

CLAIMS

1. A heat exchanger comprising:
 - an inlet for introducing heated gas;
 - 5 a duty passage having a heat exchange array to permit a transfer of heat energy to a working fluid in the heat exchange array as heated gas passes through the duty passage;
 - a bypass passage for ejecting heated gas to atmosphere, wherein the duty passage and bypass passage are concentrically arranged with respect to one another and
 - 10 define an axis; and
 - a valve arrangement located upstream of the duty and bypass passages to control the proportion of heated gas from the inlet that is directed to the duty and bypass passages,
 - wherein the valve arrangement comprises:
 - 15 a central chamber having a first opening in communication with the bypass passage and a second opening in communication with the duty passage; and
 - a valve plug axially movable between a duty position where the first opening is blocked, and a bypass position where the second opening is blocked.
- 20 2. The heat exchanger of claim 1, wherein the valve arrangement further comprises an annular gas guide having a radial wall defining the central chamber, the radial wall comprising a plurality of circumferentially distributed radial ports for introducing heated gas into the central chamber.
- 25 3. The heat exchanger of claim 2, wherein the annular gas guide comprises an axial passage that extends through the annular gas guide, the axial passage being in communication with both the duty passage and the second opening of the chamber in order to guide heated gas from the chamber to the duty passage when the valve plug is in the duty position.
- 30 4. The heat exchanger of claim 2 or claim 3, wherein the chamber is a central chamber and the radial wall of the annular gas guide is a radially inner wall defining the central chamber.
- 35 5. The heat exchanger of claim 4, wherein the annular gas guide further comprises an outer wall spaced from the inner wall, such that the axial passage through the annular gas guide is defined by the outer and inner walls.

6. The heat exchanger of claim 5, wherein the radial ports pass through the inner wall and the outer wall of the annular gas guide, wherein each radial port is defined by a conduit extending between the inner and outer walls, such that the axial passage is defined by the space between the conduits.

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7. The heat exchanger of any of claims 2 to 6, further comprising an annular outer chamber arranged concentrically around the annular gas guide, wherein the annular outer chamber is in communication with the inlet for heated gas such that heated gas passes through the annular outer chamber and into the annular gas guide.

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8. The heat exchanger of claim 7, further comprising a manifold located upstream of the valve arrangement, the inlet being located in the manifold and the annular outer chamber being in communication with the manifold, wherein an axial end wall of the central chamber defines a wall of the manifold and is shaped to direct heated gas to the annular outer chamber via vents located in the annular outer chamber.

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9. The heat exchanger of claim 8, wherein the axial end wall of the central chamber has a closeable access aperture in a side wall.

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10. The heat exchanger of any previous claim, wherein the chamber comprises a valve chamber, wherein the first and second openings are defined by the valve chamber.

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11. The heat exchanger of claim 10, wherein the chamber is a central chamber, the valve arrangement further comprises a first valve seat projecting radially inwardly from an inner surface of the valve chamber at the first opening so that valve plug seals against the first valve seat in the duty position.

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12. The heat exchanger of claim 10 or claim 11, wherein the chamber is a central chamber, wherein the valve arrangement further comprises a second valve seat projecting radially inwardly from an inner surface of the valve chamber at the second opening so that valve plug seals against the second valve seat in the bypass position.

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13. The heat exchanger of any of claims 10 to 12, wherein the chamber further comprises a duty chamber.

14. The heat exchanger of claim 13, wherein the second opening is located between the valve chamber and the duty chamber.

15. The heat exchanger of claim 13 or claim 14, wherein the first opening is located between the valve chamber and the bypass passage.
16. The heat exchanger of claim 9 when dependent on claim 3, wherein the duty
5 chamber comprises an opening in communication with the axial passage of the annular gas guide.
17. The heat exchanger of any of claims 10 to 16, wherein the chamber further comprises an actuation chamber, the actuation chamber comprising at least part of an
10 actuation arrangement for actuating the valve plug.
18. The heat exchanger of claim 17, wherein the bottom of the actuation chamber is closed.
- 15 19. The heat exchanger of claim 18, wherein the actuation chamber comprises a drainage outlet.
20. The heat exchanger of any previous claim, wherein the duty passage comprises an outlet and the bypass passage comprises an outlet, and the duty passage outlet is
20 separate to the bypass passage outlet.
21. The heat exchanger of claim 20, wherein the bypass outlet is located downstream of the heat exchange array.
- 25 22. The heat exchanger of any previous claim, wherein the valve plug comprises a valve disc supported on an axially movable support rod.
23. The heat exchanger of claim 22, wherein the valve disc is hollow and comprises at least one aperture to expel gas from the valve disc.
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24. The heat exchanger of claim 22 or claim 23, wherein the chamber is a central chamber, and an outer circumference of the valve disc has an angled surface to engage a surface of the central chamber when in the duty or bypass positions.
- 35 25. The heat exchanger of claim 24, wherein the valve disc comprises two axially spaced walls, with the angled surface being located on a bridging rim connecting the two walls together at the outer circumference of the disc.

