Claims

1. Immersive cooling system for cooling electronic components, comprising:
an immersive cooling unit, for cooling electronic components, comprising:;

- at least one closed heating channel, defined by at least one circumferential heating channel wall having a start and an end, accommodating one or more printed circuit boards, wherein one or more heat dissipating electronic components are provided on each printed circuit board~~, or accommodating one or more batteries or battery cells~~,

- at least one closed cooling channel, defined by at least one circumferential cooling channel wall, wherein a start of the cooling channel is connected to an end of the heating channel, and wherein an end of the cooling channel is connected to the start of the heating channel such that a closed circuit is formed between the channels,

wherein~~–~~ the at least one heating and cooling channel are configured for holding an immersive liquid coolant, for cooling the electronic components, said coolant at least filling the channels and submerging the printed circuit~~ board or battery~~, wherein the channels each allow a coolant flow having at least a vertical component

wherein

~~- at least a portion of the cooling channel wall is formed by a heat conducting material, said portion allowing an exchange of heat between a part of the coolant in contact with an interior side of said cooling channel wall portion and a surrounding in contact with an exterior side of said cooling channel wall portion~~an active heat exchanger is positioned in the cooling channel, said heat exchanger provided with an internal circuit for liquid cooling, and fluid circuitry for circulating such cooling liquid with the exterior side of said cooling channel wall or immersive cooling unit~~.~~; and

a holder, said holder comprising:

- at least one holding space formed by at least a holding bottom and at least one circumferential holding wall, wherein the at least one holding wall is dimensioned to receive a cooling unit, wherein the immersive cooling unit is inserted in the at least one holding space,

- fluid circuitry, and

- a least one heat extracting unit, for actively extracting heat from cooling liquid of the fluid circuitry of the active heat exchanger,

wherein an exterior side of the immersive cooling unit and the holder are each provided with co-acting fluid connections, such that the fluid circuitry of the immersive cooling unit and the fluid circuitry of the holder are fluidly connected.

2. ~~Immersive cooling unit~~The immersive cooling system according to claim 1, wherein the at least one heating channel and the at least one cooling channel are separated by a heat insulating wall, said heat insulating wall forming at least a part of the circumferential cooling channel wall and at least a part of the circumferential heating channel wall of the channels said insulating wall separates, wherein said insulating wall prevents heat exchange between said channels.

3. The immersive cooling system ~~Immersive cooling unit~~ according to any one of the preceding claims, wherein the cooling unit comprises at least two closed cooling channels, each defined by at least one circumferential cooling channel wall, and wherein a start of each cooling channel is connected to an end of the heating channel, and wherein an end of each cooling channel is connected to the start of the heating channel such that a closed circuit is formed between the channels.

~~4. Immersive cooling unit according to claim 3, wherein the at least one heating channel and each of the at least two cooling channel are separated by a heat insulating wall, said heat insulating wall forming at least a part of one of the circumferential cooling channel walls and at least a part of the circumferential heating channel wall of the channels said insulating wall separates, wherein said insulating wall prevents heat exchange between said channels.~~

~~5. Immersive cooling unit according to claim 2 or 4, wherein at least one heat insulating wall is connected to at least one printed circuit board or battery~~.

64. The immersive cooling system ~~Immersive cooling unit~~ according to any one of the preceding claims, wherein the printed circuit boards are vertically accommodated in the heating channel~~.~~

~~7. Immersive cooling unit according to claim 6~~, and wherein the electronic components on the printed circuit board are arranged, in a direction from the start of the heating channel to the end of the heating channel, according to their heat generation during use, wherein the component generating the most heat is placed closest to the start of the heating channel.

85. The immersive cooling system ~~Immersive cooling unit~~ according to any one of the preceding claims, comprising a common housing, said housing comprising a bottom, a top cover, and a housing wall, wherein the circumferential heating channel wall and/or circumferential cooling channel wall form at least a part of the housing wall.

96. The immersive cooling system ~~Immersive cooling unit~~ according to claim ~~8~~5, wherein handles are provided to the top cover, for handling the cooling unit.

~~10. Immersive cooling unit according to any of the preceding claims, wherein the liquid coolant is a dielectric fluid.~~

~~11. Immersive cooling unit according to claims 2 or 4, wherein the heat insulating wall is formed by a Resol or by an aerogel.~~

~~12~~7. The immersive cooling system ~~Immersive cooling unit~~ according to any one of the preceding claims, further comprising a valve, wherein the valve provides an access to the closed circuit formed by the at least one heating and cooling channel.

~~13~~8. The immersive cooling system ~~Immersive cooling unit~~ according to any one of the preceding claims, wherein at least one printed circuit board and/or a System on a Chip (SoC) is configured for measuring the temperature of an inserted cooling unit, preferably the coolant temperature inside an inserted cooling unit.

