The claims defining the invention are as follows:

1. A rotary fluid machine comprising:

first and second bodies, the bodies being rotatable relative to each other and arranged one inside the other to define a working fluid space there between;

a working fluid intake and a working fluid exhaust together forming an axial flow path enabling working fluid to flow into and out of the machine in an axial direction wherein the working fluid space is in fluid communication with the intake and the exhaust;

at least one gate carried by or otherwise coupled with the first body and being movable with respect to the bodies; and

a magnetic gate control system operable to exert control of motion of the at least one gate.

2. The rotary fluid machine according to claim 1 comprising at least one lobe on the second body across which the at least one gate traverses, with a working fluid inlet and a working fluid outlet provided on respective circumferentially opposite sides of the at least one lobe wherein working fluid is able to enter and exit the working fluid space through the inlet and out respectively.

3. A rotary fluid machine comprising:

first and second bodies, the bodies being rotatable relative to each other and arranged one inside the other to define a working fluid space there between;

at least one gate carried by or otherwise coupled with the first body and being movable with respect to the bodies;

at least one lobe on the second body across which the at least one gate traverses, with a working fluid inlet and a working fluid outlet provided on respective circumferentially opposite sides of the at least one lobe wherein working fluid is able to enter and exit the working fluid space through the inlet and out respectively; and

a magnetic gate control system operable to exert control of motion of the at least one gate.

4. The rotary fluid machine according to any one of claims 1 to 3 wherein the magnetic gate control system is operable to move the at least one gate in an extension direction to extend the at least one gate from the first body toward the second body.

5. The rotary fluid machine according to any one of claims 1 to 3 wherein the magnetic gate control system is operable to displace the at least one gate in a retraction direction to retract the at least one gate toward the first body.

6. The rotary fluid machine according to any one of claims 1 to 3 wherein the magnetic gate control system is operable to move the at least one gate in either one or both of: (a) an extension direction to extend the at least one gate from the first body toward the second body; and (b) a retraction direction to retract the at least one gate towards the first body.

7. The rotary fluid machine according to claim 4 or 6 wherein the magnetic gate control system is arranged to produce a magnetic attraction force between the gates and the second body to move the at least one gate in the extension direction.

8. The rotary fluid machine according to claim 4 or 6 wherein the magnetic gate control system is arranged to produce a magnetic repulsion force between the gates and the first body to move the at least one gate in the extension direction.

9. The rotary fluid machine according to claim 4 or 6 wherein the magnetic gate control system is arranged to produce one or both of (a) a magnetic attraction force between the gates and the second body to move the at least one gate in the extension direction; and (b) a magnetic repulsion force between the gates and the first body to move the at least one gate in the extension direction.

10. The rotary fluid machine according to any one of claims 5 - 9 wherein the magnetic gate control system is arranged to produce a magnetic attraction force between the gates and the first body to move the at least one gate in the retraction direction.

11. The rotary fluid machine according to any one of claims 5 - 10 wherein the magnetic gate control system is arranged to produce a magnetic repulsion force between the gates and the second body to move the at least one gate in the retraction direction.

12. The rotary fluid machine according to claim 5 or 7 wherein the magnetic gate control system is arranged to produce one or both of (a) a magnetic attraction force between the gates and the second body to move the at least one gate in the extension

direction; and (b) a magnetic repulsion force between the gates and the first body to move the at least one gate in the extension direction.

13. The rotary fluid machine according to any one of claims 1 – 12 wherein the magnetic gate control system comprises one or more magnets fixed to one or both of the first body and the second body.

14. The rotary fluid machine according to claim 13 wherein at least one of the magnets is a permanent magnet.

15. The rotary fluid machine according to claim 14 wherein at least one of the magnets is a rare earth magnet.

16. The rotary fluid machine according to claim13 wherein at least one of the magnets is an electro-magnet.

17. The rotary fluid machine according to any one of claims 13-16 wherein the magnets are hermetically sealed on the body or bodies to which they are fixed.

18. The rotary fluid machine according to any one of claims 13-17 wherein the magnetic gate control system comprises a plurality of magnets arranged in an Halbach array configuration.

19. The rotary fluid machine according to any one of claims 13-18 wherein the one or more magnets are fixed to the second body the magnets comprise a first set of at least one magnet arranged to apply a force of attraction to move the gates toward the second body.

