Claims

What I claim is:

1. A cooled enclosure of the type which cools installed equipment by thermal contact between a surface of a portion of installed equipment and a surface of the cooled enclosure, the cooled enclosure comprising a multi-port extrusion coolant guide in thermal contact with the surface of the cooled enclosure.

2. A wall of a cooled enclosure, the cooled enclosure of the type which cools installed equipment by thermal contact, the wall comprising:

- a channel comprising a coolable surface;
- a first coolant guide comprising inlet and outlet apertures, and;
- a plurality of thermally conductive features in thermal contact with the coolable surface, the thermally conductive features being disposed within the first coolant guide in such a way that a coolant flowing between the inlet and the outlet apertures flows across at least some portion of the thermally conductive features.

3. The wall of claim 2, wherein the thermally conductive features are fins.

4. The wall of claim 2, wherein the thermally conductive features are pins.

5. The wall of claim 2, wherein the thermally conductive features are projections projecting from a surface in thermal contact with the coolable surface.

6. The wall of any of claims 2 to 5, wherein the first coolant guide is manufactured by an extrusion process.

7. The wall of any of claims 2 to 5, wherein the first coolant guide is a multi-port extrusion and the thermally conductive features comprise a wall of the multi-port extrusion.

8. The wall of any of claims 2 to 7, wherein the first coolant guide comprises a first guideway and a second guideway, the first coolant guide configured such that coolant flowing in the first guideway is separated from coolant flowing in the second guideway.

9. The wall of any of claims 2 to 8, further comprising:

- a second coolant guide, and;
- a tubing network connected to the inlet aperture of the first coolant guide and the inlet aperture of the second coolant guide.

10. The wall of claim 9, wherein the tubing network is configured to deliver an approximately similar rate of coolant flow to the first coolant guide and the second coolant guide.

11. The wall of claim 10, wherein the tubing network is bifurcated.

12. The wall of any of claims 2 to 11, the wall further comprising a coolant distribution system comprising

- a tubing network connected to the inlet aperture of the first coolant guide, and;
- an automatic air-vent connected to the tubing network.

13. A wall of a cooled enclosure, the wall comprising:

- a plurality of channels comprising a coolable surface, each channel configured to receive a rail portion of installed equipment;
- a coolant distribution system;
- one or more coolant guides, each having an inlet and an outlet which are both connected to the coolant distribution system, the coolant guides being configured to guide the flow of a coolant entering the guide from the inlet to allow the cooling of at least a portion of the coolable surface of at least one of the channels before exiting via the outlet, and;
- a lid component being adapted to be joined to the plurality of channels in such a way that the space enclosed by the lid component and the plurality of channels contains at least a part of the coolant distribution system and the inlet and outlet of the one or more coolant guides.

14. The wall of claim 13, the space enclosed by the lid component and the plurality of channels being sufficiently sealed to allow a modified pressure environment.

15. The wall of claim 13, the modified pressure environment being created by evacuating air.

16. The wall of any of claims 14 or 15, the wall further comprising a pressure sensitive switch configured to change state when the state of the modified pressure environment is changed.

17. The wall of any of claims 13 to 16, wherein at least two of the one or more coolant guides are configured to independently cool a portion of the same coolable surface.

18. A cooled enclosure which cools installed equipment by thermal contact between a surface of a portion of installed equipment and a surface of the cooled enclosure, the cooled enclosure being configured such that the surface of the cooled enclosure is maintained at a temperature below a dry bulb temperature of surrounding air.

19. The cooled enclosure of claim 18, the cooled enclosure being further configured such that the surface of the cooled enclosure is further maintained at a temperature above a dew point of the surrounding air.

20. A cooled enclosure which cools installed equipment by thermal contact between a surface of a portion of installed equipment and a surface of the cooled enclosure, the cooled enclosure being configured such that the surface of the cooled enclosure is maintained at a temperature above a dew point of surrounding air.

21. The cooled enclosure of claim 20, the cooled enclosure being further configured such that the surface of the cooled enclosure is further maintained at a temperature below a dry bulb temperature of the surrounding air.

Claims

What I claim is:

1. A cooled enclosure of the type which cools installed equipment by thermal contact between a surface of a portion of installed equipment and a surface of the cooled enclosure, the cooled enclosure comprising a multi-port extrusion coolant guide in thermal contact with the surface of the cooled enclosure.

