

1   Claims

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- 3   1. A heat engine comprising:
- 4       a housing;
- 5       a first liquid and a second liquid located within the housing, the first liquid having a
- 6       higher density and lower boiling point than the second liquid;
- 7       a heat exchanger to transfer heat to the first liquid to evaporate the first liquid to form a
- 8       first liquid vapour; and
- 9       at least one fluid flow member to move in response to a fluid flow created by the
- 10      interaction of the first liquid vapour and the second liquid.
- 11
- 12   2. A heat engine as claimed in claim 1 wherein, the housing is sealable; and or the heat
- 13      engine is a closed heat engine.
- 14
- 15   3. A heat engine as claimed in either of claims 1 or 2 wherein, the first and second liquids
- 16      occupy an interior volume of the housing.
- 17
- 18   4. A heat engine as claimed in any of the preceding claims wherein, the first liquid is
- 19      located within a first portion of the housing and the second liquid is located within a
- 20      second portion of the housing.
- 21
- 22   5. A heat engine as claimed in any of the preceding claims wherein, the first liquid is de-
- 23      mineralised water and the second liquid is Xylene; and or an operating temperate
- 24      range of the heat engine is between 110 to 150 °C.
- 25
- 26   6. A heat engine as claimed in any of the preceding claims wherein, the heat exchanger
- 27      transfers heat from an external high temperature heat source to the first liquid.
- 28
- 29   7. A heat engine as claimed in any of the preceding claims wherein, the heat exchanger
- 30      is the first portion of the housing and or a pipe.
- 31
- 32   8. A heat engine as claimed in any of the preceding claims wherein, the heat engine
- 33      further comprises one or more pellets, located within the interior volume of the heat
- 34      engine, suspended within the first liquid and or second liquid, wherein the density of
- 35      the one or more pellets is between the density of the first liquid and second liquid.

- 1
- 2 9. A heat engine as claimed in claim 8 wherein, the one or more pellets are magnetic.
- 3
- 4 10. A heat engine as claimed in any of the preceding claims wherein, the at least one fluid
- 5 flow member is one or more rods.
- 6
- 7 11. A heat engine as claimed in claim 10 wherein, one or more rods comprise a first end
- 8 and a second end, wherein each first end of the one or more rods is mounted to an
- 9 interior surface of the housing and each second end of the one or more rods is free to
- 10 move.
- 11
- 12 12. A heat engine as claimed in claim 11 wherein, the one or more rods are uniformly
- 13 distributed about the interior surface; and or the one or more rods are orientated
- 14 perpendicular to the interior surface; and or the one or more rods are uniformly
- 15 dimensioned; and or the one or more rods comprise the same material composition.
- 16
- 17 13. A heat engine as claimed in any of claims 1 to 9 wherein, the at least one fluid flow
- 18 member is one or more plates, wherein one or more plates comprise one or more
- 19 perforations.
- 20
- 21 14. A heat engine as claimed in any of claims 1 to 9 wherein, the at least one fluid flow
- 22 member is one or more diaphragms, wherein the one or more diaphragms comprise
- 23 one or more perforations.
- 24
- 25 15. A heat engine as claimed in claim 9 wherein, the at least one fluid flow member is one
- 26 or more pellets.
- 27
- 28 16. A heat engine as claimed in any of the preceding claims wherein, the heat engine
- 29 further comprises a condensing loop, wherein the condensing loop transfers heat to an
- 30 external low temperature heat sink or source from the first liquid vapour.
- 31
- 32 17. A heat engine as claimed in any of the preceding claims wherein, the heat engine
- 33 further comprises a sink, wherein the sink comprises the first liquid.
- 34

- 1 18. An energy harvesting system comprising a heat engine as claimed in any of claims 1 to  
2 17, an energy conversion means and an external high temperature heat source.  
3
- 4 19. An energy harvesting system as claimed in claim 18 wherein, the energy harvesting  
5 system further comprises an external low temperature heat sink or source.  
6
- 7 20. An energy harvesting system as claimed in either of claims 18 or 19 wherein, the  
8 energy harvesting system may further comprise a vibrational lens.  
9
- 10 21. An energy harvesting system as claimed in claim 20 wherein, the vibrational lens  
11 comprises at least two focusing members, each of the at least two focusing members  
12 having a first end for attachment to a source of vibration and a second end, wherein  
13 the at least two focusing members are arranged such that the separation between the  
14 focusing members decreases from the first ends towards the second ends.  
15
- 16 22. An energy harvesting system as claimed in claim 21 wherein, the at least two focusing  
17 members are focusing plates and or focusing rods.  
18
- 19 23. An energy harvesting system as claimed in either of claims 21 or 22 wherein, the first  
20 end of the vibrational lens is fixed to the heat engine and the energy conversion means  
21 is located at the second end of the vibrational lens, between third portions of the at  
22 least two focusing members.  
23
- 24 24. An energy harvesting system as claimed in any of claims 18 to 23 wherein, the energy  
25 conversion means is one or more piezoelectric crystals; and or one or more coils.  
26
- 27 25. A method of manufacturing a heat engine comprising,  
28 - providing a housing,  
29 - providing a first liquid and a second liquid located within the housing, the first  
30 liquid having a higher density and lower boiling point than the second liquid;  
31 - providing a heat exchanger to evaporate the first liquid to form a first liquid  
32 vapour; and  
33 - providing at least one fluid flow member that moves in response to a fluid flow  
34 created by the interaction of the first liquid vapour and the second liquid.  
35

1 26. A method of manufacturing a heat engine as claimed in claim 25 wherein, the method  
2 of manufacturing a heat engine further comprises determining the characteristics of an  
3 external high temperature heat source.  
4

5 27. A method of manufacturing a heat engine as claimed in either of claims 25 or 26  
6 wherein, the method of manufacturing a heat engine further comprises determining  
7 optimum parameters of a heat engine for use with the external high temperature heat  
8 source.  
9

10 28. A method of manufacturing an energy harvesting system comprising,  
11 - providing a heat engine according to the method of any of claims 25 to 27;  
12 - providing an external high temperature heat source; and  
13 - providing an energy conversion means.  
14

15 29. A method of manufacturing an energy harvesting system as claimed in claim 28  
16 wherein, the method of manufacturing an energy harvesting system may comprise  
17 providing a vibrational lens.  
18

19 30. A method of manufacturing an energy harvesting system as claimed in claim 29  
20 wherein, wherein providing a vibrational lens comprises,  
21 - providing at least two focusing members, each having a first end and a second  
22 end; and  
23 - arranging the at least two focusing members such that the separation between the  
24 at least two focusing members decreases from the first ends towards the second  
25 ends.  
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