CLAIMS

1. A separation seal for preventing fluid from entering a dry gas seal surrounding a shaft of a rotating machine, the separation seal comprising:

a stator configured to be mounted around the shaft and configured to be fixedly attached to the rotating machine, the stator including primary ring control chamber formed therein;

a porous primary ring formed of a porous material and having a back;

a first thrust ring at least partially within the primary ring control chamber and coupled to the porous primary ring;

a mating ring coupled to the shaft that rotates with the shaft and relative to the porous primary ring; and

one or more biasing members that urge the porous primary ring toward the mating ring to form a seal interface between porous primary ring and the mating ring;

wherein the stator includes a passageway constructed and arranged to convey pressurized buffer gas at a gas pressure in normal operation to the primary ring control chamber such that the pressurized buffer gas passes from the back of the porous primary ring, through the porous primary ring and to the seal interface;

wherein buffer gas that reaches the seal interface passes, in normal operation, both radially inward and radially outward along the seal interface;

wherein the mating ring includes grooves formed on a face thereof, wherein in the event of a buffer gas delivery pressure reduction, the grooves pump gas from an inner diameter of the seal interface to an outer diameter of the seal interface.

2. The separation seal of claim 1, wherein the porous primary ring is formed of porous carbon.

3. The separation seal of claim 1, further comprising:

one or more sealing elements disposed between the first thrust ring and the back of the porous primary ring and within the primary ring control chamber, wherein the sealing elements are spaced apart from the back of the porous primary ring by a separating member.

4. The separation seal of claim 3, wherein the separating member is a ring.

5. The separation seal of claim 4, wherein the separating member is a second thrust ring.

6. The separation seal of claim 5, further comprising:

one or more secondary sealing elements disposed between the second thrust ring and the back of the porous primary ring, wherein the one or more secondary sealing elements are not in the primary ring control chamber and do not contact a side of the primary ring control chamber.

7. The separation seal of claim 1, wherein the back of the porous primary ring includes one or move grooves formed therein to receive one or more sealing elements.

8. The separation seal of claim 3, wherein the one or more sealing elements include a first sealing element and a second sealing element and wherein the first and second sealing elements are 0-rings having different cross-sectional diameters.

9. A separation seal for preventing fluid from entering a dry gas seal surrounding a shaft of a rotating machine, the separation seal comprising:

a stator configured to be mounted around the shaft and configured to be fixedly attached to the rotating machine, the stator including a primary ring control chamber formed therein;

a primary ring having a back;

a first thrust ring at least partially within the primary ring control chamber and coupled to the primary ring;

a mating ring coupled to the shaft that rotates with the shaft and relative to the primary ring; and

one or more biasing members that urge the primary ring toward the mating ring to form a seal interface between primary ring and the mating ring;

wherein the stator includes a passageway constructed and arranged to convey pressurized buffer gas at a gas pressure in normal operation to the primary ring control chamber;

wherein the primary ring is configured such that the pressurized buffer gas in the primary ring control chamber passes from the back of the primary ring, through the primary ring and to the seal interface;

wherein buffer gas that reaches the seal interface passes, in normal operation, both radially inward and radially outward along the seal interface;

wherein the mating ring includes grooves formed on a face thereof, wherein in the event of a buffer gas delivery pressure reduction, the grooves pump gas from an inner diameter of the seal interface to an outer diameter of the seal interface.

10. The separation seal of claim 9, further comprising:

one or more sealing elements disposed between the first thrust ring and the back of the primary ring and within the primary ring control chamber, wherein the sealing elements are spaced apart from the back of the primary ring by a separating member.

11. The separation seal of claim 10, wherein the separating member is a ring.

12. The separation seal of claim 11, wherein the separating member is a second thrust ring.

13. The separation seal of claim 12, further comprising:

one or more secondary sealing elements disposed between the second thrust ring and the back of the primary ring, wherein the one or more secondary sealing elements are not in the primary ring control chamber and do not contact a side of the primary ring control chamber.

14. The separation seal of claim 10, wherein the back of the primary ring includes one or move grooves formed therein to receive the one or more sealing elements.

15. The separation seal of claim 10, wherein the one or more sealing elements include a first sealing element and a second sealing element and wherein the first and second sealing elements are 0-rings having different cross-sectional diameters.