CLAIMS

1. A downhole permanent magnet electric generator comprising:

a rotor rotatable about a rotational axis, the rotor having a generally planar shape extending in a radial direction generally perpendicular to the rotational axis a distance defining a rotor radius;

one or more permanent magnets attached to the rotor for generating a magnetic field;

a stator having a generally planar shape extending in a radial direction generally perpendicular to the rotational axis a distance defining a stator radius;

a shaft connected to the rotor and rotatable about the rotational axis, the shaft attached to the rotor wherein both the rotor and shaft are rotatable about the rotational axis, the rotational shaft extending through the stator though not attached thereto; and

a linear distance along the shaft between the rotor and stator that defines a gap;

wherein the gap is variable and resistant to debris buildup, the gap configured to increase or decrease in a direction generally parallel with the rotational axis.

2. The generator of claim 1 further comprising at least one spring supporting the shaft, wherein the shaft and rotor are translatable along the rotational axis in relation to the stator, thus providing the variable gap.

3. The generator of claim 1 wherein the magnetic field will change as the rotor turns therefore the attraction between the rotor and stator will also change, thus providing the variable gap.

4. The generator of claim 1 further comprising blades projecting radially from the rotor, the blades positioned so that fluid flow across the blades will bias the rotor towards the stator, thus providing the variable gap.

5. The generator of claim 4 wherein the gap increases as fluid flow decreases, thus enabling debris to be washed from the gap.

6. The generator of claim 4 wherein during a startup, fluid flow is low, the gap is at its maximum, and interaction between the rotor and stator is at a minimum, thus it is easier to start the rotor spinning.

7. The generator of claim 1 further comprising a bearing supporting the shaft and two rotors positioned on opposing sides of the stator, the double rotor arrangement balancing the attractions of the rotors to the stator and reducing forces on the bearing.

8. The generator of claim 1 further comprising a bearing supporting the shaft and two stators positioned on opposing sides of the rotor, the double stator arrangement balancing the attractions of the rotor to the stators and reducing forces on the bearing.

9. The generator of claim 4 wherein a combination of the rotor, stator and any blades has a maximum diameter of 3 inches.

10. A downhole power generation system comprising:

a fluid flow;

an electrical generator driven by the fluid flow;

the electrical generator comprising:

a rotor rotatable about a rotational axis, a stator, a shaft connected to the rotor and rotatable about the rotational axis extending through the stator, a linear distance along the shaft between the rotor and stator that defines a gap, wherein the gap is variable, the gap configured to increase or decrease in a direction generally parallel with the rotational axis;

wherein the fluid flow rotates the rotor within the electrical generator and generates electrical power.

11. The downhole power generation system of claim 10 wherein the fluid flow that rotates the rotor within the electrical generator is fluid circulated through a tubular string disposed within a wellbore.

12. The downhole power generation system of claim 10 wherein the fluid flow that rotates the rotor within the electrical generator is fluid produced from a subterranean formation.

13. The downhole power generation system of claim 10 wherein the fluid flow that rotates the rotor within the electrical generator is fluid flow from a pump, the pump driven by a rotating tubular within a wellbore.

14. The downhole power generation system of claim 10 further comprising at least one spring supporting the shaft, wherein the shaft and rotor are movable in relation to the stator, thus providing the variable gap.

15. The downhole power generation system of claim 10 wherein the magnetic field will change as the rotor turns therefore the attraction between the rotor and stator will also change, thus providing the variable gap.

16. The downhole power generation system of claim 10 further comprising blades projecting radially from the rotor, the blades positioned so that fluid flow across the blades will bias the rotor towards the stator, thus providing the variable gap.

17. The downhole power generation system of claim 16 wherein the gap increases as fluid flow decreases, thus enabling debris to be washed from the gap.

18. The downhole power generation system of claim 16 wherein during a startup, fluid flow is low, the gap is at its maximum, and interaction between the rotor and stator is at a minimum, thus it is easier to start the rotor spinning.

19. The downhole power generation system of claim 14 further comprising a bearing supporting the shaft and two rotors positioned on opposing sides of the stator, the double rotor arrangement balancing the attractions of the rotors to the stator and reducing forces on the bearing.

20. The downhole power generation system of claim 14 further comprising a bearing supporting the shaft and two stators positioned on opposing sides of the rotor, the double stator arrangement balancing the attractions of the rotor to the stators and reducing forces on the bearing.