



## Wave powered airlift pump

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The invention (patent pending) relates to the field of devices aimed to harness wave energy (WEC) especially for artificial upwelling, forced downwelling, production of compressed air.

In its basic form, the pump consists of a hydro-pneumatic machine, driven by wave energy, characterised by the fact that it has no moving mechanical parts, and is made up of only two structural components: an hollow body, which is open at the bottom to the sea and partially immersed in sea water, and a tube, both joined together to form a single body.

The shape of the hollow body is like a mushroom whose cap and stem are hollow; the stem is open at both ends and the lower section of its surface is crossed by holes; the tube is external and coaxial to the stem and is joined to it so as to form a single body.

This shape of the hollow body and the type of connection to the tube allows the pump to operate simultaneously as an air compressor (OWC) on the cap side, and as an airlift on the stem side.

The pump can be implemented in four versions, each of which provides different variants and methods of implementation:

1. firstly, for the artificial upwelling of cold, deep ocean water;
2. secondly, for the lifting and transfer of these waters to the place of use (above all, fish farming plants), even if kilometres away;
3. thirdly, for the forced downwelling of surface sea water;
4. fourthly, for the forced downwelling of surface water, its oxygenation, and the simultaneous production of compressed air.

The transfer of the deep water or the downwelling of the raised surface water (as for pump versions indicated in points 2 and 3 above), is obtained by making the water raised by the airlift flow into the upper inlet of another pipe, internal or adjoined to the airlift; the downwelling of raised surface water, oxygenation, and the simultaneous production of compressed air (as for the pump version indicated in point 4), is obtained by installing a venturi tube on the upper end of the pipe, whose restricted section is connected to the external atmosphere, so that it also operates like a hydraulic air compressor (trompe).

Furthermore, by combining one or more pumps for the upwelling of cold, deep water, with one or more pumps for the downwelling of the warm surface water, the system can be used in an OTEC plant to supply the cold and the warm water required for the operation of the same, thus allowing to use, without increased costs, in addition to the mechanical energy of the waves, for the purposes indicated in points 1 to 4, the thermal one of the marine water treated in the process.