CLAIMS

1. A quantum mechanical circuit comprising:

a substrate;

a first electrical conductor and a second electrical conductor provided on a top face and a bottom face of the substrate and spaced apart to provide a gap therebetween; and

a third electrical conductor to: electrically connect an upper surface of the first electrical conductor and an upper surface of the second electrical conductor, and electrically connect a lower surface of the first electrical conductor and a lower surface of the second electrical conductor,

wherein the third electrical conductor is a poor thermal conductor.

2. The quantum mechanical circuit according to claim 1, wherein the third electrical conductor comprises at least one of Copper-Nickel (CuNi) or stainless steel.

3. The quantum mechanical circuit according to claim 2, wherein CuNi has an electrical resistivity that is approximately 3.8 x 10-8 Ωm at ambient temperature.

4. The quantum mechanical circuit according to any one of the preceding claims, wherein the first and second electrical conductors comprise copper (Cu).

5. The quantum mechanical circuit according to any one of the preceding claims, wherein the first, second and third electrical conductor are configured to transmit a radiofrequency electrical current.

6. The quantum mechanical circuit according to any one of the preceding claims, wherein the third electrical conductor is coupled to the substrate using fasteners.

7. The quantum mechanical circuit according to claim 6, wherein the fasteners comprise brass.

8. The quantum mechanical circuit according to any one of the preceding claims, wherein the first and second electrical conductors are connected to electrical ground.

9. The quantum mechanical circuit according to any one of the preceding claims, wherein the first and second electrical conductors are electrically decoupled by providing the gap between the first and second electrical conductors within the substrate.

10. The quantum mechanical circuit according to any one of the preceding claims, further comprising attenuator chips electrically coupled the first and second electrical conductors.

11. A superconducting quantum mechanical computer comprising:

a refrigeration system comprising a temperature-controlled vessel;

a quantum processor disposed within the temperature-controlled vessel, the quantum processor comprising a plurality of qubits; and

a superconducting circuit disposed inside the temperature-controlled vessel, the superconducting circuit comprising:

a substrate;

a first electrical conductor and a second electrical conductor provided on the substrate and spaced apart to provide a gap therebetween; and

a third electric conductor to electrically connect the first electrical conductor and the second electrical conductor, the third electrical conductor being a poor thermal conductor,

wherein each of the plurality of qubits is provided on the substrate and is at least electrically connected to ground via at least one of the first or second electrical conductors.

12. The superconducting quantum mechanical computer according to claim 11, wherein the third electrical conductor comprises at least one of Copper-Nickel (CuNi) or stainless steel.

13. The superconducting quantum mechanical computer according to claim 12, wherein CuNi has an electrical resistivity that is approximately 3.8 x 10-8 Ωm at ambient temperature.

14. The superconducting quantum mechanical computer according to any one of claims 11 to 13, wherein the first and second electric conductors comprise copper (Cu).

15. The superconducting quantum mechanical computer according to any one of claims 11 to 14, wherein the first, second and third electrical conductor are configured to transmit a radiofrequency electrical current.

16. The superconducting quantum mechanical computer according to any one of claims 11 to 15, wherein the third electrical conductor is coupled to the substrate using fasteners.

17. The superconducting quantum mechanical computer according to any one of claims 11 to 16, wherein the first and second electrical conductors are connected to electrical ground.

18. The superconducting quantum mechanical computer according to any one of claims 11 to 17, wherein the first and second electrical conductors are electrically decoupled by providing the gap between the first and second electrical conductors within the substrate.

19. The superconducting quantum mechanical computer according to any one of claims 11 to 18, further comprising attenuator chips electrically coupled to the first and second electrical conductors.

20. A method of manufacturing a quantum mechanical circuit comprising:
providing a substrate having a top face and a bottom face;
forming a conductive layer on the top face and bottom face of the substrate;

forming conductor lines in a selected pattern on the substrate by removing portions of the conductive layer, the conductor lines including a first electrical conductor and a second electrical conductor on the substrate, the first electrical conductor and the second electrical conductor being spaced apart and separated by a gap therebetween; and

electrically connecting an upper surface of the first electrical conductor and an upper surface of the second electrical conductor, and electrically connecting a lower surface of the first electrical conductor and a lower surface of the second electrical conductor, using a third electrical conductor, the third electrical conductor being a poor thermal conductor.