2. A wall of a cooled enclosure, the cooled enclosure of the type which cools installed equipment by thermal contact, the wall comprising:

- a channel comprising a coolable surface;
- a first coolant guide comprising inlet and outlet apertures, and;
- a plurality of thermally conductive features in thermal contact with the coolable surface, the thermally conductive features being disposed within the first coolant guide in such a way that a coolant flowing between the inlet and the outlet apertures flows across at least some portion of the thermally conductive features.

3. The wall of claim 2, wherein the thermally conductive features are fins.

4. The wall of claim 2, wherein the thermally conductive features are pins.

5. The wall of claim 2, wherein the thermally conductive features are projections projecting from a surface in thermal contact with the coolable surface.

6. The wall of any of claims 2 to 5, wherein the first coolant guide is manufactured by an extrusion process.

7. The wall of any of claims 2 to 5, wherein the first coolant guide is a multi-port extrusion and the thermally conductive features comprise a wall of the multi port extrusion.

~~8. A cooled enclosure comprising the wall of any of claims 2 to 7.~~

~~9.~~8. The wall of any of claims 2 to 7, wherein the first coolant guide comprises a first guideway and a second guideway, the first coolant guide configured such that coolant flowing in

the first guideway is separated from coolant flowing in the second guideway.

~~10.~~9. The wall of any of claims 2 to ~~7 or claim 9~~8, further comprising:

- a second coolant guide, and;
- a tubing network connected to the inlet aperture of the first coolant guide and the inlet aperture of the second coolant guide.

~~11.~~10. The wall of claim ~~10~~9, wherein the tubing network is configured to deliver an approximately similar rate of coolant flow to the first coolant guide and the second coolant guide.

~~12.~~11. The wall of claim ~~11~~10, wherein the tubing network is bifurcated.

~~13.~~12. The wall of any of claims 2 to ~~7, 9 to 12~~11, the wall further comprising a coolant distribution system comprising

- a tubing network connected to the inlet aperture of the first coolant guide, and;
- an automatic air-vent connected to the tubing network.

~~14.~~13. A wall of a cooled enclosure, the wall comprising:

- ~~a first component comprising~~ a plurality of channels comprising a coolable surface, each channel configured to receive a rail portion of installed equipment;
- a coolant distribution system;
- one or more coolant guides, each having an inlet and an outlet which are both connected to the coolant distribution system, the coolant guides being configured to guide the flow of a coolant entering the guide from the inlet to allow the cooling of at least a portion of the coolable surface of at least one of the channels before exiting via the outlet, and;
- a lid component being adapted to be joined to the ~~first component~~plurality of channels in such a way that the space enclosed by the lid component and the ~~first component~~plurality of channels contains at least a part of the coolant distribution system and the inlet and outlet of the one or more coolant guides.

~~15.~~14. The wall of claim ~~14~~13, ~~–~~the space enclosed by the lid component and the ~~first component~~plurality of channels being sufficiently sealed to allow a modified pressure environment.

~~16.~~15. The wall of claim ~~14~~13, the modified pressure environment being created by evacuating air.

~~17.~~16. The wall of any of claims ~~15~~14 or ~~16~~15, the wall further comprising a pressure sensitive switch configured to change state when the state of the modified pressure environment is changed.

17. The wall of any of claims ~~14~~13 to ~~17~~16, wherein at least two of the one or more coolant guides are configured to independently cool a portion of the same coolable surface.

18. A cooled enclosure which cools installed equipment by thermal contact between a surface of a portion of installed equipment and a surface of the cooled enclosure, the cooled enclosure being configured such that the surface of the cooled enclosure is maintained at a temperature below a dry bulb temperature of surrounding air.

19. The cooled enclosure of claim 18, the cooled enclosure being further configured such that the surface of the cooled enclosure is further maintained at a temperature above a dew point of the surrounding air.

20. A cooled enclosure which cools installed equipment by thermal contact between a surface of a portion of installed equipment and a surface of the cooled enclosure, the cooled enclosure being configured such that the surface of the cooled enclosure is maintained at a temperature above a dew point of surrounding air.

~~18.~~21. The cooled enclosure of claim 20, the cooled enclosure being further configured such that the surface of the cooled enclosure is further maintained at a temperature below a dry bulb temperature of the surrounding air.