26. The heat exchanger of claim 24 or claim 25, wherein the central chamber further comprises a deflector projecting radially inwardly, the deflector being angled and arranged to align with the angled surface of the valve disc to direct heated gas.
- 5 27. The heat exchanger of claim 25 or claim 26, wherein one or both of the two axially spaced walls comprise a curved portion, each curved portion being curved from a radially oriented portion adjacent the outer circumference of the valve disc to an axially oriented portion adjacent the support rod.
- 10 28. The heat exchanger of any of claims 22 to 27, wherein the support rod comprises a guide rod that engages a guide bracket fixed to the heat exchanger.
29. The heat exchanger of any of claims 22 to 28 wherein the support rod is actuated by a cam and follower arrangement.
- 15 30. The heat exchanger of claim 29, wherein the cam and follower arrangement comprises a lever driven by an actuator fixed to a rotatable drive shaft, the lever pivotable between first and second positions, wherein rotational movement of the lever is converted to linear motion by a cam that drives a follower fixed to the support rod.
- 20 31. The heat exchanger of claim 30 wherein a bracket is fixed to a lower end of the support rod, the bracket comprising a guide slot for guiding the follower.
32. A heat exchanger comprising:
- 25 a inlet for introducing heated gas;
- a duty passage having a heat exchange array to permit a transfer of heat energy to a working fluid in the heat exchange array as heated gas passes through the duty passage;
- a bypass passage for ejecting heated gas to atmosphere, wherein the duty
- 30 passage and bypass passage are concentrically arranged with respect to one another and define an axis;
- a valve arrangement located upstream of the duty and bypass passages to control the proportion of heated gas from the inlet that is directed to the duty and bypass passages;
- 35 a cooling region concentrically located between the duty passage and the bypass passage; and
- a cooling gas supply in communication with the cooling region to introduce cooling gas into the cooling region.

33. The heat exchanger of claim 32, wherein the cooling region comprises a cooling gas inlet connected to the cooling gas supply, the cooling gas inlet being configured to introduce cooling gas into the cooling region in an axially offset and at least partially circumferential direction.
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34. The heat exchanger of claim 33 further comprising a gas diverter arranged around the cooling gas inlet to direct cooling gas into the cooling region in the axially offset and at least partially circumferential direction.
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35. The heat exchanger of claim 34, wherein a first part of the cooling region is defined by a first wall extending to a downstream end of the heat exchange array and a second wall extending at least partially towards the downstream end of the heat exchange array.
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36. The heat exchanger of claim 35, wherein the second wall terminates before an upstream end of the heat exchange array.
37. A heat exchanger comprising:
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- an inlet for introducing heated gas;
 - a duty passage having a heat exchange array to permit a transfer of heat energy to a working fluid in the heat exchange array as heated gas passes through the duty passage;
 - a bypass passage for ejecting heated gas to atmosphere, wherein the duty passage and bypass passage are concentrically arranged with respect to one another and
 - 25 define an axis;
 - a valve arrangement located upstream of the duty and bypass passages to control the proportion of heated gas from the inlet that is directed to the duty and bypass passages;
 - an inlet pipe for introducing non-heated gas into the heat exchanger; and
 - 30 a splitter, arranged in the inlet pipe, to divert the non-heated gas to:
 - a sealing path in communication with a sealing arrangement for helping the valve arrangement to create a seal; and/or
 - a cooling path in communication with a cooling arrangement for reducing heat transfer between the bypass passage and the duty passage.
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38. The heat exchanger of claim 37, wherein the splitter is a proportional valve arranged between the sealing and cooling paths.

39. The heat exchanger of claim 38, wherein the valve arrangement has an outer casing and the proportional valve comprises a valve control located outside the outer casing
- 5 40. The heat exchanger of any of claims 37 to 39, wherein the inlet pipe comprises first and second ducts, wherein the first duct is arranged concentrically inside the second duct, and the splitter diverts non-heated gas to the first or second duct depending on the amount of sealing or cooling required.
- 10 41. The heat exchanger of claim 40, wherein the second duct is the sealing path, the sealing path being in communication with a valve plug to help the valve plug create a seal with a corresponding valve seat.
42. The heat exchanger of claim 41, wherein the first duct is the cooling path.
- 15 43. The heat exchanger of claim 41 or claim 42, wherein, when the valve plug is in the bypass position, the non-heated gas is directed through a hollow support rod of the valve plug and out through at least one aperture in a valve disc of the valve plug.
- 20 44. The heat exchanger of any of claims 37 to 43, wherein the first duct is the cooling path, the first duct being in communication with a cooling region located between the duty passage and the bypass passage.