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(54) Title: MULTI-STAGE ADSORBER DEVICE AND USES THEREOF FOR CHILLING AND/OR ATMOSPHERIC WATER HARVESTING

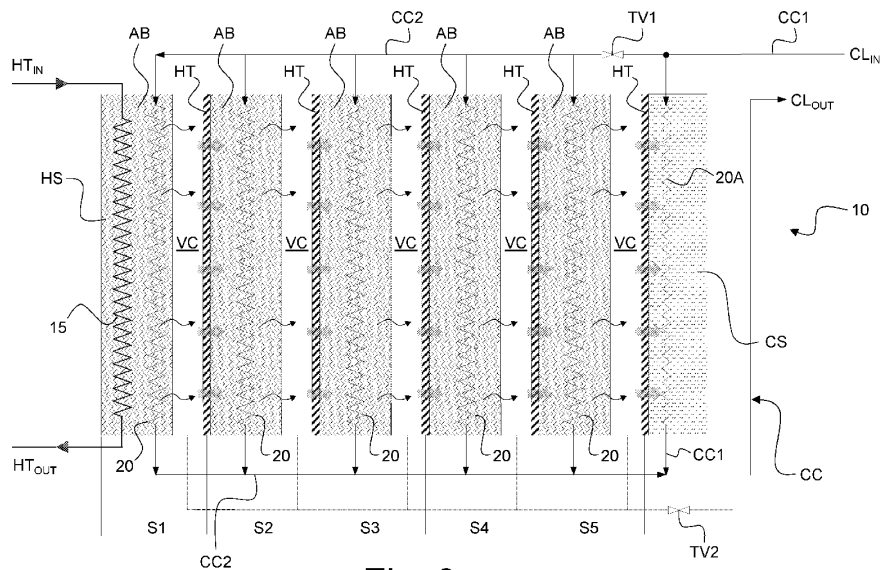


Fig. 3

(57) Abstract: There is described a multi-stage adsorber device (10) comprising a plurality of adsorption stages (S1-S5) distributed in sequence, each adsorption stage (S1-S5) including an adsorber (AB) coupled to an adjacent vapor chamber (VC), wherein the adsorber (AB) of each following adsorption stage (S2-S5) is thermally coupled to the vapor chamber (VC) of a preceding adsorption stage (S1-S4) via a heat transfer structure (HT). A heating stage (HS) is thermally coupled to a first one (S1) of the adsorption stages (S1-S5) to selectively provide thermal energy to the adsorbers (AB), while a cooling stage (CS) is thermally coupled to a final one (S5) of the adsorption stages (S1-S5) to selectively cause condensation of desorbed vapor in the vapor chambers (VC). The adsorber device (10) further comprises a cooling circuit (CC) having first and second cooling sections (CC1, CC2) to selectively cause circulation of a cooling fluid through the cooling stage (CS) and through each of the adsorbers (AB), respectively. During a desorption cycle, the

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heating stage (HS) is activated to induce vapor desorption in the adsorbers (AB) resulting in desorbed vapor flowing from each adsorber (AB) into the adjacent vapor chamber (VC), and cooling fluid circulates exclusively through the cooling stage (CS) via the first cooling section (CC1). As a result, desorbed vapor condenses along a surface of the heat transfer structure (HT), during the desorption cycle, releasing latent heat that is transferred to the adsorber (AB) of the following adsorption stage (S2-S5). During an adsorption cycle, the heating stage (HS) is deactivated to allow vapor adsorption into the adsorbers (AB), and cooling fluid circulates through both the cooling stage (CS) and each of the adsorbers (AB) via the first and second cooling sections (CC1, CC2). Uses of such adsorber device (10) are especially contemplated for chilling and/or atmospheric water harvesting (AWH) applications.