

CLAIMS

1. A rotor assembly comprising:
- a rotor having a plurality of blades and an axis about which the rotor rotates, each blade
5 being spaced from the axis of the rotor such that there is a gap between the axis and an inner edge of each blade through which fluid can flow, and inner and outer edges of each blade lying in and defining a blade plane and each blade being offset from the axis of the rotor such that the axis does not lie in the blade plane;
 - a casing partially surrounding the rotor, the casing having a first opening to permit a fluid
10 flow into or out of the casing in a direction generally perpendicular to the rotor axis; and
 - a second opening at an axial end of the casing to permit a fluid flow into or out of the casing in a direction generally parallel to the rotor axis,
- wherein during a first mode of operation fluid flow through the rotor assembly is generally from the first opening to the second opening.
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2. A rotor assembly as claimed in claim 1, wherein in a second mode of operation fluid flow through the rotor assembly is generally from the second opening to the first opening.
3. A rotor assembly as claimed in claim 1 or claim 2, wherein the rotor has two, three, four, five,
20 six, seven or eight blades.
4. A rotor assembly as claimed in any preceding claim, wherein angles between the blade planes of adjacent blades are the same.
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5. A rotor assembly as claimed in claim 4, wherein the rotor has four blades, and blade planes of adjacent blades are substantially perpendicular to each other.
6. A rotor assembly as claimed in any preceding claim, wherein the blades are flat.
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7. A rotor assembly as claimed in any preceding claim, wherein an angle between each blade plane and a plane containing the rotor axis can be adjusted, with an angle between blade planes of adjacent blades remaining constant.
8. A rotor assembly as claimed in any preceding claim, wherein each blade is elongate in a
35 direction parallel to the rotor axis and the casing is generally tubular.
9. A rotor assembly as claimed in any preceding claim further comprising a drive shaft coaxial with the rotor axis.

10. A rotor assembly as claimed in any preceding claim, wherein the first opening forms an inlet of the rotor assembly to permit a fluid flow to enter the casing to drive the rotor, and the second opening forms an outlet provided in an exhaust region at the axial end of the casing.
- 5 11. A rotor assembly as claimed in any one of claims 1 to 9, wherein the second opening forms an inlet of the rotor assembly, and the first opening forms an outlet of the rotor assembly.
- 10 12. A transverse axis fluid turbine for use in a working fluid flow comprising a rotor assembly as claimed in Claim 10, the axis of the rotor defining an axis of the fluid turbine, an inlet section of the fluid turbine comprising at least a part of the casing and the inlet permitting a portion of the working fluid flow to enter the casing to drive the rotor, and wherein said fluid flow exits the casing through the exhaust region.
- 15 13. A fluid turbine as claimed in claim 12, wherein angles between the blades are such that part of the fluid flow within the inlet section may be deflected by a pressure surface of a first one of the blades through said gap between the axis and the blade inner edge and onto the pressure surface of a second one of the blades.
- 20 14. A fluid turbine as claimed in claim 12 or claim 13, further comprising a rotor cap disposed proximate an end of the blades, the rotor cap having a radial dimension up to half the swept radius of the rotor, and the rotor cap being arranged to at least partially restrict a flow of fluid from a region beyond the end of the blades into a central region of the rotor including the gap between the turbine axis and the inner edge of each blade.
- 25 15. A fluid turbine as claimed in any one of claims 12 to 14, wherein the inlet section comprises a guide panel extending outwardly from the casing at an edge of the inlet, the guide panel extending generally in a direction opposite the working fluid flow direction and the guide panel being arranged to guide a portion of the working fluid flow into the casing through the inlet.
- 30 16. A fluid turbine as claimed in any one of claims 12 to 15, wherein the inlet section comprises a return side guide panel extending outwardly from the casing proximate an edge of the inlet proximate a return side of the rotor, the return side guide panel extending generally in a direction opposite the working fluid flow direction and being arranged to guide a portion of the working fluid flow into the casing through the inlet.
- 35 17. A fluid turbine as claimed in claim 16, wherein, during rotation of the rotor, each blade passes through a forward position at which the blade is proximate the inlet and the blade plane is parallel to but offset from a plane of the return side guide panel.
- 40 18. A fluid turbine as claimed in any one of claims 12 to 17, wherein the inlet section comprises

a drive side guide panel extending outwardly from the casing proximate an edge of the inlet furthest from a return side of the rotor, the drive side guide panel extending generally in a direction opposite the working fluid flow direction and being arranged to guide a portion of the working fluid flow into the casing through the inlet.

