

MULTI-STAGE VACUUM DISTILLING, COOLING AND FREEZING PROCESSES AND APPARATUSES FOR SOLUTION SEPARATION AND SEAWATER DESALINATION

ABSTRACT OF THE DISCLOSURE

Multi-stage vacuum distilling, cooling, and freezing processes for solution separation and seawater desalination are implemented through multi-stage vacuum distilling, cooling, and freezing systems. The systems are set to their initial state for implementing constant temperature distilling process, drain-to-vacuum and freezing process, transferring of a specific solution, and recycling of a hot circulating solution, so as to separate the specific solution. In the multi-stage cooling process, vacuum evaporation cooling is utilized to cool the solution in order to supply the low-temperature solution needed in the multi-stage vacuum freezing process. Vapors produced in the multi-stage vacuum distilling and cooling systems provide condensation heat needed to melt ice crystals produced in the multi-stage vacuum freezing system. And, the low-temperature concentrated solution and molten ice crystals produced in the multi-stage vacuum freezing system may be used to cool the hot circulating solution discharged at the lowest stage of the multi-stage vacuum distilling system.

Fig. 1