20. The rotary fluid machine according to claim 19 wherein the one or more magnets fixed to the second body comprise a second set at least one magnet arranged to apply a force of repulsion to move the gates toward the first body

21. The rotary fluid machine according to claim 20 wherein the one or more magnets fixed to the second body comprise a third set at least one magnet arranged to apply a force of attraction to hold the gates near the second body, the third set of magnets being on a side of the first set of magnets opposite the second set.

22. The rotary fluid machine according to claim 20 or 21 when dependant on claim 1 or 2 comprising at least one lobe on the second body across which the at least one gate traverses wherein the at least one lobe has a crest that lies in close proximity to the first body and the first set of at least one magnet extends along one side of the at least one lobe toward the crest.

23. The rotary fluid machine according to claim 20 or 21 when dependent on claim 3 wherein the at least one lobe has a crest that lies in close proximity to the first body and the first set of at least one magnet extends along one side of the at least one lobe toward the crest.

24. The rotary fluid machine according to claim 22 or 23 wherein the second set of at least one magnet extends along an opposite side of the at least one lobe toward the crest.

25. The rotary fluid machine according to claim 24 wherein the third set of at least one magnet extends from the first set of magnets distant the crest.

26. The rotary fluid machine according to any one of claims 22 – 24 wherein the one side of the crest leads to an adjacent fixed diameter portion of the second body and wherein the first set of magnets comprises a first one piece magnet that spans from a first location adjacent the crest to a second location adjacent the fixed diameter portion and wherein the first one piece magnet has a constant or a variable magnetic field in the direction of rotation between the first and second locations.

27. The rotary fluid machine according to claim 26 wherein each one piece magnet has a planar base on a radial inner side of the one piece magnet that is inclined relative to a tangent plane of an immediately adjacent portion of the second body.

28. The rotary fluid machine according to claim 26 or 27 wherein the first one piece magnet has a radial outer surface of a profile substantially the same as that of the one side of the lobe.

29. The rotary fluid machine according to any one of claims 26 - 28 comprising at least one further one piece magnet, each further one piece magnet being substantially identical to the first one piece magnet and wherein the one piece magnets are in axial alignment across the one side of the lobe.

30. The rotary fluid machine according to any one of claims 22 – 29 wherein the at least one lobe is one of a plurality of lobes, and wherein each lobe is provided with a like arrangement of the magnets.

31. The rotary fluid machine according to any one of claims 1 – 30 wherein the gate is made of a ferromagnetic material and the gate forms part of the magnetic gate control system.

32. The rotary fluid machine according to any one of claims 1 – 30 wherein the gate is a magnet and the gate forms part of the magnetic gate control system.

33. The rotary fluid machine according to any one of claims 1 – 32 wherein the gate is provided with one or more gate magnets and the gate magnets form part of the magnetic gate control system.

34. The rotary fluid machine according to any one of claims 1 – 33 wherein the gates are tapered on opposite radially extending sides in a manner so that an axially extending side of the gate closest the second body is shorter in length than an opposite axially extending side of the gate.

35. The rotary fluid machine according to any one of claims 1 – 34 wherein the magnetic gate control system is further arranged to space the gates from opposite radial sided of the first body.

36. The rotary fluid machine according to any one of claims 1 – 35 comprising M gates where M is a integer, wherein the second body is provided with N lobes wherein M>N and M /N is a non-integer >1.

37. The rotary fluid machine according to any one of the preceding claims when dependant directly or indirectly on claim 16 wherein the machine is bi-directional.

38. The rotary fluid machine according to any one of claims 22 – 37 wherein each lobe is provided with a lobe surface across which a gate traverses when the first body is rotating relative to the second body, the lobe surface provided with: openings to form one or more inlets and outlets for the working fluid; and a plurality of relatively raised and relatively recessed surfaces arranged such that an adjacent end of a gate

traversing the lobe surface is subjected to substantially uniform wear across an entirety of a length of the gate that co-extends with an axial width of the lobe.

39. The rotary fluid machine according any one of claims 2 – 38 wherein each lobe is separately formed of the second body.

40. The rotary fluid machine according claim 39 wherein at least one of the lobes is made of a plastics material and the body is made of a metal.

