

FILM EVAPORATOR OF PLATE TYPE WITH ELECTRIC HEATING ELEMENTS

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Evaporation processes are quite common in chemical, food and pharmaceutical industries. It is known that evaporation requires significant energy costs. One of the ways to reduce energy consumption during evaporation is to improve the design of evaporators, thereby increasing the intensity of boiling of the solution and, as a result, reduction in energy consumption. In this direction, the use of evaporators with a plate heating chamber is quite promising. Plate heating elements have high heat transfer coefficients, low metal content and high reliability.

The plate evaporator has a housing, separator and plate heating chamber which is a package of plates located between the clamping plates, as well as fittings for evaporating solution input, fittings for output evaporated solution, secondary steam and condensate. The use of heating steam requires the cost of its formation, and a large number of repeated cycles of evaporation can take a long time, and to remove steam requires a separator that is quite metal content.

A new design solution is proposed to replace the standard system of steam supply to the heating chamber for heating the evaporating solution with a system of electric heating elements built into the clamping plates.

The solution will be fed from the vertical collectors in the end part of the plates through which the film will flow down the plates. The heating elements will be switched on and off automatically as a thermostat to maintain a constant temperature on the surface of the plate walls. The evaporated solution will be pumped by a vacuum pump to repeat the evaporation process, forming a closed cycle, it will be continued until the formation of the required concentration of the solution. [1]

Components of the plate heating chamber (Fig. 1). The heating chamber consists of a package of welded flat plates 3, which are clamped between the plates 1 with bolts 5 and nuts 6, in the clamping plates made recesses for installing heating elements 2 on both sides of the plates, the plate system is connected by pins 4.

The advantage of using electric heating elements in the construction of plate evaporator is the reduction of energy costs for heating the solution and uniform temperature distribution over the entire surface of the plates, as well as the formation of the continuous flow film.

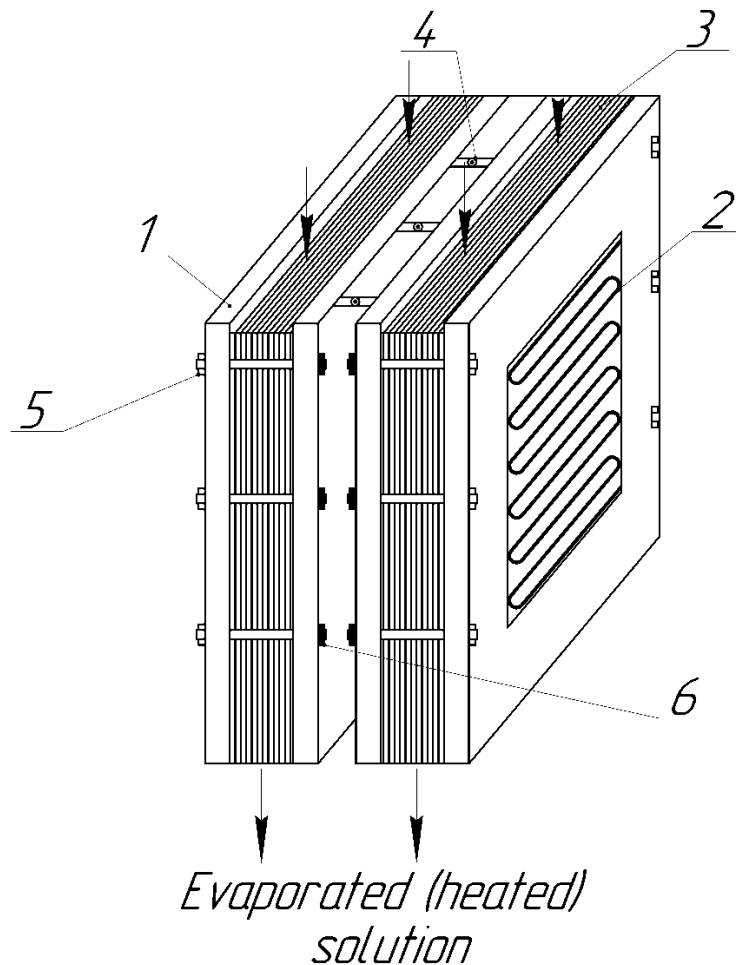


Fig. 1. Collapsible heating chamber of lamellar type, general view

The next stage of the work will be mathematical modeling of the proposed design to determine the values of heat transfer coefficients and optimization of design for specific production conditions. Also, the improvement of the device can be done through the use of mobile devices with vertical and rotational drives and replaceable nozzles. Or the use of systems for washing plates and movable blades, which will form a uniform film on the surface of the plates, thus helping to reduce film breaks.

References:

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