CLAIMS

1. Apparatus for extracting energy from an oscillating working fluid, the apparatus comprising: a flow passage for the oscillating working fluid, a turbine and a flow control device, each of the turbine and the flow control device being in respective, direct fluid communication with the flow passage and with the atmosphere outside of the apparatus, wherein in use the flow control device is selectively moveable between a first configuration in which the flow control device is open to allow the oscillating working fluid to exit the flow passage by flowing through the flow control device and bypassing the turbine, rather than for any significant quantity of oscillating working fluid to leave the flow passage via the turbine, and a second configuration in which the flow control device restricts a flow of the oscillating working fluid from flowing through the flow control device, such that a flow of the oscillating working fluid enters the flow passage via the turbine, the turbine being configured to operate separately and sequentially to the flow control device as the flow control device moves between said first and second configurations.

2. The apparatus as claimed in claim 1, wherein the flow control device changes the configuration of access to the flow passage in response to changes in the pressure and/or direction of flow of the oscillating working fluid.

3. The apparatus as claimed in claim 1, wherein the flow control device is fully closable so as to facilitate the flow of the oscillating working fluid solely via the turbine in the second configuration.

4. The apparatus as claimed in Claim 1, wherein the flow control device has an element which is moveable to become open and closed to the flow of oscillating working fluid, and is of a shape which covers a cross-sectional opening passage of the fluid control device.

5. The apparatus as claimed in claim 1, wherein the turbine includes a rotor comprising a central hub and a plurality of blades arranged about and extending from the periphery of the hub, the rotor disposed within a rotor housing connected to the flow passage,

whereby the shape of the blades and the orientation of the blades in relation to the hub facilitates unidirectional rotation of the turbine rotor in response to a unidirectional axial flow of oscillating working fluid through the rotor housing.

6. The apparatus as claimed in claim 1, wherein the oscillating working fluid is air, and the flow of the air is generated by oscillations of an oscillating water column which is in fluid communication with the flow passage, wherein the flow passage is located in a housing.

7. The apparatus as claimed in claim 6, wherein the housing is configured in use to be located adjacent a body of water, with the flow passage arranged to be responsive to incoming and outgoing waves from said body of water which establish the oscillating water column therein, so that a unidirectional axial flow of the oscillating working fluid acting on the turbine rotor is associated with suction created by the fall of a passing wave causing the oscillating water column to flow out of the housing.

8. The apparatus as claimed in Claim 7, wherein the housing comprises: a. a first portion arranged in use to be substantially submerged below a mean surface level (MSL) of the body of water in which the housing is located, the first portion having an opening arranged for receiving the incoming wave from the body of water, and b. a second portion which depends from the first portion and which is arranged in use to extend above the MSL, the second portion for receiving water from the incoming wave after the wave flows through the first portion, wherein the flow passage is defined by a region of the second portion which extends above a maximum level of water received from the incoming wave after it the wave flows through the first portion.

9. The apparatus as claimed in claim 8, wherein a cross-sectional area at the opening of the first portion is of a greater cross-sectional area than the remainder of the first portion, the flow passage tapering down in cross-sectional area when moving in a direction from an outer entry mouth region at the opening toward the second portion, so as to accelerate the flow of incoming waves from the body of water.

10. A wave energy extraction system, the system including: a. at least one flow passage for receiving an oscillating water column, the flow passage comprising: i. a first portion arranged in use to be substantially submerged below a mean surface level (MSL) of a body of water in which the flow passage is located, the first portion having an opening arranged for receiving an incoming wave from the body of water, and ii. a second portion which depends from the first portion and which is arranged in use to extend above the MSL, the second portion for receiving water from the incoming wave after it the wave flows through the first portion, such that in use the oscillating water column is established within the flow passage as a result of repeated movement of water into and out of the flow passage, the flow of water out of the flow passage also being via the opening, but in a direction opposite to the direction of the incoming wave; b. a rotatable air turbine which is in direct fluid communication with the second portion of the flow passage; and c. at least one flow control device which is also in direct fluid communication with said flow passage, the flow control device being arranged in use to move between a first configuration in which the device is open, allowing a flow of displaced air to exit the flow passage and bypass the rotatable air turbine, rather than for any significant quantity of air to leave the flow passage by flowing via the rotatable air turbine when the oscillating water column is received into the second portion of the flow passage, and then to a second configuration in which the device restricts air flowing into the second portion, whereupon, as the oscillating water column flows out of the flow passage in the said opposite direction, a flow of air is drawn back into the flow passage via the rotatable air turbine; wherein in use, the rotatable air turbine is configured to operate separately and sequentially to the flow control device as the flow control device moves between said first and second configurations.

11. The system as claimed in Claim 10, wherein the flow control device changes the configuration of access to the second portion in response to changes in the pressure and/or direction of flow of the oscillating working fluid.

12. The system as claimed in Claim 10, wherein the rotatable air turbine includes a rotor comprising a central hub and a plurality of blades arranged about and extending from the periphery of the central hub, the rotor disposed within a rotor housing connected to the second portion, whereby the shape of the blades and the orientation of the blades in

relation to the central hub facilitates unidirectional rotation of the turbine rotor in response to a unidirectional axial air flow through the rotor housing and into the second portion of the flow passage.

13. The system as claimed in Claim 10, wherein the cross-sectional area of the flow control device(s) as a proportion of the surface area of the second portion which extends above the MSL, is arranged to be less than 15 percent.

14. Apparatus for extracting energy from an oscillating working fluid, the apparatus including: a housing having an interior region which defines a flow passage at its interior for receiving the oscillating working fluid; an energy conversion unit disposed at the housing, in fluid communication with the oscillating working fluid in the flow passage when in use; and a flow control device which is in fluid communication with the flow passage, wherein in use, the flow control device and the energy conversion unit are configured to operate separately and sequentially for selectively changing the configuration of the flow passage between: an active configuration in which a flow of the oscillating working fluid acts on the energy conversion unit as the oscillating working fluid enters the flow passage via the energy conversion unit, and a bypass configuration in which, rather than for any significant quantity of the oscillating working fluid leaving the flow passage by flowing via the energy conversion unit, the oscillating working fluid bypasses the energy conversion unit and exits the flow passage by flowing via the flow control device.

15. A method of extracting energy from an oscillating working fluid, the method including the steps of: (i) positioning a housing at least partially in a body of water having waves, an interior of the housing defining a flow passage for receiving the oscillating working fluid; (ii) arranging an energy conversion unit to be in fluid communication with the flow passage and the oscillating working fluid; and (iii) providing a flow control device which is in fluid communication with the flow passage, wherein, in use, the flow control device and the energy conversion unit are configured to operate separately and sequentially, the flow control device for selectively changing the configuration of the flow passage between: an active configuration such that a flow of the oscillating working fluid enters the flow passage

in a first direction via the energy conversion unit to cause the energy conversion unit to move, and a bypass configuration in which, rather than any significant quantity of the oscillating working fluid leaving the flow passage via the energy conversion unit, the oscillating working fluid bypasses the energy conversion unit and exits the flow passage by flowing in another direction, via the flow control device.