

CLAIMS

We claim:

Claim 1. A system for providing electrical power in a wellbore comprising:

5 a drill string disposed within the wellbore comprising an outer surface defining an annular space between the drill string and the wellbore; and

a power generator sub disposed in a cavity on the outer surface of the drill string, the generator sub comprising:

10 a thermoelectric generator; and

a thermal insulator disposed adjacent to and radially inward from the thermoelectric generator,

wherein the power generator sub is in contact with a drilling fluid flowing through the annular space.

15 Claim 2. The system of claim 1, the power generator sub further comprising a hot side disposed on a side in contact with the drilling fluid and a cold side on the opposing side.

Claim 3. The system of claim 1, further comprising a plurality of power generator subs disposed on the outer surface of the drill string.

20 Claim 4. The system of claim 3, wherein the plurality of power generator subs are coupled in parallel.

Claim 5. The system of claim 3, wherein the plurality of power generator subs are coupled in series.

Claim 6. The system of claim 1, further comprising a power conditioning unit.

Claim 7. The system of claim 1, wherein the power generator sub is disposed proximate a wear band disposed on the drill string.

5 Claim 8. The system of claim 1, the power generator sub further comprising a thermal conductor disposed adjacent to and radially outward from the thermoelectric generator.

10 Claim 9. The system of claim 8, wherein a voltage potential is generated across the thermoelectric generator by way of a thermal path across the thermoelectric generator.

Claim 10. The system of claim 9, further comprising a downhole tool, the downhole tool comprising electronics and sensors configured to be powered at least in part by the voltage potential.

15 Claim 11. The system of claim 9, further comprising a capacitor, the capacitor configured to be charged at least in part by the voltage potential.

Claim 12. The system of claim 1, the thermoelectric power generator further comprising two materials comprising different Seebeck coefficients.

20 Claim 13. The system of claim 12, wherein a voltage potential is generated across the two materials by way of a thermal path created across the two materials.

25 Claim 14. The system of claim 13, further comprising a downhole tool, the downhole tool comprising electronics and sensors configured to be powered at least in part by the voltage potential.

Claim 15. The system of claim 13, further comprising a capacitor, the capacitor configured to be charged at least in part by the voltage potential.

5 Claim 16. A power generator sub apparatus disposed in a cavity on an outer surface of a drill string comprising:

a thermoelectric generator; and

a thermal insulator disposed adjacent to and radially inward from the thermoelectric generator,

10 wherein the power generator sub is in contact with a drilling fluid flowing through an annular space.

Claim 17. The apparatus of claim 16, the power generator further comprising a hot side disposed on a side in contact with the drilling fluid and a cold side on the opposing side.

15 Claim 18. The apparatus of claim 16, further comprising a plurality of power generators disposed on the outer surface of the drill string.

Claim 19. The apparatus of claim 18, wherein the plurality of power generators are coupled in parallel.

Claim 20. The apparatus of claim 18, wherein the plurality of power generators are coupled in series.

20 Claim 21. The apparatus of claim 16, further comprising a power conditioning unit.

Claim 22. The apparatus of claim 16, wherein the power generator is disposed proximate a wear band disposed on the drill string.

Claim 23. The apparatus of claim 16, the power generator sub further comprising a thermal conductor disposed adjacent to and radially outward from the thermoelectric generator.

5 Claim 24. The apparatus of claim 23, wherein a voltage potential is generated across the thermoelectric generator by way of a thermal path across the thermoelectric generator.

Claim 25. The apparatus of claim 24, further comprising a downhole tool, the downhole tool comprising electronics and sensors configured to be powered at least in part by the voltage potential.

10 Claim 26. The apparatus of claim 24, further comprising a capacitor, the capacitor configured to be charged at least in part by the voltage potential.

15 Claim 27. The apparatus of claim 16, the thermoelectric generator further comprising two materials comprising different Seebeck coefficients.

Claim 28. The apparatus of claim 27, wherein a voltage potential is generated across the two materials by way of a thermal path created across the two materials.

20 Claim 29. The apparatus of claim 28, further comprising a downhole tool, the downhole tool comprising electronics and sensors configured to be powered at least in part by the voltage potential.

Claim 30. The apparatus of claim 28, further comprising a capacitor, the capacitor configured to be charged at least in part by the voltage potential.

Claim 31. A method for providing electrical power in a wellbore comprising:

providing a thermoelectric power generator on the outer surface of a drill string, the power generator being in contact with drilling fluid flowing through an annular space outside the drill string;
and

converting thermal energy of the drilling fluid into electrical power using Seebeck effect to create a voltage potential across the power generator.