~~14. Immersive cooling unit according to any of the preceding claims, and a holder, said holder comprising:~~

~~- at least one holding space formed by at least a holding bottom and at least one circumferential holding wall,~~
~~wherein the at least one holding wall is dimensioned to receive a cooling unit, wherein a part of the holding wall facing toward the holding space is thermally connected to at least the exterior side of the cooling channel wall of an inserted cooling unit,~~
~~- a least one heat extracting unit, for actively extracting heat from the part of the holding wall that is thermally connected to the exterior side of the cooling channel wall of an inserted cooling unit.~~

~~15~~9. The immersive cooling system ~~Immersive cooling unit~~ according to ~~claim 14~~any one of the preceding claims, wherein the holder comprises a plurality of holding spaces, each holding space:

- formed by at least a holding bottom and at least one holding wall, wherein the at least one holding wall is dimensioned to receive an independent cooling unit, wherein a plurality of immersive cooling units are inserted in the plurality of holding spaces~~a part of the holding wall facing toward the holding space is thermally connected to at least the exterior side of the cooling channel wall of an inserted cooling unit~~,

wherein the heat extracting unit is a central heat extracting unit, for actively extracting heat from ~~each holding wall that is in thermally connected with the exterior side of the cooling channel wall of an inserted cooling unit~~the cooling liquid of the fluid circuitry of the active heat exchanger of each inserted cooling unit.

~~16~~10. The immersive cooling system ~~Immersive cooling unit~~ according to claim ~~15~~9, wherein the holder is configured for independently and separately regulating the heat extraction rate and/or temperature of each inserted cooling unit.

~~17~~11. The immersive cooling system ~~Immersive cooling unit~~ according to any one of claims ~~13 and claim 15 or 16~~8 to 10, wherein the heat extraction rate and/or temperature of each inserted cooling unit is regulated based on measurements of an external or internal temperature of each inserted cooling unit.

~~18. Immersive cooling unit according to any claims 14 - 17, wherein the heat extracting unit is in particular formed by cold plates, peltier effect cooling~~.

~~19~~12. The immersive cooling system ~~Immersive cooling unit~~ according to any one of ~~the~~ claims ~~14 - 18~~9 to 11, wherein the cooling unit further comprises at least one connector, wherein the at least one connector is connected to the printed circuit board ~~or battery~~ by at least one wire, for electronically connecting at last one printed circuit board ~~or battery~~ to an external device and/or~~.~~

~~20. Immersive cooling unit according to claim 19, wherein the at least one connector is positioned on a side of the cooling channel wall and/or heating channel wall facing away from the coolant.~~

~~21. Immersive cooling unit according to claim 19 or 20,~~ wherein the holder~~,~~ comprises a holding connector, wherein the holding connector is positioned to receive the connector of an inserted cooling unit, forming an electronic connection between the one or more printed circuit boards ~~or battery~~ and the holder.

~~22~~13. The immersive cooling system ~~Immersive cooling unit~~ according to any one of ~~the~~ claims ~~14-21~~9 to 12, wherein the holder, preferably the holding space, further comprises a guide, for guiding the housing into the holding space.

~~23. Immersive cooling unit according to claim 22, wherein the guide is formed by a gas spring or actuator, wherein said gas spring or actuator are at least movable in a direction parallel to the holding wall.~~

~~24. Immersive cooling unit according to any of the preceding claims, wherein the immersive cooling unit comprises;~~

~~- at least one, preferably closed, immersive space, wherein the at least one closed cooling channel and the at least one closed heating channel are at least partially located inside the immersive space, and~~
~~- at least one non-immersive space, separated from said immersive space, and configured for receiving one or more electronic components.~~

~~25. Immersive cooling unit according to claim 24, wherein the non-immersive space is provided with one or more connectors, configured to co-act with electronic components for electrically connecting one or more electronic components, via the one or more connectors, to a printed circuit board or battery in the immersive space.~~

~~26. Immersive cooling unit according to one of the claims 24 - 25, wherein the non-immersive space is provided with a common printed circuit board, comprising a plurality of connectors, wherein the common printed circuit board is electronically connected or connectable to a printed circuit board or battery in the immersive space.~~

~~27. Immersive cooling unit according to one of the claims 24-26, wherein the immersive cooling unit comprises a common housing, wherein the immersive and non-immersive space are defined by the common housing.~~

~~28~~14. The immersive cooling system ~~Immersive cooling unit~~ according to any one of the preceding claims, wherein at least a part of the heating channel wall and the cooling channel wall are insulated walls.

~~29. An immersive cooling device, comprising at least one non-immersive space according to any of the claims 24-27.~~

~~30. Holder, in particular a holder according to any of the claims 14-28, for use in an immersive cooling system, said holder comprising:~~

~~- at least one holding space formed by at least a holding bottom and at least one circumferential holding wall,~~
~~wherein the at least one holding wall is dimensioned to receive a cooling unit, wherein a part of the holding wall facing toward the holding space is thermally connected to at least the exterior side of the cooling channel wall of an inserted cooling unit,~~
~~- a least one heat extracting unit, for actively extracting heat from the part of the holding wall that is thermally connected to the exterior side of the cooling channel wall of an inserted cooling unit.~~

~~31~~15. Method of using ~~an immersive cooling unit~~a system according to any one of the claims 1-~~28~~14, for actively cooling electronic components.