41. The rotary fluid machine according claim 39 or 40 wherein the second body is provided with a constant diameter portion between rotationally adjacent lobes across which of the at least one gate traverses and wherein each constant diameter portion of formed by a lining block and wherein each lining block is formed separately of the second body.

42. The rotary fluid machine according to any one of claims 1 – 41 the first body is provide with a recess for each of the at least one gate, and a respective fluid bleed path formed between each gate and a corresponding recess to facilitate flow of working fluid out of the recess when a gate is moved toward the first body.

43. The rotary fluid machine according to claim 42 comprising a respective insert strip coupled to one side of each recess wherein the bleed path is formed between the gate and the one side of the recess.

44. The rotary fluid machine according to claim 43 wherein the bleed path comprises one or more holes formed in the insert strip.

45. The rotary fluid machine according to any one of claims 42 - 44 wherein the first body comprises a working surface that faces the second body and wherein the working surface is composed of a plurality of mutually separately formed first body lining blocks.

46. The rotary fluid machine according to claim 45 where the first body lining blocks are spaced apart to form a throat for each recess that narrows in the radial direction toward the axis of rotation.

47. The rotary fluid machine according to claim 46 wherein the bleed path comprises one or more holes formed in one end of each first body lining block.

48. A rotary fluid machine comprising:

first and second bodies, the bodies being rotatable relative to each other and arranged one inside the other to define a working fluid space there between, the second body being provided with N lobes where N is a integer > 1, each lobe having a crest lying in close proximity to or touching the first body to divide the working fluid space into a plurality of chambers;

M gates where M is a integer >1 and wherein M>N and M/N is a non-integer greater than 1, the gates being supported by the first body and movable in with respect to the bodies to extend into and retract from the working fluid space; and

a gate control system operable to exert control of motion of the at least one gate.

49. The rotary fluid machine according to claim 48 wherein the gate control system is a magnetic gate control system operable to exert control of motion of the at least one gate in the radial direction.

50. A method of operating a rotary fluid machine having first and second bodies, the bodies being rotatable relative to each other and arranged one inside the other to define a working fluid space there between, a working fluid intake and a working fluid exhaust forming an axial flow path enabling working fluid to flow into and out of the machine in an axial direction wherein the working fluid space is in fluid communication with the intake and the exhaust, and at least one gate, the at least one gate being carried by or otherwise coupled with the first body and movable with respect to the bodies, the method comprising magnetically controlling motion of the gates for at least one portion of a cycle of the rotation of one of the bodies relative to the other.

51. A method of operating a rotary fluid machine having first and second bodies, the bodies being rotatable relative to each other and arranged one inside the other to define a working fluid space there between, the at least one gate being carried by or otherwise coupled with the first body and movable with respect to the bodies, and at least one lobe on the second body across which the at least one gate traverses, with a working fluid inlet and a working fluid outlet provided on respective circumferentially opposite sides of the at least one lobe wherein working fluid is able to enter and exit the working fluid space through the inlet and out respectively, the method comprising

magnetically controlling motion of the gates for at least one portion of a cycle of the rotation of one of the bodies relative to the other.

52. The method according to claim 50 or 51 wherein magnetically controlling motion of the gates comprises magnetically biasing the gates to move toward the second body for a plurality of first portions of the cycle of rotation.

53. The method according to claim 52 wherein magnetically controlling motion of the gates comprises magnetically biasing the gates to retract into the first body for a plurality of second portions of the cycle of rotation, wherein the second portion are interleaved with the first portions.

54. The method according to any one of claims 50 - 53 wherein magnetically controlling motion of the gates comprises providing one or magnets in or on the second body to produce a magnetic field capable of inducing the motion of gates.

55. The method according to any one of claims 50 - 54 wherein magnetically controlling motion of the gates comprises providing one or magnets in or on the first body to produce a magnetic field capable of inducing the motion of gates.

56. The method according to any one of claims 50 - 55 wherein magnetically controlling motion of the gates comprises providing one or magnets in or on the gates to produce a magnetic field capable of inducing the motion of gates.

57. The method according to any one of claims 50 - 55 wherein magnetically controlling motion of the gates comprises using gates made of a ferromagnetic material.

58. The method according to claim 54 or 55 wherein, when a plurality of magnets is provided, arranging the magnets in a Halbach array.

