Claims

1. An inductor coil, comprising:

- a first component (12);
- a second component (14);
- a length of conductor (18);
- a heat sink (100);

wherein, the first component is located adjacent to the second component;

wherein, a core (16) is formed from the first component and the second component;

wherein, a first part of the length of conductor is wound around at least the core to form a plurality of turns of conductor;

wherein, the heat sink comprises a thermally conductive material;

wherein, the heat sink comprises a first part (90, 110) and a second part;

wherein, the first part of the heat sink has a first material and/or structural characteristic and the second part of the heat sink has a second material and/or structural characteristic different to the first material and/or structural characteristic; and

wherein, an inner surface of the first part of the heat sink is in contact with an outer surface of a part of the plurality of turns of conductor;

wherein the first material and/or structural characteristic comprises a resistance or resistivity and the second material and/or structural characteristic comprises a resistance or resistivity less than the resistance or resistivity of the first part of the heat sink; and

wherein a circumferential resistance of the first part of the heat sink is greater than a radial resistance of the first part of the heat sink, and wherein the circumferential resistance of the first part of the heat sink is greater than a radial resistance of the second part of the heat sink and is greater than a circumferential resistance of the second part of the heat sink.

2. Inductor coil according to claim 1, wherein the first material and/or structural characteristic comprises a magnetic permeability and the second material and/or structural

characteristic comprises a magnetic permeability greater than the magnetic permeability of the first part of the heat sink.

3. Inductor coil according to any of claims 1-2, wherein the first material and/or structural characteristic comprises a conductivity or conductance and the second material and/or structural characteristic comprises a conductivity or conductance less than the conductivity or conductance of the first part of the heat sink.

4. Inductor coil according to claim 3, wherein a circumferential conductance of the first part of the heat sink is less than a radial conductance of the first part of the heat sink, and wherein the circumferential conductance of the first part of the heat sink is less than a radial conductance of the second part of the heat sink and is less than a circumferential conductance of the second part of the heat sink.

5. Inductor coil according to any of claims 1-4, wherein the heat sink is formed from a single piece, wherein the first structural characteristic of the first part is different to the second structural characteristic of the second part.

6. Inductor coil according to any of claims 1-5, wherein the first part (110) of the heat sink has a thickness in an axial direction of the core that is less than a thickness of the second part of the heat sink in the axial direction of the core.

7. Inductor coil according to any of claims 1-6, wherein, the first part (90) of the heat sink comprises a plurality of slots or grooves.

8. Inductor coil according to claim 7, wherein the plurality of slots or grooves extend to the inner surface of the first part of the heat sink.

9. Inductor coil according to any of claims 7-8, wherein the plurality of slots or grooves extend to a boundary between the first part of the heat sink and the second part of the heat sink.

10. Inductor coil according to any of claims 7-9, wherein the plurality of slots or grooves each have a longitudinal axis that intersects with a central axis of the core.

11. Inductor coil according to any of claims 1-10, wherein the second part of the heat sink is configured to connect to a printed circuit board (120).

12. Inductor coil according to any of claims 1-11, wherein the heat sink comprises at least one third part (130, 140) located on at opposite side of the second part of the heat sink to the first part of the heat sink, and wherein the at least one third part of the heat sink is configured to transfer heat away from the second part of the heat sink.

13. Inductor coil according to claim 12, wherein a third part of the at least one third part the heat sink comprises a finned structure (130).

14. Inductor coil according to any of claims 12-13, wherein a third part of the at least one third part of the heat sink comprises a connection terminal (140).

15. Inductor coil according to claim 14, wherein the connection terminal comprises the finned structure.

16. Inductor coil according to claim 14, wherein the connection terminal comprises a thick copper wire.

17. Inductor coil according to any of claims 1-16, wherein the second part of the heat sink comprises one or more pins configured for mechanical alignment with a printed circuit board (120) and/or for mechanical fixation to the printed circuit board.

18. Inductor coil according to any of claims 1-17, wherein the first part and second part of the heat sink extend substantially in a direction perpendicular to a central axis of the core.