~~19. A method of fabricating a cooled enclosure wall, the method comprising:~~

~~preparing one or more coolant guides to connect a coolant distribution system to an inlet portion and an outlet portion of each coolant guide;~~

~~disposing the one or more coolant guides on a face component such that a coolant flowing through one of the coolant guides cools at least a portion of a surface of at least one of a plurality of channels disposed upon the face component.~~

~~20. The method of claim 19 wherein the coolant guide comprises an extrusion.~~

21. The method of any of claims 19 or 20, wherein the method further comprises connecting a coolant distribution system to the one or more coolant guides.

22. A data center comprising:

an enclosure having a plurality of channels, the plurality of channels being configured to cool installed apparatus by contacting a thermally conductive surface on a rail of the installed apparatus;

a coolant distribution system comprising:

an outer portion comprising coolant supply piping and coolant return piping;

an inner portion comprising inner supply piping and inner return piping, the inner supply piping and inner return piping of the inner portion being connected to the enclosure;

a mixer valve connecting the outer portion and the inner portion, the mixer valve being operable to allow coolant from the outer portion to mix with coolant flowing through the inner portion;

a temperature sensor, and;

a controller operably connected to the mixer valve, the controller being configured to operate the mixer valve in response to information received from the temperature sensor.

23. The data center of claim 22 further comprising a dew point sensor, the controller being configured to operate the mixer valve in response to information received from both the temperature sensor and the dew point sensor.

24. The data center of claim 23 wherein the controller operates the mixer valve in such a way that the temperature reported by the temperature sensor is maintained above the temperature reported by the dew point sensor.

25. The data center of claim 23 or 24 wherein the dew point sensor is located in proximity to a surface of the enclosure and the temperature sensor is located in such a way that it measures the temperature of coolant flowing through the inner supply piping.

26. The data center of any of claims 23 to 25, wherein the dew point sensor comprises a humidity sensor and wherein the controller is configured to calculate the dew point using information received from the humidity sensor.

27. The data center of any of claims 22 to 26, wherein the controller is computerized.

28. A coolant distribution system for use in a data center, the coolant distribution system comprising:

an outer portion comprising coolant supply piping and coolant return piping;

an inner portion comprising inner supply piping and inner return piping;

a mixer valve connecting the outer portion and the inner portion, the mixer valve being operable to allow coolant from the outer portion to mix with coolant flowing through the inner portion;

a dew point sensor;

a coolant temperature sensor, and;

a controller operably connected to the mixer valve and adapted to receive information from the dew point sensor and the coolant temperature sensor, the controller configured to operate the mixer valve in response to information received from the dew point sensor and the coolant temperature sensor.

29. The coolant distribution system of claim 28 wherein the controller is configured to operate the mixer valve to maintain the temperature reported by the coolant temperature sensor to be above the temperature reported by the dew point sensor.

30. The coolant distribution system of claim 29 further comprising an air temperature sensor and wherein the controller is further configured to operate the mixer valve to attempt maintaining the temperature reported by the coolant temperature sensor to be below the temperature reported by the air temperature sensor.

31. The coolant distribution system of claim 29 or 30 wherein the dew point sensor comprises a humidity sensor and wherein the controller is configured to compute the dew point using information received from the humidity sensor.

32. The coolant distribution system of claim 28 wherein the mixer valve is a 4 way mixer valve.

33. A method of managing the temperature of coolant distributed to an enclosure, the method comprising:

~~measuring the temperature of coolant flowing through the enclosure;~~

~~measuring the dew point of air surrounding the enclosure;~~

~~controlling the temperature of the coolant flowing through the enclosure so that the temperature of the coolant flowing through the enclosure remains higher than the measured dew point.~~

~~34. The method of claim 33 wherein the enclosure is of the type characterized by having a plurality of channels which are configured to cool installed apparatus by contacting a thermally conductive surface on a rail of the installed apparatus.~~

~~35. The method of claim 34 further comprising:~~

~~measuring the temperature of a portion of the air surrounding the enclosure;~~

~~controlling the temperature of the coolant flowing through the enclosure so that the temperature of the coolant flowing through the enclosure remains lower than the measured temperature of the portion of the air surrounding the enclosure.~~

~~36. The method of any of claims 33 to 35 wherein the step of controlling the temperature of the coolant flowing into the enclosure comprises:~~

~~inputting the measured temperature and dew point information into a computerized controller;~~

~~operating on the controller a control algorithm which responds to the inputted measured temperature and dew point information by operating a valve whereby adjusting the temperature of the coolant by mixing coolant flowing to the enclosure with a lower temperature coolant.~~