59. The method according to any one of claims 50 - 58 comprising magnetically levitating the gates.

60. A rotary fluid machine comprising:

first and second bodies, the bodies being rotatable relative to each other and arranged one inside the other to define a working fluid space there between;

at least one gate carried by or otherwise coupled with the first body and being movable with respect to the bodies;

at least one lobe on the second body across which the at least one gate traverses; and

a gate control system operable to exert control of motion of the at least one gate;

wherein each lobe is provided with a lobe surface across which a gate traverses when the first body is rotating relative to the second body, the lobe surface provided with openings to form one or more inlets and outlets for the working fluid; and a plurality of relatively raised and relatively recessed surfaces arranged such that an adjacent end of a gate traversing the lobe surface is subjected to substantially uniform wear across an entirety of a length of the gate that co-extends with an axial width of the lobe.

61. The rotary fluid machine according claim 60 wherein each lobe is separately formed of the second body.

62. The rotary fluid machine according claim 60 or 61 wherein the second body is provided with a constant diameter portion between rotationally adjacent lobes across which of the at least one gate traverses and wherein each constant diameter portion of formed by a lining block and wherein each lining block is formed separately of the second body.

63. The rotary fluid machine according to any one of claims 60 -62 wherein the first body comprises a working surface that faces the second body and wherein the working surface is composed of a plurality of mutually adjacent separately formed first body lining blocks.

64. The rotary fluid machine according to claim 63 where the first body lining blocks are spaced apart to form a throat for each recess that narrows in the radial direction toward the axis of rotation.

65. A rotary fluid machine comprising:

first and second bodies, the bodies being rotatable relative to each other and arranged one inside the other to define a working fluid space there between;

at least one gate carried by or otherwise coupled with the first body and being movable with respect to the bodies; and

a gate control system operable to exert control of motion of the at least one gate;

wherein one or both of the first and second bodies comprise a respective super structure and one or more separately made lining blocks detachably coupled to the respective super structure, wherein each of the lining blocks have respective surfaces that face and form part of the working fluid space, the respective surface extending in an axial direction in the working fluid space and facing the working fluid space in a radial direction.

The claims defining the invention are as follows:

1. A rotary fluid machine comprising:

first and second bodies, the bodies being rotatable relative to each other about an axis of rotation, the axis of rotation forming an axial direction of the machine, the bodies being arranged one inside the other to define a working fluid space there between;

a working fluid intake and a working fluid exhaust together forming an axial flow path being co-axial with the axial direction and enabling working fluid to flow into and out of the machine in an axial direction wherein the working fluid space is in fluid communication with the intake and the exhaust;

at least one gate carried by or otherwise coupled with the first body and being movable with respect to the bodies; and a magnetic gate control system operable to exert control of motion of the at least one gate.

2. The rotary fluid machine according to claim 1 wherein the magnetic gate control system is operable to move the at least one gate in an extension direction to extend the at least one gate from the first body toward the second body.

3. The rotary fluid machine according to claim 1 wherein the magnetic gate control system is operable to displace the at least one gate in a retraction direction to retract the at least one gate toward the first body.

4. The rotary fluid machine according to claim 1 wherein the magnetic gate control system is operable to move the at least one gate in either one or both of: (a) an extension direction to extend the at least one gate from the first body toward the second body; and (b) a retraction direction to retract the at least one gate towards the first body.

5. The rotary fluid machine according to claim 1 wherein the magnetic gate control system comprises one or more magnets fixed to one or both of the first body and the second body.

6. The rotary fluid machine according to claim 5 wherein at least one of the magnets is an electro-magnet.

7. The rotary fluid machine according to claim 5 wherein the one or more magnets are hermetically sealed on the body or bodies to which they are fixed.

8. The rotary fluid machine according to claim 5 wherein the magnetic gate control system comprises a plurality of magnets arranged in a Halbach array configuration.

9. The rotary fluid machine according to claim 5 wherein the one or more magnets are fixed to the second body and the one or more magnets comprise a first set of at least one magnet arranged to apply a force of attraction to move the gates toward the second body.

10. The rotary fluid machine according to claim 9 wherein the one or more magnets fixed to the second body comprise a second set of at least one magnet arranged to apply a force of repulsion to move the gates toward the first body.

