CLAIMS

What is claimed is:

1. A gravitational vapor compressor, GVC, device, characterized in that the GVC device comprises

at least one vertical compression chamber (16),

a plurality of nozzles arranged at an upper part of the at least one vertical compression chamber (16) that are adapted to form at least one droplet beam or spray (10) of liquid water,

at least one inlet for primary water vapor to be compressed (8) in the upper part of a vertical compression chamber (16),

a secondary water vapor outlet duct (13) located at a lower part of the vertical compression chamber (16),

wherein the vertical compression chamber (16) comprises a portion of height h_1 located in the upper part of the vertical compression chamber (16) and that is configured so that the droplets of at least one droplet beam (10) reach the terminal velocity of free fall relative to the water vapor flow, and wherein the vertical compression chamber (16) comprises a portion of height h_2 configured so that the droplets fall through the this lower part of the vertical compression chamber (16) in an ordered flow (11) with a fall velocity relative to the vapor flow equal to or close to the terminal velocity of the droplets in the water vapor flow, which is evacuated through the secondary vapor outlet duct (13).

2. The GVC device according to claim 1, wherein the vertical compression chamber (16) comprises in the lower part a liquid water accumulation zone (12) and a pumping system for pumping all or part of the accumulated water (12) from the lower part of the vertical compression chamber (16) to the plurality of nozzles arranged in the upper part of the vertical compression chamber (16).

3. The GVC device according to claim 2, wherein the GVC gravitational vapor compressor device is mechanically coupled to a condenser evaporator device (1) comprising:

at least one water vapor conduit connecting at least one outlet of primary vapor (7) generated in the condenser evaporator device (1) with the at least one inlet of the primary vapor to be compressed (8) in the vertical compression chamber (16), and

at least one water vapor conduction duct that connects the secondary water vapor duct (13) of the vertical compression chamber (16) with at least one secondary water vapor inlet (14) to be condensed in the condenser evaporator device (1).

4. The GVC device according to claim 3, wherein the condenser evaporator device (1) comprises at least one latent heat exchanger (2) that in turn comprises a plurality of evaporator-condenser tubes or chambers, where a condensing face of the plurality of evaporator-condenser tubes or chambers is entirely or partially covered with microchannels configured so that condensed water flows within the microchannel with the liquid-gas interface curved across the entire width of the microchannel from wall to wall and where the evaporator face of the plurality of evaporator-condenser tubes or chambers is entirely or partially covered with microchannels and comprises at least one saline solution supply system arranged in the upper part (3) of the inner evaporating face of the plurality of heat exchanger tubes or chambers configured so that a saline solution flows inside the microchannels of the evaporating face of the plurality of evaporating-condensing tubes or chambers configured so that the saline solution flows inside the microchannels with the liquid-gas interface curved across the entire width of the microchannel from wall to wall.

5. The GVC device according to claim 4, wherein the condensing face of the plurality of evaporator-condenser tubes or chambers is completely or partially covered with microchannels with a depth of less than or equal to 1 mm and a width of less than or equal to 1 mm from crest to crest of the microchannel and where the evaporator face of the plurality of evaporator-condenser tubes or chambers is completely or partially covered with microchannels with a depth less than or equal to 1 mm and a width less than or equal to 1 mm from crest to crest of the microchannel.

6. The GVC device according to claim 4, wherein the wall (25) of the plurality of evaporator-condenser tubes or chambers comprises microchannels on both sides of the wall (25) positioned alternately or with a section pattern following an even function symmetry section, where an evaporator microchannel is configured to contain a downward flow of water solutions to be evaporated that forms an evaporator meniscus (26) rotated about 180º, in inverse symmetry

with respect to the adjacent alternate condenser microchannels located on the condenser side and being configured to contain a flow of water that forms a condenser meniscus (27).

7. The GVC device according to claim 6, wherein the wall (25) of the plurality of evaporator-condenser tubes or chambers in an alternating or laid head-to-toe shape between the evaporator microchannels and condenser microchannels is a continuous microchannel structure, without flat areas, configured for a high density of transition regions per unit of wall surface (25) on the surface of the evaporator side and on the surface of the condenser side of the evaporator-condenser tubes or chambers.

8. The GVC device according to any one of the preceding claims, wherein a flow rate of the primary water vapor to be compressed (8) depends on an inner diameter of the vertical compression chamber (16).

9. The GVC device according to any one of the preceding claims, wherein the height h1 of the upper portion of the vertical compression chamber (16) is determined from a difference between an exit velocity of liquid water droplets from the nozzles and a flow velocity of the primary water vapor to be compressed (8).

10. The GVC device according to any one of the preceding claims, wherein the nozzles are configured to operate at pressures of between 1.5 and 3 bars and droplet exit velocities of between 10 and 20 m/s so as to form liquid water droplets of between 100 and 300 microns.