

DOUBLE EFFECT SOLAR STILL PATENT

The patent is about a floating double effect solar basin device, simple in construction and made with low cost plastic materials. It is designed for application in calm and shallow brackish waters, as in salt works that cover tens of thousands of hectares in the Mediterranean costs and around the world. The apparatus recycles the heat of condensation and it is not effected by rough waves and wind gusts. Such a device of ca. 10 square meters is the module to run parallel with many hundred similar modules connected together in an open outdoor installation able to produce thousand of cubic meters of distilled water per day, coupled with salt production at an efficiency around 60%.

As shown in the attached figures, the double effect solar still module is made by a floating hemispherical transparent plastic cupola that covers a salt water basin exposed to sun rays and anchored to the basin bottom. The air/water vapour space above water is atmosphere gas tight. Evaporation takes place as effect of irradiation and production is partly due to condensation of water in the inner side of glazing and partly as effect of gas circulation inside an array of tubes immersed in the cooler water below the surface. Circulation of water vapour/air inside the cupola space along the heat exchanger tubes and back to the cupola, is forced via a draft fan in a closed loop. Fan sucks in dry air from heat exchanger tubes and pumps it inside the cupola in order to let it carry a substantial amount of water evaporated from the liquid surface. Saturated air is then forced through the tubes where extra condensation takes place via heat transfer between tubes and the inner and cooler salt water layers.

The whole system as it was built as a prototype to test is shown in the pictures of Figure 1, 2, 3 and 4.



Figure 1



Figure 2



Figure 3

The experimental module basin 0.5 m deep is insulated from the bottom and sides, as it should be in a salt work, because a single unit is circled by other modules in every direction. Brackish water is heated by solar heat and then evaporates. In order to transform the basin in a thin like water layer with low heat inertia, over the water surface is floating a polystyrol insulation made of small rectangular plates. The insulation plates are completely covered by a black cotton textile, wet and exposed to sun rays. The cotton tissue is wet by capillarity. In this fashion the water basin is stratified in at least three layers at different temperatures. Going from top to bottom: a) the water layer over the top of insulation, the wet black tissue, that rapidly reaches an equilibrium temperature that is function of solar heat flux only; b) below the insulation a second layer performs as cooling media for the heat exchanger tubes, recovers the condensation heat and makes it useful to the upper water layer, sucked by capillarity in the black tissue; c) a deeper layer stays steady almost all day no matter how high are the fluctuations of solar radiation and it works as added insulation to heat loss from the bottom.

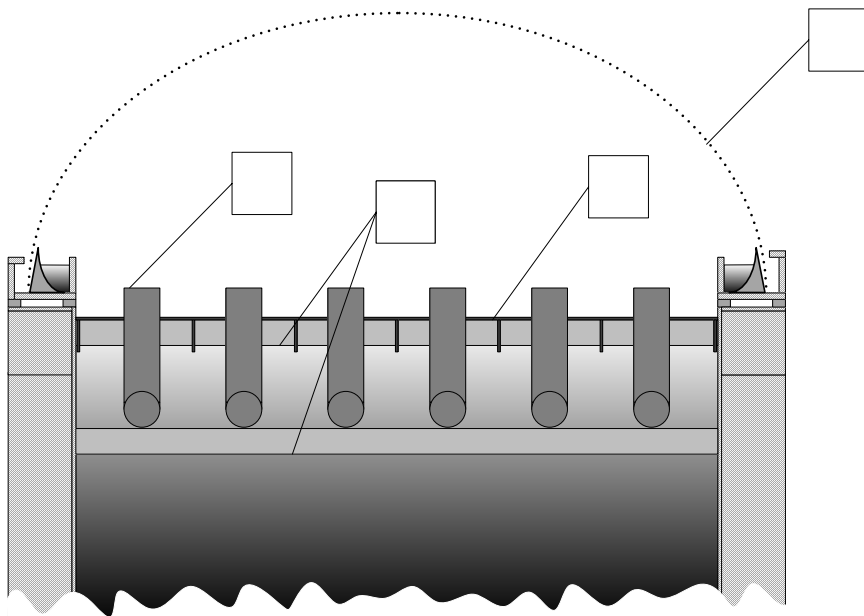
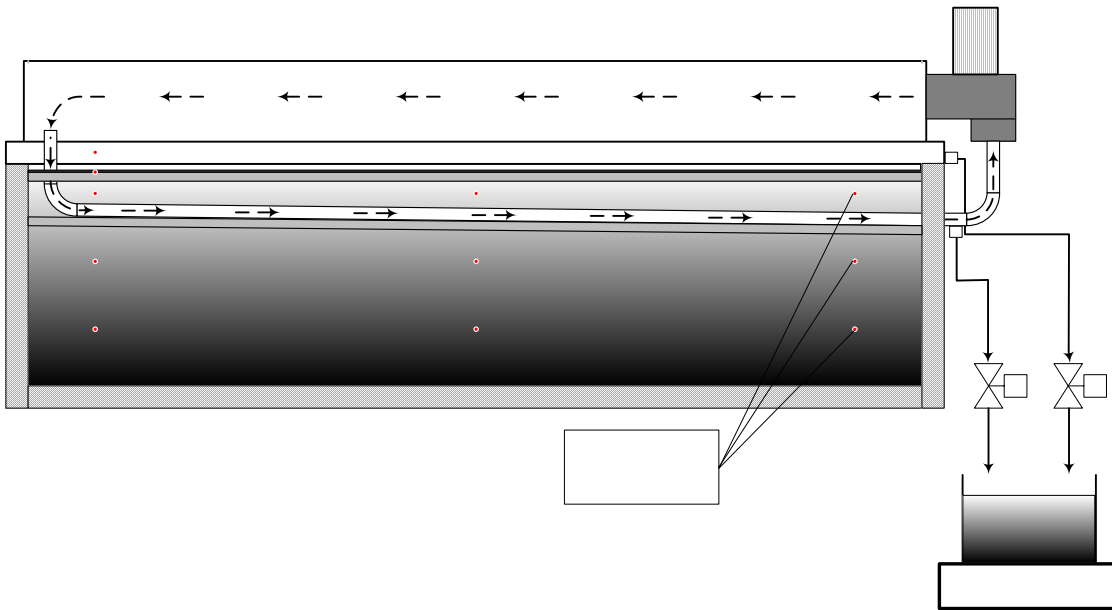


Figura 4 **Errore. Nel documento non esiste testo dello stile specificato.**—Front and cross sections of solar still module: 1 inlet of humid air; 2 polystyrol insulation; 3 black textile; 4 transparent cupola