11. The rotary fluid machine according to claim 10 wherein the one or more magnets fixed to the second body comprise a third set of at least one magnet arranged to apply a force of attraction to hold the gates near the second body, the third set of magnets being on a side of the first set of magnets opposite the second set.

12. The rotary fluid machine according to claim 9 comprising at least one lobe on the second body across which the at least one gate traverses wherein the at least one lobe has a crest that lies in close proximity to the first body and the first set of at least one magnet extends along one side of the at least one lobe toward the crest.

13. The rotary fluid machine according to claim 12 wherein the one side of the crest leads to an adjacent fixed diameter portion of the second body and wherein the first set of magnets comprises a first one piece magnet that spans from a first location adjacent the crest to a second location adjacent the fixed diameter portion and wherein the first one piece magnet has a constant or a variable magnetic field in the direction of rotation between the first and second locations.

14. The rotary fluid machine according to claim 13 wherein each one piece magnet has a planar base on a radial inner side of the one piece magnet that is inclined relative to a tangent plane of an immediately adjacent portion of the second body.

15. The rotary fluid machine according to claim 13 wherein the first one piece magnet has a radial outer surface of a profile substantially the same as that of the one side of the lobe.

16. The rotary fluid machine according to claim 1 wherein the gate is: (a) made of a ferromagnetic material and the gate forms part of the magnetic gate control system; (b) a magnet and the gate forms part of the magnetic gate control system; or, (c) provided with one or more gate magnets and the gate magnets form part of the magnetic gate control system.

17. The rotary fluid machine according to claim 1 wherein the gates are tapered on opposite radially extending sides in a manner so that an axially extending side of the gate closest the second body is shorter in length than an opposite axially extending side of the gate.

18. The rotary fluid machine according to claim 1 wherein the magnetic gate control system is further arranged to space the gates from opposite radial sided of the first body.

19. The rotary fluid machine according to claim 1 comprising M gates where M is an integer, wherein the second body is provided with N lobes wherein M>N and M/N is a non-integer >1.

20. The rotary fluid machine according to claim 1 wherein the machine is bi-directional.

21. The rotary fluid machine according to claim 1 comprising at least one lobe on the second body across which the at least one gate traverses, with a working fluid inlet and a working fluid outlet provided on respective circumferentially opposite sides of the at least one lobe wherein working fluid is able to enter and exit the working fluid space through the inlet and out respectively.

22. The rotary fluid machine according to claim 1 comprising a manifold located between the working fluid intake and the working fluid exhaust, the manifold configured to divert an axial flow of fluid entering from the working fluid intake to flow in a radial outward direction into the working fluid space, and subsequently divert working fluid in the working fluid space in a radial inward direction to exit from working fluid exhaust in the axial direction.

23. A method of operating a rotary fluid machine having first and second bodies, the bodies being rotatable relative to each other about an axis of rotation, the axis of rotation forming an axial direction of the machine, the bodies being arranged one inside the other to define a working fluid space there between, a working fluid intake and a working fluid exhaust forming an axial flow path being co-axial with the axial direction and enabling working fluid to flow into and out of the machine in an axial direction wherein the working fluid space is in fluid communication with the intake and the exhaust, and at least one gate, the at least one gate being carried by or otherwise coupled with the first body and movable with respect to the bodies, the method comprising magnetically controlling motion of the gates for at least one portion of a cycle of the rotation of one of the bodies relative to the other.

24. The method according to claim 23 wherein magnetically controlling motion of the gates comprises magnetically biasing the gates to move toward the second body for a plurality of first portions of the cycle of rotation.

25. The method according to claim 24 wherein magnetically controlling motion of the gates comprises magnetically biasing the gates to retract into the first body for a plurality of second portions of the cycle of rotation, wherein the second portion are interleaved with the first portions.

26. The method according to claim 23 wherein magnetically controlling motion of the gates comprises one of: (a) providing one or magnets in or on the second body to produce a magnetic field capable of inducing the motion of gates; (b) providing one or magnets in or on the first body to produce a magnetic field capable of inducing the motion of gates; (c) providing one or magnets in or on the gates to produce a magnetic field capable of inducing the motion of gates; or, (d) forming the gates of a ferromagnetic material.

27. The method according to claim 26 comprising, when a plurality of magnets is provided, arranging the magnets in a Halbach array.

28. The method according to claim 23 comprising magnetically levitating the gates.