19. Inductor coil according to any of claims 1-18, wherein a core portion of the first component is spaced from a core portion of the second component to form a gap (20) in the core; wherein the first part of the length of conductor is wound around the core and the gap in the core; wherein an inner part of the conductor of two or more turns of the conductor located around the core are spaced from a central axis of the core by at least one first distance;

and wherein an inner part of the conductor of one or more turns of the conductor located around the gap in the core is spaced from the central axis by at least one second distance greater than the at least one first distance.

20. Inductor coil according to any of claims 1-19, wherein a core portion of the first component is spaced from a core portion of the second component to form a gap (20) in the core; wherein a spacer (30) is located in the gap in the core to form a gap (22) around the core, wherein an outer surface of a portion of the spacer is located a distance from a central axis of the core that is greater than a distance from the central axis to an outer surface of the first component and an outer surface of the second component that form the core.

21. An inductor coil, comprising:

- a first component (12);
- a second component (14);
- a length of conductor (18);
- a heat sink (100);

wherein, the first component is located adjacent to the second component;

wherein, a core (16) is formed from the second component;

wherein, a first part of the length of conductor is wound around at least the core to form a plurality of turns of conductor;

wherein, the heat sink comprises a thermally conductive material;

wherein, the heat sink comprises a first part (90, 110) and a second part;

wherein, the first part of the heat sink has a first material and/or structural characteristic and the second part of the heat sink has a second material and/or structural characteristic different to the first material and/or structural characteristic;

wherein, an inner surface of the first part of the heat sink is in contact with an outer surface of a part of the plurality of turns of conductor;

wherein the first material and/or structural characteristic comprises a resistance or resistivity and the second material and/or structural characteristic comprises a resistance or resistivity less than the resistance or resistivity of the first part of the heat sink; and

wherein a circumferential resistance of the first part of the heat sink is greater than a radial resistance of the first part of the heat sink, and the circumferential resistance of the first part of the heat sink is greater than a radial resistance of the second part of the heat sink and is greater than a circumferential resistance of the second part of the heat sink.

22. A method of cooling an inductor coil, wherein the inductor coil comprises a first component (12), a second component (14), a length of conductor (18); wherein the first component is located adjacent to the second component, wherein a core (16) is formed from the first component and the second component, wherein a first part of the length of conductor is wound around at least the core to form a plurality of turns of conductor; and wherein the method comprises:

- utilizing a heat sink (100), wherein the heat sink comprises a thermally conductive material, wherein the heat sink comprises a first part (90, 110) and a second part, wherein, the first part of the heat sink has a first material and/or structural characteristic and the second part of the heat sink has a second material and/or structural characteristic different to the first material and/or structural characteristic;
- wherein, utilizing the heat sink comprises contacting an inner surface of the first part of the heat sink with an outer surface of a part of the plurality of turns of conductor;

wherein the first material and/or structural characteristic comprises a resistance or resistivity and the second material and/or structural characteristic comprises a resistance or resistivity less than the resistance or resistivity of the first part of the heat sink; and

wherein a circumferential resistance of the first part of the heat sink is greater than a radial resistance of the first part of the heat sink, and the circumferential resistance of the first part of the heat sink is greater than a radial resistance of the second part of the heat sink and is greater than a circumferential resistance of the second part of the heat sink.

23. A method of cooling an inductor coil, wherein the inductor coil comprises a first component (12), a second component (14), a length of conductor (18), wherein the first component is located adjacent to the second component, wherein a core (16) is formed from the second component, wherein a first part of the length of conductor is wound around at least the core to form a plurality of turns of conductor; and wherein the method comprises:

- utilizing a heat sink (100), wherein the heat sink comprises a thermally conductive material, wherein the heat sink comprises a first part (90, 110) and a second part, wherein, the first part of the heat sink has a first material and/or structural characteristic and the second part of the heat sink has a second material and/or structural characteristic different to the first material and/or structural characteristic;
- wherein utilizing the heat sink comprises contacting an inner surface of the first part of the heat sink with an outer surface of a part of the plurality of turns of conductor;

wherein the first material and/or structural characteristic comprises a resistance or resistivity and the second material and/or structural characteristic comprises a resistance or resistivity less than the resistance or resistivity of the first part of the heat sink; and

wherein a circumferential resistance of the first part of the heat sink is greater than a radial resistance of the first part of the heat sink, and the circumferential resistance of the first part of the heat sink is greater than a radial resistance of the second part of the heat sink and is greater than a circumferential resistance of the second part of the heat sink.