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19. A fluid turbine as claimed in claim 18 when dependent on claim 16, wherein the return side and drive side guide panels diverge in a direction opposite the working fluid flow direction.

20. A fluid turbine as claimed in any one of claims 12 to 19, wherein the inlet section comprises an inlet baffle that partially blocks the inlet of the casing, the inlet baffle extending from a side of the inlet proximate a return side of the rotor and obscuring a part of a drive side of the rotor, and the inlet baffle being configured to obstruct a portion of the working fluid flow such that a region of reduced pressure is formed at the rear of the inlet baffle.

21. A fluid turbine as claimed in claim 20, wherein the inlet baffle is moveable to alter the degree to which the inlet baffle obscures the drive side of the rotor.

22. A fluid turbine as claimed in claim 20 or claim 21 when dependent on claim 17, wherein an edge of the inlet baffle can be set to lie substantially in the same plane as the blade in the forward position.

23. A fluid turbine as claimed in any one of claims 12 to 22, further comprising a funnel guide extending from a region proximate the inlet in a direction generally opposite to the working fluid flow direction, the funnel guide including a flow surface disposed at an axial end of the casing inlet and being generally transverse to the turbine axis, and the flow surface extending from the casing at an angle of at least 90° to the turbine axis so as to guide fluid flow into the inlet.

24. A fluid turbine as claimed in claim 23, wherein the flow surface includes a proximal region adjacent the inlet configured to modify the working fluid flow through the inlet to be substantially perpendicular to the turbine axis.

25. A fluid turbine as claimed in claim 24, wherein the proximal region of the flow surface is planar and an angle between the proximal region of the flow surface and the turbine axis is approximately 90°, and the flow surface includes a distal region further from the inlet in which an angle between the flow surface and the turbine axis is greater than 90°.

26. A fluid turbine as claimed in any one of claims 23 to 25, comprising two funnel guides, each disposed at a respective end of the inlet.

27. A fluid turbine as claimed in any one of claims 12 to 26, comprising two exhaust regions at

opposite axial ends of the inlet section.

28. A fluid turbine as claimed in any one of claims 12 to 27, wherein the or each exhaust region comprises an exhaust baffle, the exhaust baffle being disposed upstream of the outlet relative to the working fluid flow to deflect a portion of the working fluid flow so as to create a region of reduced pressure at the outlet.

29. A fluid turbine as claimed in claim 28, further comprising an exhaust bypass surface extending from a region proximate the or each exhaust region in a direction generally opposite to the working fluid flow direction, the exhaust bypass surface being substantially parallel to the rotor axis and the exhaust bypass surface being contoured so as to increase the velocity of the portion of the working fluid flow that strikes and is deflected by the or each exhaust baffle.

30. A fluid turbine as claimed in claim 28 or claim 29, further comprising an exhaust guide surface extending from a region proximate the or each exhaust region in a direction generally opposite to the working fluid flow direction, the exhaust guide surface extending substantially transverse to the rotor axis and the exhaust guide surface being contoured so as to increase the velocity of the portion of the working fluid flow that strikes and is deflected by the or each exhaust baffle.

31. A fluid turbine as claimed in any one of claims 12 to 30, wherein each blade extends into the or each exhaust region.

32. A fluid turbine as claimed in any one of claims 12 to 30, wherein each blade does not extend into the or each exhaust region.

33. A fluid turbine as claimed in any one of claims 12 to 32, wherein fluid flow through the outlet is in a direction substantially parallel to the turbine axis.

34. A fluid turbine as claimed in any one of claims 12 to 32, wherein fluid flow through the outlet is in a direction substantially transverse to the turbine axis.

35. A fluid turbine as claimed in claim 34, wherein the or each exhaust region comprises an end plate extending transverse to the turbine axis and spaced from an end of the inlet section.

36. A fluid turbine as claimed in claim 35, wherein the end plate prevents fluid flow from the exhaust region in a direction parallel to the turbine axis and fluid flow from the exhaust region is only in a direction transverse to the turbine axis.

37. A fluid turbine as claimed in claim 35, wherein the end plate includes at least one hole to allow a flow of exhaust fluid from the exhaust region in a direction substantially parallel to the turbine

axis.

