Quantum computing is a form of unconventional computation utilizing quantum effects as a fundamental part of its computations. It has already been used in practical signal encryption in the 2010 World Cup, and there is a race amongst many governments to build more powerful and practical quantum computers. In unconventional computation more generally, a recent area of research has been the meeting point between unconventional computation and arts – specifically music. This has the potential to provide novel composition and performance techniques for musical creativity, for new audio–based display methods for scientists researching unconventional computation, and to aid in education about the processes in unconventional computation. Although quantum computing is the most widespread and invested in form of unconventional computation, there have been no implementations of computer music systems with hardware quantum computers. Q–Muse is the first musical composition partly run on a hardware quantum processing chip. There are many types of quantum computation hardware implementations including Nuclear Magnetic Resonance, Trapped Ions, and Optical Computing. Q–Muse is based on the third of these – a system that utilizes phrase–shifters, beam splitters and polarizers to compute with entangled photons. The processor is located at University of Bristol in the UK and accessed over the cloud. It implements a Controlled NOT gate (CNOT) – an essential component in the construction of quantum processors. Any quantum circuit can be simulated using a combination of CNOT gates with other fundamental quantum processes. In this paper a composition algorithm is presented which sends calculations to the quantum processor and turns these calculation results into musical structures. These structures are then fed back into the quantum processor, resulting in more musical structures. The resulting compositions provide not only a representation for the quantum processes in the processor, but a proof–of–concept for using hardware quantum computing processors in computer–aided composition.