states, and (iii) measurable. If the techniques for any of (i)-(iii) are non-trivial or not yet well established within the field, then a patent application describing a novel two-level quantum system which could in principle serve as a qubit may not be able to make a claim to a qubit per se without running into sufficiency issues.

For nascent quantum technologies in which companies are seeking foundational patents, striking a balance between future promise and concrete, demonstrated implementation is essential. Otherwise, we could see sufficiency issues making a dramatic impact on the patent landscape, for example if key patents for a particular technology are held to be invalid due to insufficiency.

~~Conclusion~~

We expect to see sufficiency play an increasingly prominent part in the assessment of validity of patents in the quantum technology space. Choosing the right moment to patent your innovation in this field will be important to obtain resilient protection that can withstand deep scrutiny and third-party challenges. If you would like to discuss protecting your IP in the quantum technology arena or how to optimise your patent filing strategy, please do get in touch with our Quantiphy team.

[1] Microsoft unveils Majorana 1, the world's first quantum processor powered by topological qubits - Microsoft Azure Quantum Blog

[2]Interferometric single-shot parity measurement in InAs–Al hybrid devices | Nature

[3]Retraction Note: Quantized Majorana conductance | Nature