38. A fluid turbine as claimed in any one of claims 35 to 37, wherein a part of the casing extends into the or each exhaust region and spans the distance between the inlet section and the end plate, and wherein the part of the casing in the or each exhaust region includes a gap that provides the outlet and the outlet subtends an angle of approximately 270° from an upstream point of the casing in the direction of rotor rotation.

39. A fluid turbine as claimed in any one of claims 35 to 38, wherein the or each exhaust baffle extends in a direction parallel to the turbine axis to protrude beyond the end plate.

40. A fluid turbine as claimed in claim 39, when dependent on claim 36, wherein a section of the exhaust baffle that protrudes beyond the end plate is movable in a direction parallel to the working fluid flow direction so as to adjust the effect of the draw, generated by the baffle, on the exhaust outlet transverse to the turbine axis.

41. A fluid turbine as claimed in any one of claims 12 to 40, further comprising a tail panel disposed on the return side of the rotor and arranged to deflect working fluid flow around the side of the fluid turbine, the tail panel extending in a plane parallel with the rotor axis and spanning at least the exhaust region of the turbine, the tail panel extending from the exhaust region in a direction generally the same as the working fluid flow direction.

42. A fluid turbine as claimed in claim 41, wherein the tail panel spans the inlet section of the turbine.

43. A fluid turbine as claimed in claim 41 or claim 42, wherein the tail panel extends in a direction generally opposite the working fluid flow direction such that a leading edge of the tail panel is upstream of the exhaust region.

44. A fluid turbine as claimed in claim 43 when dependent on claim 16, wherein the leading edge of the tail panel is in contact with the return side guide panel.

45. A fluid turbine as claimed in any one of claims 12 to 44, further comprising means for attaching the fluid turbine to a structure.

46. A fluid turbine as claimed in claim 45, comprising means for rotatably attaching the fluid turbine to a post.

47. A fluid turbine array comprising two fluid turbines, each fluid turbine being according to any one of claims 12 to 46, the turbine axes of the fluid turbines being parallel to each other.

48. A fluid turbine array as claimed in claim 47 when dependent on claim 18, wherein the casings of the fluid turbines are adjacent each other, the drive side guide panels of the two fluid turbines extend in a direction substantially opposite to the working fluid flow direction, and the drive side guide panels of the two fluid turbines diverge in a direction opposite the working fluid flow direction.

49. A fluid turbine array as claimed in claim 47 or claim 48 when dependent on claim 16, wherein leading edges of the return side guide panels furthest from the casings are joined such that working fluid flow between the return side guide panels is restricted.

50. A fluid turbine array as claimed in claim 47, wherein the fluid turbines are arranged end to end such that the turbine axes of the fluid turbines are parallel and co-axial.

51. A fluid turbine array as claimed in claim 47, wherein the fluid turbines are offset from each other in a direction parallel to the turbine axes such that the inlet section of one of the turbines is disposed adjacent the exhaust region of the other one of the turbines.

52. A fluid turbine assembly comprising a post and a fluid turbine according to any one of claims 11 to 46 or a fluid turbine array according to any one of claims 47 to 51, the fluid turbine or the fluid turbine array being rotatably attached to the post.

53. A fluid turbine assembly comprising a post and a fluid turbine array according to any one of claims 47 to 51 when dependent on claim 16, wherein the post is disposed between the return side guide panels.

54. A fluid turbine assembly comprising a post and a fluid turbine array according to claim 47, wherein the post is clamped between the two fluid turbines.

55. A fluid turbine assembly as claimed in any one of claims 52 to 54, wherein the turbine axis of the or each fluid turbine is parallel to an axis of the post.

56. A method of generating electricity using a fluid turbine according to any one of claims 12 to 46, or a fluid turbine array according to any one of claims 47 to 51, or a fluid turbine assembly according to any one of claims 52 to 55, the method comprising connecting a drive shaft of the or each fluid turbine directly or indirectly to a generator.

57. A pump comprising:
- a rotor assembly as claimed in claim 11;
- a drive shaft operably connected to the rotor assembly to rotate the blades about the axis of the rotor; and

- a motor connected to the drive shaft.

58. A pump as claimed in Claim 57, comprising two second openings at opposite axial ends of the casing.

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59. A propeller comprising:

- a rotor assembly as claimed in claim 11;
- a drive shaft operably connected to the rotor assembly to rotate the blades about the axis of the rotor; and

- 10 - a motor connected to the drive shaft.

60. A propeller as claimed in Claim 59, comprising two second openings at opposite axial ends of the casing.

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