

CLAIMS

1. Apparatus for harvesting energy from fluids, said apparatus comprising;
a rotor; and
a support structure supporting said rotor to rotate about a generally horizontal rotational axis in a rotation direction, said support structure being configured such that said rotational axis is selectively above and below a boundary between two fluids of different density;
said rotor defining at least a first cavity at a first radial orientation relative to the rotational axis and a second cavity at a second radial orientation relative to the rotational axis, each of said first cavity and said second cavity being spaced from the rotational axis, and said first radial orientation being spaced from said second radial orientation in the rotation direction;
wherein said rotor defines a first trailing aperture extending from the first cavity in a direction opposite to the rotation direction, to an outside of the rotor, and a second trailing aperture extending from the second cavity in a direction opposite to the rotation direction, to the outside of the rotor.
2. Apparatus according to claim 1, wherein the two fluids are water and air, the boundary between said fluids is a water surface, and the rotational axis is selectively above and below said water surface.
3. Apparatus according to claim 2, wherein the water surface is subject to wave action and the rotational axis is at an elevation that causes it to be selectively above and below the water surface as a result of said wave action.
4. Apparatus according to claim 2 or claim 3, wherein the elevation of the water surface changes due to tidal action and the rotational axis is at an elevation that causes it to be selectively above and below the water surface as a result of said tidal action.

5. Apparatus according to any one of the preceding claims, wherein the first radial orientation and the second radial orientation are diametrically opposed about the rotational axis.
6. Apparatus according to any one of the preceding claims, wherein the rotor defines more than two of said cavities and said cavities being at different radial orientations in the rotation direction, about the rotational axis.
7. Apparatus according to any one of the preceding claims, wherein the rotor includes a plurality of hollow elements and each of said cavities is defined inside one of said hollow elements.
8. Apparatus according to claim 7, wherein a plurality of said hollow elements are arranged within the rotor, to form vanes.
9. Apparatus according to claim 7 or claim 8, wherein each of said hollow elements has a wall surrounding the cavity defined within said hollow element, at least in part, and the trailing aperture of said cavity being defined within said wall.
10. Apparatus according to any one of the preceding claims, which includes valves that are configured to open and close the first and second trailing apertures, selectively.
11. Apparatus according to any one of the preceding claims, wherein said rotor defines a first leading aperture extending from the first cavity in the rotation direction, to the outside of the rotor, and a second leading aperture extending from the second cavity in the rotation direction, to the outside of the rotor.
12. Apparatus according to claim 11, which includes valves that are configured to open and close the first and second leading apertures, selectively.

13. A method of harvesting energy from fluids, said method comprising:
- providing the apparatus according to any one of claims 1 to 10;
 - supporting the rotor with its rotational axis sequentially above and below the boundary between the two fluids of different density, said rotor being in a submerged position when its rotational axis is below said boundary and in an elevated position when its rotational axis is above said boundary;
 - while the rotor is in the submerged position:
 - positioning the rotor with the first cavity and the second cavity below said boundary and with the first trailing aperture directed upwards and the second trailing aperture directed downwards;
 - holding the lower density fluid captive inside the second cavity and thereby maintaining a buoyant force exerted by said lower density fluid in the second cavity;
 - allowing the lower density fluid to escape from the first cavity and the higher density fluid to enter the first cavity, via the first trailing aperture, thereby increasing the overall density of contents inside the first cavity and reducing a buoyant force exerted by the contents of the first cavity;
 - exerting a moment on the rotor in the rotation direction, by virtue of the maintained buoyant force exerted by the lower density fluid in the second cavity and the reduced buoyant force exerted by the contents of the first cavity; and
 - while the rotor is in the elevated position:
 - positioning the rotor with the first cavity and the second cavity above said boundary and with the first trailing aperture directed upwards and the second trailing aperture directed downwards;
 - holding the higher density fluid captive inside the first cavity and thereby maintaining a gravitational force exerted by said higher density fluid in the first cavity;
 - allowing the higher density fluid to escape from the second cavity and

the lower density fluid to enter the second cavity, via the second trailing aperture, thereby reducing the overall density of contents inside the second cavity and reducing a gravitational force exerted by the contents of the second cavity;

exerting a moment on the rotor in the rotation direction, by virtue of the maintained gravitational force exerted by the higher density fluid in the first cavity and the reduced gravitational force exerted by the contents of the second cavity.

14. A method according to claim 13, which includes exposing said rotor to a fluid flow which impinges on the rotor, said impinging fluid flow exerting a force on the rotor in an impingement direction that causes a moment on the rotor in the rotation direction.
15. A method according to claim 14, which includes directing said fluid flow to impinge on the rotor in said impingement direction.
16. A method according to claim 14 or claim 15, in which the impinging fluid flow is a flow of the low density fluid and said impinging fluid flow impinges the rotor above the rotational axis.
17. A method according to claim 16, wherein the low density fluid is air and the impinging fluid flow is wind.
18. A method according to claim 14 or claim 15, in which the impinging fluid flow is a flow of the high density fluid and said impinging fluid flow impinges the rotor below the rotational axis.
19. A method according to claim 18, wherein the high density fluid is water and the impinging fluid flow is water moving by wave action.

20. A method according to claim 18, wherein the high density fluid is water and the impinging fluid flow is water moving in a tidal flow.
21. A method according to claim 18, wherein the high density fluid is water and the impinging fluid flow is water flowing under gravity.
22. A method according to any one of claims 13 to 21, wherein said rotor defines a first leading aperture extending from the first cavity in the rotation direction, to the outside of the rotor, and a second leading aperture extending from the second cavity in the rotation direction, to the outside of the rotor, and the rotor includes valves that are configured to open and close the first and second leading apertures, selectively, said method including:
 - selectively opening the first leading aperture while the rotor is in the submerged position; and
 - selectively opening the second leading aperture while the rotor is in the elevated position.
23. A method according to any one of claims 13 to 21, wherein said rotor defines a first leading aperture extending from the first cavity in the rotation direction, to the outside of the rotor, and a second leading aperture extending from the second cavity in the rotation direction, to the outside of the rotor, and the rotor includes valves that are configured to open and close the first and second leading apertures and the first and second trailing apertures, selectively, said method including opening the leading apertures and closing the trailing apertures, selectively, to invert the rotation direction.